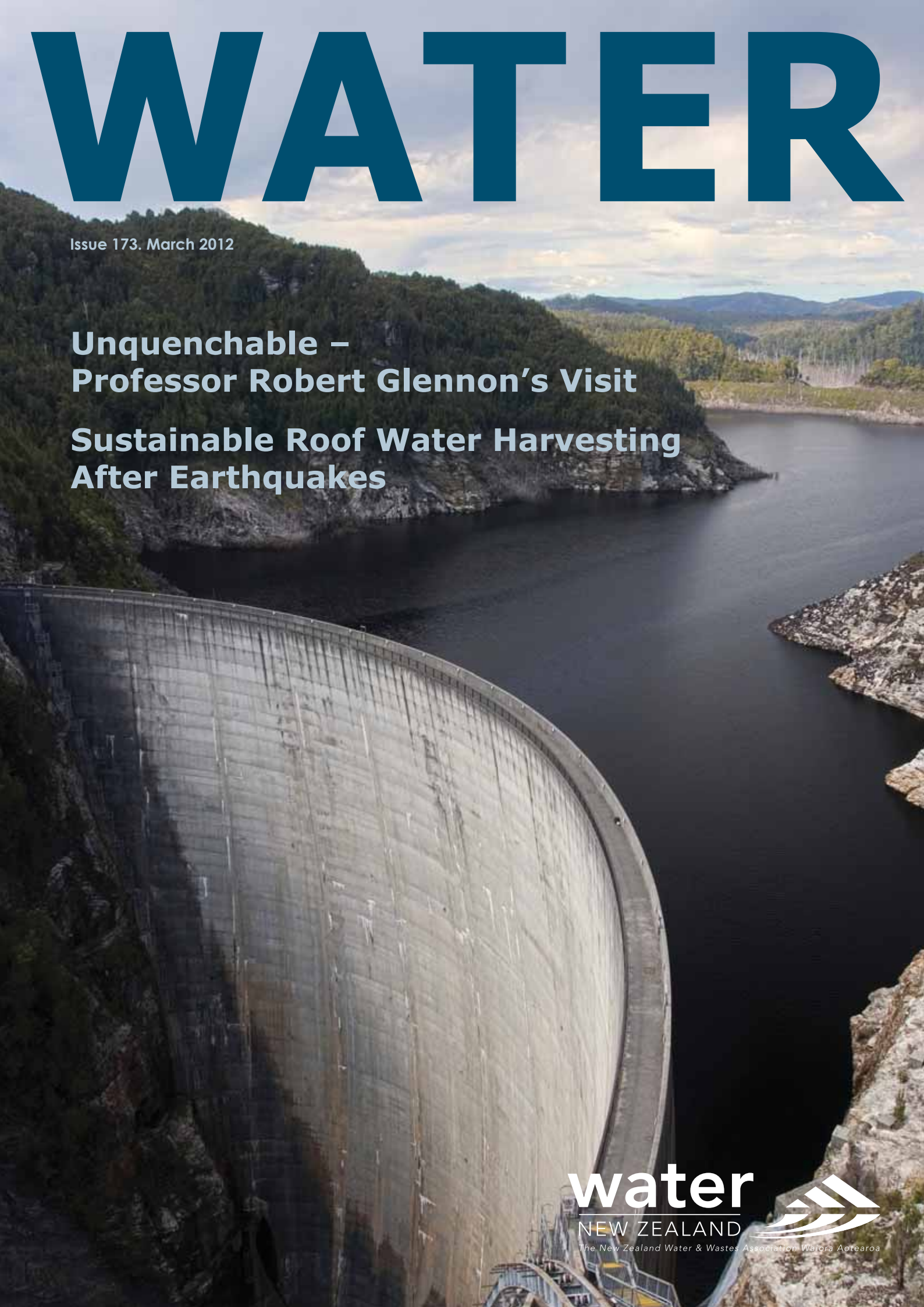
WATER

Issue 173. March 2012

Unquenchable – Professor Robert Glennon's Visit

Sustainable Roof Water Harvesting After Earthquakes



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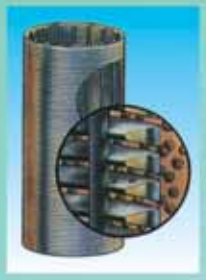

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Postal: PO Box 1316, Wellington 6140
Level 12, Greenock House,
39 The Terrace, Wellington, 6011
P 04 472 8925, F 04 472 8926
enquiries@waternz.org.nz
www.waternz.org.nz

President: Clive Rundle
Board Members: Steve Couper, Mark Bourne, Brent Manning, Hugh Blake-Manson, Rob Blakemore, Margaret Devlin, David Hill
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Membership and Business Support: Cherish Low

Water Services Managers' Group:
Andrew Venmore, P 09 430 4268

SPECIAL INTEREST GROUPS
Trade Waste: Bruce Collier, P 04 801 3295
Stormwater: Paul Kennedy, P 09 486 8068
Operations: Peter Whitehouse, P 04 495 0895
Backflow: Nick Fleckney, P 09 622 0927
Modelling: Brian Robinson, P 06 878 3705
Small Water Systems: Craig Freeman, P 04 232 2402
Small Wastewater & Natural Systems: Rob Potts, P 03 374 6515
Telemetry: Tim Harty, P 07 838 6699
Rivers Group (with IPENZ): Peter Whitehouse, P 04 495 0895

WATER JOURNAL
Editorial/Writer: Simone Olsen, simone@avenues.co.nz
Advertising Sales: Noeline Strange, P 09 528 8009, M 027 207 6511, n.strange@xtra.co.nz
Articles: To contribute to future issues please contact Simone Olsen at Avenues, simone@avenues.co.nz, P 04 473 8047
Design: Leyla Davidson, Avenues, Level 1, 56 Victoria Street, PO Box 10–612, Wellington, P 04 473 8044
www.avenues.co.nz
Distribution: Hannah Smith, P 04 495 0897,
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The next issue of *WATER* will be published in May 2012.

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.

Clive Rundle

Optimism for the Year Ahead

I can't put my finger on the reason, but I feel a strong sense of optimism about 2012. Perhaps it is because New Zealand's economic outlook is strong and we have so far been relatively isolated from the financial turmoil in Europe. Perhaps it is because despite the tragedy that has befallen it and the inevitable frustrations that follow, the recovery in Christchurch has begun. Many of our members are in the thick of it, rising to the challenges of rebuilding the infrastructure for what will be a glittering new city in the future. Or perhaps it's just the lingering glow from a summer spent with friends and family.

For *Water New Zealand* too, the year ahead looks bright. There is a sense of opportunity for change, whatever that may be, and we are well positioned to make your voice heard. We have been assigned a senior and well-informed Minister for Local Government which bodes well for a reasoned debate and then sensible, pragmatic changes where necessary.

In addition, 2012 will provide plenty of learning and networking opportunities too. *Water New Zealand*'s Annual Conference returns to its usual timing of September this year and planning for our smaller specialty conferences is well in hand. Visit http://www.waternz.org.nz/events.html for details.

"In the year ahead *Water New Zealand* may need to consider changes to evolve to meet the changing nature of our industry."

NZWETA continues to provide excellent training courses that are widely recognised in our industry. It has added eagerly anticipated new courses in Wastewater Microbiology, Farm Effluent Treatment Design and Pipeline Condition Assessment this year. In addition, the Pacific Water & Wastes Association is in the throes of organising its Conference in Auckland in November this year, providing our members with the opportunity to learn from their activities and to market our products and services to the key players in this significant market. Ozwater too is more accessible this year, Sydney being scarcely more difficult than a trip between New Zealand cities.

The *WATER* journal is also an opportunity for members to share the things we have learnt. This issue features the themes of Rainwater Harvesting, Water Storage and Modelling. The themes for the balance of this year are:

May Issue: Stormwater and Flood Management

July Issue: Wastewater Design and Small Water Systems

September Issue: Urban Metering, Demand Management, Governance and Training & Recruitment

November Issue: Water Quality and Community Awareness & Engagement of Water Issues

The articles that appear in the journal are not limited to these topics and I encourage you to think about the work you are currently doing and whether others could benefit from what you have learnt. Writing an article is not difficult and the more we each contribute, the more we all learn. Perhaps a younger member of staff might benefit from this task and in so doing enhance their own profile in our industry?

In the year ahead *Water New Zealand* may need to consider changes to evolve to meet the changing nature of our industry. Your Board is considering options to provide asset owners (local authorities and CCOs) a special position within the organisation that enables them to collectively voice their specific interests and combine their resources to seek solutions to the particular challenges and opportunities they face. A variety of organisational structures provide this in other countries with whom New Zealand often compares itself. Keep an eye on the *Water New Zealand* website where we will be seeking your views on this.

So there is much to look forward to in the year ahead. I look forward to crossing paths with many of you as the year unfolds. ■

Clive Rundle
President, Water New Zealand

new members

Water New Zealand welcomes the following new members:

GERALD LILLEY
MARYAM MAMO
TED ANDERSON
PHILIP HUGHES
DARRELL TONGE
JOHN BOYLE
GARRY MCGRAW
ALBERT ADAMS
MEHDI MIRZAEE
CHRIS STEVENS
DAVID HUGHES
HELEN SHAW
CHRISTOPHER HEPWORTH

Welcome to the First issue of *WATER* for 2012

WATER is published five times a year, and we welcome contributions of technical and general news items across the spectrum of the water and wastes industry on the following areas:

- Policy and legislation
- Water quality
- Demand management
- Wastewater
- Project news
- Modelling
- Stormwater
- International
- Training
- Trade waste
- Industry news
- Technical topics/paper

The next issue of *WATER* will be published in May, the themes are Stormwater and Flood Management. Please contact the Editor, Simone Olsen at simone@avenues.co.nz if you have any story ideas, contributions, or photos. The deadline for the May issue is Thursday 5 April.

To view the themes for 2012 visit www.waternz.org.nz/journal

Murray Gibb

Infrastructure Plans and Performance of Water Infrastructure

It is generally agreed that quality of infrastructure networks contribute significantly to the economic performance of countries. Nations with well performing infrastructure are likely to have higher productivity and greater rates of growth than those where investment has been less than optimal. Conversely those with poorer networks tend to have lower productivity and grow less quickly.

Infrastructure networks are not just about economic growth though. To paraphrase from New Zealand's first National Infrastructure Plan produced in 2010, *"well performing infrastructure enables the movement of people, goods and information around countries and across the world. It services housing and households, supports the quality of life within communities and connects those communities with each other and the rest of the world."*

Because it is so commonplace we often take our infrastructure services for granted. We automatically expect our phones to work when making calls, rooms to light up when we flick on the switches, and water to arrive when we turn on taps. It is only when something goes seriously wrong that the critical role of infrastructure in our everyday lives is highlighted.

The Canterbury earthquakes dramatically highlighted our dependence on these networks. Arguably the most valued were those supplying water services. When asked what they missed most following the earthquakes in the region, deprived Christchurch residents opined that ready access to hot showers and flushing toilets were at the top of their list.

How does New Zealand's infrastructure match up with the rest of the world? Sitting on the edge of two tectonic plates, broken up by mountainous terrain, we are a long skinny young island nation with a small population, geographically isolated from the rest of the world. Furthermore we have only had 160 odd years to put in place infrastructure networks.

It would be a hard task for a relatively new nation labouring under these constraints to match or exceed the performance of our European counterparts. Some comparison can be made though, through examination of the national infrastructure planning documents produced by other countries.

National infrastructure planning is a relatively new phenomenon. Historically, with a few notable exceptions, the approach to the development of infrastructure networks by most countries has tended to be fragmented and piecemeal. As a result investment often hasn't kept up with need. Along with other countries New Zealand is now attempting a more coordinated approach.

An infrastructure unit was established in Treasury in 2009. It has produced two iterations of a national plan in the last two years. The first was more of a stocktake of what each infrastructure had in terms of assets. The second, produced last year, assessed the performance of our infrastructure under several headings.

In contrast to some other countries, for example Denmark, New Zealand does not intend to use its infrastructure plan to identify specific projects that will lead to better performing networks. Rather the approach taken here is to improve the performance overall through better planning, funding, procurement, building and use of networks.

Late last year both Scotland and the United Kingdom produced national infrastructure plans. They make interesting reading. Copies of these plans are available on the internet.

As with New Zealand's plan, the UK version provides analysis of the current state of the networks in England, Wales and Northern Ireland. In contrast to our plan, both identify specific infrastructure projects and set out timelines for their construction.

In the UK plan the performance of each infrastructure sector is quantified and reported via a comparative index for the period since 2005. Amongst other things asset condition, service quality and reliability, capacity access and availability and utilisation are assessed. In total, 11 performance indicators are used to assess the performance of water and wastewater infrastructure – more than for any other sector.

In this plan water and communications infrastructure emerge as the best performing networks since 2005.

Investment needs are also analysed for each sector, with lists of priority programmes and projects being detailed in the plan. Notably, there are no priority expenditure requirements in the water sector, whereas there is the need for considerable investment in roads, public transport, airports, ports, regional development, energy, telecommunications and flood protection.

Given that it has been the equal top performer, and that it is alone in having no priority expenditure requirements, water services come out on top overall.

In the Scottish plan there is no quantitative attempt to measure performance, although there is a narrative account of progress made in each sector since 2008. Service levels for water infrastructure are now comparable to those in England and Wales.

Scottish Water is a public corporation providing water services across the whole of the country. Investment intentions along with service levels for five year periods are required to be signed off in advance by responsible Ministers. In effect Scottish Water already has a national infrastructure plan. Strong regulation along with mandatory reporting requirements ensure it delivers on that plan.

In summary both the UK and Scottish infrastructure plans report well performing water infrastructure. By contrast New Zealand's plan for 2011 scored water as the worst performing infrastructure sector.

To quote from the report, *"of all the sectors analysed in this plan the management, regulatory settings and governance relating to water infrastructure will require the most attention in the next three years."*

The obvious question is why is there such a difference between the performance of water infrastructure in New Zealand, the UK and Scotland? The latter operate under radically different policy settings put in place between 1989 and 2001. The difference in performance here, as compared with levels achieved in the British Isles is arguably a direct result of those reforms and an outstanding measure of their success. ■

Murray Gibb
Chief Executive, Water New Zealand

stormwater2012
10 & 11 may, wellington

Water New Zealand's Stormwater Conference 2012

The Stormwater and Modelling Special Interest Groups of Water New Zealand, in conjunction with the Rivers Group invite you to the 2012 Stormwater Conference in Wellington. The Stormwater Conference is an annual event, with a larger conference being held every second year to include an international component. The 2012 conference will be held on the 10–11 May 2012 at the Amora Hotel, Wellington.

Visit www.waternz.org.nz/stormwater_conference.html to view the preliminary programme and to register.

The 2012 conference will feature three streams, one of which will be devoted to stormwater modelling and another to the Rivers Group. These groups are excited to bring you this two day conference.

An interesting and topical programme has been developed with stimulating keynote address from leading industry commentators.

Hon Fran Wilde QSO

Chair – Greater Wellington Regional Council

Hon Fran Wilde QSO has held a number of leadership positions in business and politics. She is currently Chair of the Greater Wellington Regional Council and also chair of the Local Government New Zealand Regional Sector Group, which comprises of Chairs and CEOs of all regional councils in New Zealand. Fran is a company director and has her own consultancy business, Fran Wilde & Associates Ltd.

In politics Fran has been MP for Wellington Central, a Minister in the Labour Government of the 1980's and Mayor of Wellington. Business positions have included CEO of the New Zealand Trade Development Board and a number of chair and director roles in the private and public sectors.

Fran is active in the philanthropic and community sectors. She has an honorary doctorate from Victoria University of Wellington and is a Fellow of the NZIM.

Craig Potton

Craig is a noted New Zealand photographer and conservationist. For more than three decades he has documented the New Zealand wilderness, exploring relationships between the concept of artistic beauty and wilderness in the natural world. He has been actively involved in conservation work for more than thirty years.

Craig has recently completed the New Zealand documentaries Rivers (2010) and Wild Coasts (2011) which he conceived, screen-wrote and presented. In 2011, he won an award for the Best Documentary Script for his programme on the Rangitata River.

Exhibition & Sponsorship Opportunities at the Conference are Available

We expect approximately 200 delegates to attend Water New Zealand's Stormwater Conference 2012, some of whom will be *Water New Zealand* members while others will be interested parties.

We are seeking to partner with organisations to create an exhibition area to contribute to an even more exciting and valuable event for all participants.

The Exhibition area will provide your company to reach a range of participants. Morning tea, lunch and afternoon tea, as well as the Welcome Function are all held in the Exhibition Area.

If your company is interested in developing or enhancing business relationships with regional council and TLA staff, professionals from related disciplines, procurement managers, and academia and infrastructure providers the sponsorship opportunities may be of interest to you.

For more information on these opportunities please visit www.waternz.org.nz/stormwater_conference.html

Water New Zealand's Annual Conference & Expo 2012

The Annual Conference and Expo will again be an industry gathering not to be missed. It remains the largest and broadest conference of its kind held in New Zealand.

The annual conference provides the water industry and in particular association members a chance to gather together for three days to catch up with old friends and colleagues, discuss the latest developments, technologies and debate the issues at the forefront of our sector. It is also a chance to meet new members of the industry and view the new tools and technology in the largest water and wastewater trade exhibition in New Zealand.

We look forward to seeing you in Rotorua 26–28 September. Mark the following key dates in your diary!

Key Dates

Exhibition sales open	Wednesday 7 March
Call for abstracts close	Wednesday 4 April
Authors notified of selection	Friday 25 May
Registration live	Wednesday 6 June
Poster summaries close	Monday 30 July
Final papers due	Thursday 2 August
Earlybird registration closes	Friday 3 August
Presentations due	Friday 14 September

Exhibition

Held for the duration of the Conference, the exhibition gives delegates and trade visitors the opportunity to meet with leading equipment manufacturers and service providers and see state-of-the- art equipment, technology and services. Over 100 companies take part and the exhibition sites at this event are extremely popular.

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Water New Zealand's Strategic Plan

Water New Zealand's strategic plan is aimed at clarifying the organisation's role and where it wishes to be in the future. The Board reviews the plan each year. Annual reviews generally result in minor changes which are then executed via a business plan.

From time to time major reviews are undertaken. The last major review was done in December 2008. Ordinarily the next major review would have been due in 2012 or 2013, but given the changing public policy environment on water matters the Board made a decision to bring this forward, and the planning occurred in August last year.

A professional facilitator was engaged. He ran a conventional planning exercise.

Two new major themes emerged. The first was that *Water New Zealand's* primary focus should be on the modified or 'built' environment. The second was that the organisational structures within *Water New Zealand* needed to be reconfigured to meet the current and future needs of members. A copy of the plan for 2012 is set out below.

Vision: *Ensuring sustainable water services for New Zealanders.*

Mission: *Promoting and enabling sustainable management and development of the water environment.*

"Two new major themes emerged. The first was that *Water New Zealand's* primary focus should be on the modified or 'built' environment. The second was that the organisational structures within *Water New Zealand* needed to be reconfigured to meet the current and future needs of members."

Core Purpose

Strategic

National and regional policies in the water environment are integrated, and based on sound principles and knowledge.

Service to Members

Members are able to exchange knowledge and their needs for effective representation, quality products and services are met.

Societal

A better societal understanding of the sustainable management and development of the water environment.

Resourcing

The fundamental and practical knowledge of natural water resources, water use and the water environment is advanced and applied by motivated and competent people.

Five Year Vision

- New Zealand has a national water strategy
- Water services in New Zealand are well regulated
- International benchmarking verifies well performing water services businesses in New Zealand
- *Water New Zealand* is well resourced and well engaged with its members, meeting their collective needs for advocacy, along with the promotion and delivery of relevant standards and services

Key Strategic Goals

1. *Water New Zealand* is the 'go to organisation' for all key stakeholders for relevant advice and information. Stakeholders include members, media, politicians and international organisations. Our advocacy role meets the needs of members.
2. New Zealand has a national water strategy. There is evidence of well performing three waters infrastructure. The National Infrastructure Plan reports progress in the performance of the water sector. The Land and Water Forum's recommendations are implemented.
3. *Water New Zealand's* members are well engaged. Special interest groups are well aligned, and members are satisfied with the performance of the organisation.
4. Water infrastructure operates in an effective regulatory environment.
5. *Water New Zealand* is well resourced and technically enabled.
6. *Water New Zealand* runs well supported conferences, and provides effective education and information channels.
7. *Water New Zealand* has an actively sought skill base. ■

Goal	Strategy	Tactics
Goal 1 *Water New Zealand* is the 'go to organisation' for all key stakeholders for relevant advice and information. Stakeholders include members, media, politicians and international organisations. Our advocacy role meets the needs of members.	• Ensure *Water New Zealand* is structured to retain full industry representation – the constitution aligns with the structure • *Water New Zealand* engages with key influencers • *Water New Zealand*'s builds technical credibility • *Water New Zealand*'s profile is built • Funding streams support all activities • Develop information directories that are accessible	• Review and revise *Water New Zealand*'s organisational structures to be more closely aligned with member needs • Implement Board ratified communications strategy • Continuously monitor and feed into development of relevant public policy using collaborative approach with aligned groups where possible • Ongoing programme of policy and technical standards development and review • Publish and promote good quality information through *Water New Zealand* suite of publications
Goal 2 New Zealand has a national water strategy. There is evidence of well performing three waters infrastructure. The National Infrastructure Plan reports progress in the performance of the water sector. The Land and Water Forum's recommendations are implemented.	• Continue engagement with Land and Water Forum • Keep *Water New Zealand* voice in regulation development • Develop and provide accurate and effective benchmarking of utilities' performance	• Lobby for implementation of relevant recommendations from Land and Water Forum • Develop and feed Association position into policy initiatives on local government reform • Work closely with Government to inform 2nd stage reform of RMA • Work closely with National Infrastructure Unit and local network operators to improve performance • Continuously expand reach and quality of current national performance review
Goal 3 *Water New Zealand*'s members are well engaged. Special interest groups are well aligned, and members are satisfied with the performance of the organisation.	• Raise services to SIGs to required levels • Provide customer focus • Engage technical expertise	• Review and revise existing model for relationship between parent body and SIGs to ensure that mutual needs are met • Promote NZWETA and support development of training and qualifications within the water industry • Promote regional activity to foster collegiality and interest in the industry
Goal 4 Water infrastructure operates in an effective regulatory environment.	• Identify strengths and weaknesses in current regulatory environment • Engage in improving regulatory environment	• Continue involvement on Small Group of LAWF • Develop and feed Association position into policy initiatives on local government reform • Work closely with Government to inform 2nd stage reform of RMA
Goal 5 *Water New Zealand* is well resourced and technically enabled.	• Use sector groups for scale and scope • Use contractors to develop and revise technical standards	• Continuously seek out new and enhanced funding streams • Form new group for local network operators encompassing WSMG and SEF • Use contractors to develop and revise technical standards
Goal 6 *Water New Zealand* runs well supported conferences, and provides effective education and information channels.	• World class content • Clear standards for papers • Tight compact duration • Focus on the high standing of *Water New Zealand* events • Proactively seek opportunities for seminars/ forums • Provide value in member website content	• Foster and encourage Technical Committee • Maintain and seek to improve conference, seminar and workshop programmes • Proactively seek opportunities for seminars/forums • Develop members' zone of website and populate with relevant material
Goal 7 *Water New Zealand* has an actively sought skill base.	• Find ways to deliver improved technical knowledge to members and stakeholders	• Consult with SIG leaders and LNO group on need • Facilitate funding to develop/revise technical material • Commission technical resource to develop/revise technical material

Priorities and Timelines

The following table specifies priorities and timelines for implementation of strategies specified in the plan in the period 2012.

Strategy	Priority	Timeline
Ensure *Water New Zealand* is restructured to retain full industry representation i.e. reconfigure the organisation to meet sector needs	High	By end of 2012
Engage with key influencers to promote effective governance regime for water infrastructure	High	By end of 2012
Deliver improved technical knowledge to members and stakeholders	High	By end of 2012

Joe Gielen – A Valuable Voluntary Contribution

Murray Gibb – Chief Executive, Water New Zealand

In order to function, not for profit organisations such as *Water New Zealand* are significantly reliant on voluntary input from members. While some are happy to let others lead, other members step up to the plate, providing the necessary leadership and direction to advance the collective cause of the not for profit entity in which they chose to become involved. This in turn benefits both members and society in general.

Joe Gielen sat firmly within the latter group and for many years made a very significant contribution to our Association and the industry it serves, particularly during its formative years.

He served as a committee member and office holder on the New Zealand Water Supply and Disposal Association. Thanks to Joe and other far sighted leaders at the time, the IPENZ Technical Interest Group on Water, the Institute of Sewage Works Managers and the New Zealand Water Supply and Disposal Association were amalgamated in the early 1990s to form the *New Zealand Water and Wastes Association,* the forerunner of *Water New Zealand*, as we know it today.

Joe brought an operator's perspective to an engineer and scientist dominated committee. Former committee members advise that he was an excellent committee-man; not backward in coming forward on any issue on which he held a strong opinion. On matters of principle, he was unshakeable.

He worked very hard to make the Association conferences more accessible to the other operators, whom he considered to be a very important part of what the organisation was about.

Joe and a few other strong individuals instilled professionalism into the operation and management of wastewater treatment plants in New Zealand. He was also a pioneer and was involved in the selection, construction and commissioning of a new wastewater treatment plant at Rotorua using the Bardenpho process for the removal of nutrients.

Joe Gielen

Fittingly he was awarded the William D Hatfield award in 1990 for his sterling work as the treatment plant operator in Rotorua. His election to be a life member of the Association in 1996 capped a long period of active but quiet involvement in the organisation's affairs and as the champion of operators everywhere.

On behalf of the Board and members I thank Joe for his contribution and wish him a long and well deserved retirement. ■

> "Joe and a few other strong individuals instilled professionalism into the operation and management of wastewater treatment plants in New Zealand."

WEF Sets New Strategic Direction – "Water's Worth It"

Garry Macdonald – WEF Board of Trustees

In the largest self-review of its 85 year history, the Water Environment Federation (WEF) Board of Trustees and staff worked throughout 2011 to evaluate all facets of WEF; give every WEF member the opportunity to provide input through surveys, focus groups, and interviews; and develop a future direction that responds to the needs of the water sector and WEF members.

Our planning was extremely successful due to an enthusiastic, willing, and able Board of Trustees; excellent WEF staff leadership, especially our new Executive Director Jeff Eger; and great data from our consultant-assisted process.

The result of our efforts is a new, bold strategic direction for WEF.

Our new vision: *WEF – essential to water professionals around the world.*

This captures our aspiration to be an indispensable and vital part of your career.

Our new mission statement: *WEF's Mission – to provide bold leadership, champion innovation, connect water professionals, and leverage knowledge to support clean and safe water worldwide.*

This illustrates how our strengths will be applied to our commitment to protect public health.

Our critical objectives: *Drive innovation in the water sector, enrich the expertise of global water professionals, and increase awareness of the value of water.*

This will focus WEF on achieving the vision and mission.

As part of this new approach, WEF is championing leadership in the global water sector, not just on its own but in partnership with other like-minded organisations. Under the simple but effective banner of "Water's Worth It", WEF will be even more proactive in engaging with its peers, water leaders in the public and private sectors, elected officials and the general public to highlight the value of water and of the environment.

As an example, WEF recently released a Revised Position Statement on Biosolids Recycling and Resource Recovery encouraging innovative, comprehensive approach to wastewater treatment and solids management. The statement expands on the Federation's existing support of federally regulated land application by encouraging a comprehensive approach to wastewater treatment and solids management that ensures the recycling and recovery of all associated resources including water, nutrients, organic matter and energy.

"As a natural byproduct of wastewater treatment, WEF recognises that biosolids is a renewable resource that is too valuable to waste given our growing needs for renewable energy and sustainability," said WEF Executive Director Jeff Eger. "The adoption of this revised statement reflects WEF's support of initiatives to ensure an expanded view of wastewater and solids management as well as our commitment to pursue innovation in water quality."

> "WEF believes that a cultural move toward sustainability has the potential to shift policy-maker and public perception of biosolids from a waste to a community resource that can help achieve sustainability goals."

WEF believes that a cultural move toward sustainability has the potential to shift policy-maker and public perception of biosolids from a waste to a community resource that can help achieve sustainability goals. This shift is creating unprecedented opportunities for the wastewater and biosolids community to position biosolids as a valuable commodity.

Also recognising that biosolids recycling remains a local decision, WEF encourages the use of whatever associated practice-land application, composting, energy generation, product development, land-filling, incineration, or other uses – is best suited to a community's economic and technological capabilities.

To take full advantage of the inherent resource value of biosolids, WEF supports development of multiagency coordinated regulations that are based on sound research and best practices; advancements, innovation, and development of new technologies; recognition of the expanded role of wastewater and solids management; enhanced sharing of knowledge both within the profession and with other organisations, the regulatory community, and the public; and continued research.

This position is consistent with decades of scientific research and years of field practice that have clearly established the value and environmental benefits of biosolids, when properly treated and managed. It is also consistent with the U.S. Environmental Protection Agency's (EPA) position and those of other federal agencies, which encourage the beneficial use of biosolids through policies and regulations, including the Clean Water Act.

Visit www.wef.org/GovernmentAffairs/PolicyandPositionStatements/ to read the complete position statement.

I am personally very keen to see *Water New Zealand* partnering with WEF and other peer organisations on such 'position statements' and joint initiatives where we have shared concerns over the current way in which national and global water resources are 'undervalued' and byproducts of wastewater treatment are (mis)managed.

Please contact me at (09) 300 9281 or garry.macdonald@beca.com if you want to know how to get involved with WEF or have comments or views that I can relay to my fellow Board Trustees and WEF staff. ■

Oxfam Water Challenge 2012 – Now Cancelled

Oxfam New Zealand

Over the past three years, the Oxfam Water Challenge has been a fantastic way for New Zealanders in the water sector to make a difference to communities living in poverty, and have a great time doing it. The contributions raised have helped people in developing countries take their first steps out of poverty, and Oxfam has been able to provide them with life-saving clean water, hygiene education and sanitation.

While it has been rewarding working with our sponsors, corporate partners and all participants to make the event successful over the past few years, in the face of belt-tightening across the events industry we've had to re-evaluate our efforts. Even big, commercial institutions have been forced to cut back over the last few years and charity events have taken a bigger hit, with large drops in team registrations and fundraising. The Oxfam Water challenge has been no exception. It is for this reason that Oxfam has made the difficult decision to cancel the Oxfam Water Challenge 2012.

The purpose of the event has always been to raise money in support of communities in the Pacific and Southeast Asia that are struggling to achieve some of life's basics, like access to clean water and toilets. When an event stops generating enough funds it's a clear signal for us to re-focus on efforts that deliver for communities that need it most.

So we want to acknowledge those who have supported us over the years, especially our Gold Sponsors; Beca, Opus, Lend Lease and Hynds, the city councils, local sponsors, prize donors and the many *Water New Zealand* members who have taken part in past Oxfam Water Challenges.

We're pleased to tell you that there are still ways you can make a difference. Keep your eyes peeled for the forthcoming Oxfam Water Appeal, which will change lives through clean water in Papua New Guinea and beyond. You could donate your Oxfam Water Challenge entry fee and sponsorship to support the cause. Or why not join Round the Bays in Auckland or Wellington and fundraise for Oxfam? There is still plenty of time to register.

Our long-term development programmes – and particularly the delivery of water, sanitation and hygiene – remain robust, and we truly hope that as members of the New Zealand water sector you will continue to support that work.

For more information on staying involved please visit www.oxfam.org.nz/water or email oxfam@oxfam.org.nz ■

Review of the Biosolids Guidelines

Susannah Peddie – Policy & Project Advisor, Water New Zealand

Water New Zealand and the New Zealand Land Treatment Collective are coordinating a joint initiative to begin a formal review of The Guidelines for the Safe Application of Biosolids to Land in New Zealand this year. The overall goal is to provide a tool that will guide users through biosolids related decisions.

The initial Guidelines were produced in August 2003 by *Water New Zealand*. Financial support was provided by the Ministry for the Environment's Sustainable Management Fund with co-funding from the then Drainage Manager's Group, North Shore City Council and Watercare Services Ltd. The Guidelines were developed by a steering group of experts, a project co-ordinator and consultants. At the time, it was recognised that the Guidelines were a living document and would need to be reviewed.

> "The overall goal is to provide a tool that will guide users through biosolids related decisions."

The updated Guidelines will reflect users' experiences, taking into account feedback from producers, dischargers and regulators (regional councils), who have indicated that although the Guidelines are comprehensive, they would benefit from a review to facilitate ease of use, and to reflect new findings here and overseas, particularly relating to permitted contaminant levels.

It is hoped that the improved Guidelines will inform strategy for central and local government, and promote the use of biosolids to a wide range of groups including territorial local authorities, biosolids manufacturers and distributors, biosolids users, regulatory agencies, environmental groups, iwi and the broader community.

The review process will be led by *Water New Zealand* and the Land Treatment Collective, but in conjunction with a number of interested parties from the science, agriculture and health sectors and from regional councils. Wide-ranging stakeholder involvement will ensure all areas are considered including cultural issues.

The review steering group intends to submit an application for the fifth round of the Ministry for the Environment's Waste Minimisation Fund in the middle of this year, and will also be seeking funding from other sources. ■

Water New Zealand New Office Location

At the end of January 2012, we shifted from our office in Lambton Quay to new premises in Greenock House on The Terrace. The move went well and we are settling into our new environment. You will now find us at:

Level 12, Greenock House
39 The Terrace, Wellington

Postal address and telephone remain the same. Access is available to the building from Lambton Quay via the arcade at 102 Lambton Quay.

Water New Zealand Member Contact Details

Please advise us if you changed contact details recently. An accurate database depends on the supply of timely and accurate information.

Contact: Cherish Low
P: +64 4 472 8925, E: cherish.low@waternz.org.nz

Details can be updated on line at www.waternz.org.nz/forms/changeofdetails/changeofdetails.html

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Hon Dr Nick Smith Outlines the Government's Priorities in First Major Speech for the Year

Simone Olsen – Editor, WATER

The end of 2012 saw the General Election which resulted in a reinstatement of the National-led Government and the re-organising of portfolios among continuing and newly appointed Ministers.

Hon Dr Nick Smith kept his Environment and Climate Change portfolios and was also given the Local Government portfolio.

The three portfolios have significant overlap in many areas and are the three very relevant portfolios to *Water New Zealand* and its membership.

In a recent address to the Nelson Rotary Club, an annual and significant speech in his electorate, Dr Smith outlined his work plans and priorities for the next Parliamentary term.

The Minister began by stating that his first environmental priority for the year was to pass and implement new laws to provide for the environmental protection of New Zealand's vast ocean area – formally known as the Exclusive Economic Zone and Extended Continental Shelf.

"The issue is that the jurisdiction of the RMA ceases at the 12 mile limit of the territorial sea, yet we need to have a robust system for assessing the environmental impacts of activities in the ocean environment," said Dr Smith.

"We need look no further than the Gulf of Mexico disaster in 2010 as to what can go wrong. A key conclusion of the subsequent inquiry was that an independent regulator, separate from the government agency responsible for promoting mineral exploration, needed to robustly check the environment risks. That is just what we are proposing with the Environmental Protection Authority."

"Balance is at the core of the Government's approach to this issue. There are significant economic opportunities for New Zealand from minerals in New Zealand's EEZ, the fourth largest in the world. This legislation is about taking these opportunities in an environmentally responsible way."

The Minister also outlined his plans for the improved management of freshwater saying that it would remain a priority following the establishment of the Land and Water Forum in the previous Parliamentary term.

"Few New Zealanders truly appreciate how blessed we are in having the second highest per capita water resource in the world, nor how much of our export and energy industries depend on that resource."

"The Land and Water Forum produced a consensus across 58 groups of a way forward for improving the management of water."

"This year it is my priority to make progress on getting clearer rules for farmers on what they need to do to better protect water quality as well as progressing clean-up plans for a number of significant rivers and lakes that had over precious decades become polluted."

The integrity of New Zealand's green brand will also be a high priority for the Minister as he proposes a new Environmental Reporting Act.

"We are the only OECD nation that does not have a statutory system of nationwide environment reporting. This is out of step with the importance of the environment to our national identity, economy and quality of life."

The Minister used the issue of our water quality to highlight the need for such reporting. With no consistent system of measurement it is very difficult to ascertain if it is declining further or if or where it may be improving and therefore compounding the political difficulties in improving management.

"My aim is to establish a nationwide five-yearly report that ranks New Zealand's rivers and lakes from the cleanest to the dirtiest and clearly identifies which ones are improving and which are deteriorating. This will help focus communities on better managing this precious resource. The intended author of the report is the Parliamentary Commissioner for the Environment to ensure its independence and integrity."

The Minister also outlined his continuing work on the Resource Management Act.

"The first phase of reform in 2009 has delivered real benefits in the processing of small non-notified consents."

The number of late consents grew from 18% to 31% between 2002 and 2008. That is 16,000 people in 2008 that had consents that were not processed within the statutory timeframes.

The 2009 changes reduced this number to 5% or just 1800. This means 14,200 fewer people facing the frustrations of late consents.

The Minister talked about the three major issues on the agenda in the next phase of the RMA reforms:

1. Addressing delays in medium sized projects
2. The strengthening of requirements for councils to consider natural hazards
3. Simplifying the planning framework

With his new portfolio of Local Government the themes of improved efficiency and responsiveness continue to be a focus for the Minister. In this first speech of the year he stressed the Government's view that an efficient, responsive and well focused local government sector is absolutely vital to New Zealand.

"Our 78 Councils are responsible for $100 billion worth of public assets, employ 23,000 people, spend $7.5 billion each year of public money and every day make thousands of regulatory decisions that impact on the lives of all New Zealanders."

"Doing these jobs well is a turbocharger for New Zealand Inc but performed poorly and they become a handbrake on our nation's success. My hope is to work with Councils to ensure they are a help not a hindrance to New Zealand getting ahead."

The Minister's number one concern is the spending and financial burden of rates on households and businesses. Over the past decade average rates across the country have grown by 6.8% per annum or by more than twice the rate of inflation.

It is not just the rising cost of rates but also the increasing indebtedness of Councils that is a concern to the Minister and probably many ratepayers. Council debt has roughly quadrupled from $1.8 billion to $7 billion over the past decade.

"There has been much commentary about Government and private sector debt increases over the past decade yet Council debt has grown faster than any other sector. It is now at levels unprecedented in the 140 year history of local government in New Zealand."

"I believe the new council in Auckland poses a real challenge for the rest of New Zealand. Its single voice, coordinated planning and efficiency gains are going to give it a competitive edge. Other communities need to start thinking about how their area can do better and what future structure of councils will best assist their regions' prosperity and growth. From the Government's perspective, we want the rest of the country as well as Auckland to be successful and want to facilitate a sensible dialogue on reform."

The underlying issue here is that while central government, households and businesses have responded to the crisis internationally over debt by pulling in spending, local government has been slow to respond.

"My endeavours will be about how Government can better support more efficient councils. Inevitably this raises the question over local government reorganization beyond the big changes made in Auckland."

"I wish to make it plain however that the Government is not going to embark on a central government led, nationwide programme of forced change as occurred in the 1980s. Nor do we take the view that bigger is necessarily better."

"I believe the new council in Auckland poses a real challenge for the rest of New Zealand. Its single voice, coordinated planning and efficiency gains are going to give it a competitive edge. Other communities need to start thinking about how their area can do better and what future structure of councils will best assist their regions' prosperity and growth. From the Government's perspective, we want the rest of the country as well as Auckland to be successful and want to facilitate a sensible dialogue on reform."

"My overriding national goal is to work with local government and communities to ensure councils are in a position to support a growing economy. That means better constraint of costs on households and businesses, reducing unnecessary red tape, providing good quality infrastructure and limiting the accumulation of debt."

The Minister concluded that 2012 is a critical year for the Government progressing the long term substantive reforms that will make for a better country. 2011 was a year of distractions. The tragic earthquakes, the Rugby World Cup and the General Election.

"This is the year we have a real opportunity and a mandate to get on with the reforms that will secure a brighter future for New Zealand." ■

Water Industry Training and InfraTrain Create New Qualifications Pathway for Utilities Sector

Water Industry Training

Water Industry Training and InfraTrain have created a new qualifications pathway for the utilities sector, including the areas of water reticulation and infrastructure works. The changes follow a successful 2011 review of the sector's existing qualifications undertaken by the industry training organisations in consultation with industry.

A range of qualifications from Level 2 to 4 (see diagram) that recognise the specialist technical skills for water reticulation and the installation and maintenance of infrastructure pipes are now available. These include an introductory qualification for those new to or transferring from another industry and higher level supervisory programmes for those managing others.

Three specialist qualifications for those at operator level are now available, as are supervisory and management level qualifications for those involved in managing people or projects. Trainees may undertake one or all of these qualifications depending on their career objective and the requirements of their role.

Additionally, the entirely new New Zealand Certificate in Infrastructure Works (Excavation and Reinstatement) (Level 3) has been developed to meet the needs of the new National Code of Practice for Utility Operator's Access to Transport Corridors.

Phil Duns, Underground Manager at Connetics Ltd, Christchurch, was on the Industry Advisory Group for the development of the qualifications. He says the new Excavation and Reinsatement qualification will have significant benefits for the industry.

"Poor excavation, compaction and reinstatement is a real problem in our industry. A huge amount of remedial work is undertaken each year, costing the country millions of dollars. InfraTrain has developed a new qualification which will give people the skills they need to do the job right first time. It has been developed in partnership with industry experts and represents best practice.

"The qualification will benefit the wider industry by raising standards among contractors. It will also give confidence to councils and local authorities that work is being done properly," he says.

Steve Apeldoorn, the Director of Project Max, Auckland, and also on the Industry advisory group, agrees with Phil.

"The new qualifications herald a way forward for industry training," he says. "They unify the infrastructure development and maintenance sectors and simplify the training development process, while providing a structured career pathway that will attract new people to enter the industry.

"A significant benefit of these new qualifications has been the development of the career pathway. The pathway provides a clear framework and alignment for all of the qualifications, and makes it easier for councils and contractors to understand and select the most appropriate qualifications to specify and train their staff to. The pathway will also provide organisations and their staff with the flexibility of moving their existing skills across sectors much more easily."

The National Certificate in Water Reticulation (Level 3) has also been updated to better meet industry needs.

"The new version of the National Certificate in Water Reticulation (Planned and Reactive Maintenance Technician) is the best reflection yet of the role of a reticulation service person and network/utilities operator," Annie Yeates, Water Industry Training manager, says.

"There are some significant differences between the old versions of the qualification and the new. For example the new version includes assessing and reporting on asset condition, an area that is becoming more and more important to local authorities to assist with asset management.

"The new qualification focuses on the skills and knowledge required to maintain reticulation systems, like repairing water leaks, installing connections and fittings, working on live water mains and removing blockages in wastewater systems, and is complemented by the other qualifications in the utilities sector pathway."

"I encourage people who have historically been involved with the reticulation and pipelaying qualifications to contact their ITO for more details on the new programmes so that they can understand the changes."

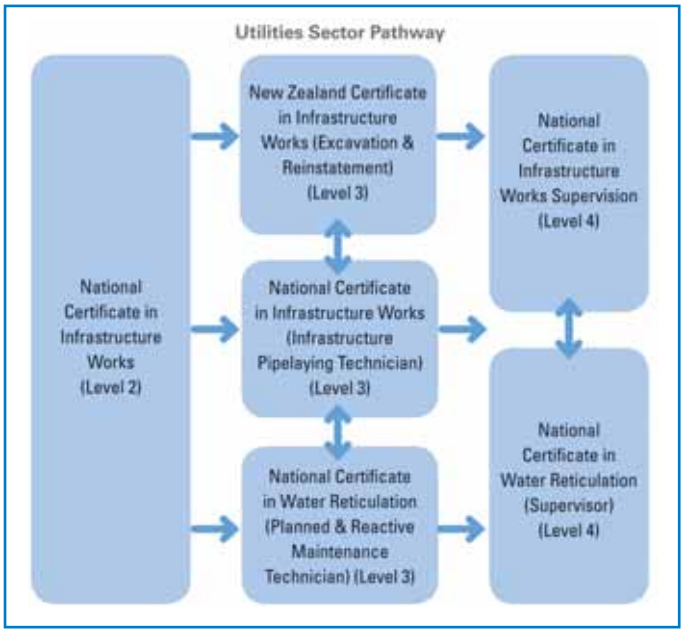
Water Industry Training and InfraTrain have also been working in conjunction with the Plumbing, Gasfitting, Drainlaying, and Roofing ITO (PGDR ITO) to clarify the boundaries between the Level 3 qualifications offered by the three ITOs and to define which qualification is the most appropriate for specific roles in the sector (see table).

"We are in discussions with regard to ways of recognising the skill sets between the various roles and qualifications for those people working with water and wastewater systems across our various industry sectors," Annie says.

"The three ITOs are also working together to inform industry about the differences between the three qualifications, where historically there has been some confusion, so that local authorities can accurately specify the correct qualification in their contracts and that employers and trainees can choose the qualification most suited to their activities."

Annie adds that those involved are very pleased with the collaboration happening between the ITOs.

"We are very much working together to ensure that the programmes we develop fulfil industry needs," she says. "Our organisations are working together to convey this information to our industries, especially to utilities managers, contractors and contract writers. Our aim is to increase understanding of the new qualifications and to reduce confusion between them.



Utilities Sector Pathway

"It has been a great experience working with the ITOs who share common ground. The outcomes of this project really are of benefit to the industry."

InfraTrain chief executive Philip Aldridge agrees. "It makes sense that we can work together with Water Industry Training to develop qualifications that are relevant to our industry. The launch of these new qualifications is an exciting move forward, and our team of regional advisers are keen to talk to contractors and councils about the advantages of on the job training."

These qualifications are now available for enrolment. Please contact Water Industry Training on 0800 928 374 or InfraTrain on 0800 486 626 for further information and to enrol. ■

Guide to Utilities Qualifications

	NATIONAL CERTIFICATE IN INFRASTRUCTURE WORKS (Infrastructure Pipelaying Technician) (Level 3)	NATIONAL CERTIFICATE IN WATER RETICULATION (Planned & Reactive Maintenance Technician) (Level 3)	NEW ZEALAND CERTIFICATE IN INFRASTRUCTURE WORKS (Excavation & Reinstatement) (Level 3)	NATIONAL CERTIFICATE IN DRAINLAYING (Installation) (Level 4)
WHO IS IT FOR?	For people engaged in installing new pipes, fittings and associated structures for infrastructure, including gas, potable water, sanitary sewage, storm water and cable ducting	For people working in reactive maintenance roles for water/ wastewater/stormwater reticulation systems i.e. network operator, utilities/reticulation service person	For people who excavate and reinstate trenches and dig-outs for installing and maintaining utility services	National qualification for drainlaying practice for those who are able to use drainlaying tools and equipment, excavate, trench and install and maintain drainlaying structures and fittings
WHAT IS IT FOR?	The installation of all pipes outside a private boundary, and maintenance of pipes for the warranty period only	The maintenance of reticulation systems, outside the private boundary i.e. repairing water leaks, installing connections and fittings, and removing blockages in wastewater systems	The excavation and re-instatement of trenches and dig-outs safely and correctly, generally within the roading corridor	For drainlaying from the domestic or commercial dwelling to the street boundary
	Pipe installation requires extensive civil construction knowledge and skills with some associated water reticulation knowledge	Requires extensive water reticulation knowledge and skills with some civil construction knowledge and may include the replacement of water reticulation pipes up to the property boundary		

Tap the Global Talent Pool with AIESEC

Mark Rodgers – Vice President Business Development, AIESEC New Zealand

For over 60 years, AIESEC has been providing businesses across the globe with solutions to their skill shortages. We are the largest youth run organisation in the world exchanging over 13,000 students and graduates across 110 countries annually. Our global partners range from Unilever, Ingersoll Rand, Microsoft and Electrolux. In New Zealand our operations are equally impressive; we have worked with over 250 big companies including Fonterra and Air New Zealand to smaller NGOs and organisations such as the Green Party and Parent Help. Thirty five years since our inception in New Zealand, we are still placing home-grown and international talent – if you haven't heard of us yet; your business is missing out.

AIESEC was originally founded through collaboration between five European countries in 1948. The initial aim of the organisation was to develop a new generation of young people who possessed the cross-cultural understanding and leadership skills necessary to avoid a repeat of the two world wars that had wiped out millions and caused widespread destruction. Now more than half a century later, the entity stands as the world's largest student youth run organisation.

Everyone who works at AIESEC, from those members on the ground level to those running the international operations, is a university student or recent graduate under the age of 30. All are volunteers and yet its members give hours of work every week to generate results that continue to grow.

AIESEC New Zealand is a proud member of this community and every day it is increasing the number of corporations and not-for-profits within New Zealand who have direct access to skilled graduates and undergraduates from universities around the world. AIESEC works to generate cross-cultural exchanges. Its members approach companies with a pitch to fill recruitment needs with skilled applicants from around the globe. Meanwhile, its overseas branches are doing the same. In 2011, AIESEC generated 73 internship opportunities for New Zealand companies and sent 125 university students to overseas internship positions. The results are New Zealand graduates with international work experience, international interns with a knowledge of New Zealand business practises and New Zealand employers with the best of both worlds.

What makes the AIESEC intern source programme so attractive for companies? For some it's the desire to bring a stronger workplace diversity and culture. Other organisations find the programme an obvious solution to filling any gaps in language, skill or competency. Whatever the reason, many find much more value for money from what they originally bargained for. PwC; a global partner of AIESEC in 2012, has employed over 80% of the 500 AIESEC interns they have taken since 2004. Within New Zealand, Siemens New Zealand, Fonterra and Green Party have taken multiple interns or extended the contracts of their original interns proving that the AIESEC intern placement programme is a recipe for success.

Many companies also find the overall process of receiving an intern surprisingly hassle free since AIESEC takes a central role in the process. We pre-select an average of more than 20,000 interns per year who are placed on our global database. When a company is interested in taking an intern we have already selected the best and a simple search and selection means the companies only sort through a handful of the best matches.

Once the intern is selected by the company, AIESEC will begin the process of cultural and logistical preparation. An intern will receive cultural preparation before leaving their host country and upon arrival in New Zealand as well as support obtaining the appropriate work visa. When an intern arrives in New Zealand it is a huge occasion for the local student chapters based around New Zealand who are able to see the results of their hard work. Interns are treated to airport pickup, traditional Kiwi reception and orientation, are shown around their host city and taken to their first day at work. Throughout the internship, AIESEC also works to ensure the intern is integrated into the local chapter during their internship and is working well within the company environment. It's hassle free from the company's side who only need to ensure there is work for the intern to complete!

Veronica Brief (HR Advisor for Fonterra) and Kirsty Dronjak (HR Manager, Customer Service for Fonterra) have given their support to the programme.

"A tight recruitment market in New Zealand, the specialised language skills required and the unique working environment of the Customer Service Centre meant that traditional recruitment methods had to be supplemented in other ways. The AIESEC selection process ensured that all the graduates that were short-listed and presented to Fonterra were appropriately qualified and fully briefed on expectations of the internship in New Zealand", says Veronica.

"What makes the AIESEC intern source programme so attractive for companies? For some it's the desire to bring a stronger workplace diversity and culture."

"AIESEC gave us an opportunity to find our ideal applicants at relatively low cost, whilst also helping young people increase their skill sets and experience a different country. AIESEC provides a full 'turn-key' service including pre-selection, immigration clearance and relocation support – as a partner, Fonterra benefits by not having to be involved in the entire search and select process."

"For Fonterra it enabled us to diversify our recruitment strategy, attract quality skilled candidates, some of whom have elected to stay with Fonterra NZ. Our bi-lingual requirements have been met and some of our outstanding employees are AIESEC interns. It's a win-win!"

Our most recent project with Wellington charity Parent Help has also been met with acclaim. The project involved connecting Parent Help with three interns thus solving a temporary recruitment need. Over 300 applicants applied for the twelve week volunteer internship with the final candidates hailing from Germany, Turkey and Canada. Two of these interns had recently completed their masters degrees. The interns were recruited to run project designing and implementing Parent Help's annual PEGS campaign. The result was the participation of over 400 primary students generating 50 pieces of 'peg' art, culminating in a one-day event that saw families enjoying local performing arts and the top three entrants recognised with some great prizes.

Securing Local Talent

As an international organisation, AIESEC has partnered with global giants such as Tata Consultancy Services, Deutsch Post DHL, UBS, HULT Business School and most recently Pepsi Co. These companies take large numbers of highly skilled interns as well as gaining access to and the attention of the global membership network. AIESEC's engagement with corporates is not limited to managing talent requirements. Many have utilised the benefits of the 60,000 strong

membership base to boost their brand amongst young people and conduct market research.

AIESEC New Zealand hosts three national conferences annually, contributing to a total of 400 across the network. These conferences provide a fantastic opportunity for businesses to actively target large groups of highly motivated individuals. AIESEC New Zealand's Autumn Conference in April 2011 had guest speakers from HRINZ, Thought Partners and Hutt City Council. Larger conferences such as the Asia-Pacific regional conference held in Vietnam in March 2011, attracted guest speakers from UBS, Deutsch Post DHL, Pepsi Co and HULT Business School. When asked why it chose to participate in such events, Abid Hussein of DHL Global Business Services explains, "In the employer branding events, DP DHL gets the opportunities to showcase our employer value proposition (EVP) towards the leadership body of AIESEC globally, build their interests to want to be a part of us, and then provide various internship opportunities worldwide for them to experience the EVP, and potentially retain them after."

New Zealand has seen a growing number of partnerships between companies and local branches with organisations taking advantage of the available potential. Ernst and Young has partnered with AIESEC Canterbury since 2010 through funding their local leadership events. Through this engagement they are able to directly target pro-active students seeking leadership experience while gaining invaluable brand awareness through support of local student organisations. Partnerships with HRINZ, GradConnection, Sta Travel and Podio are active across our seven universities in New Zealand.

AIESEC New Zealand is also offering organisations new and unique ways to interact with students. New for 2012 is our 'Youth to Business' or 'Y2B' events which connect students and companies around the discussion of pressing global and local issues. Companies can also reach their targeted student and graduate populations via AIESEC's leadership tournament competitions which pits top students against each other to solve a given business problem.

AIESEC is currently operating out of seven of New Zealand's top universities: University of Auckland, Auckland University of Technology, University of Waikato, Massey University Palmerston North, Victoria University of Wellington, University of Canterbury and University of Otago.

If you are interested in engaging with AIESEC you can contact our university bodies via our website www.aiesec.org or directly through our national committee by contacting Mark Rodgers at mark.rodgers@aiesec.org.nz ■

Recent Water Cases

Helen Atkins – Partner & Vicki Morrison – Senior Associate, Atkins Holm Majurey

Introduction

Happy New Year! As this is our first article for 2012 and because there has been little to report on the legislative front since our last article, this article provides an overview of some recent cases relating to water.

The first case that we will discuss is the Variation 6 decision which we noted as being pending at the time of our last article. This decision has now been issued and is interesting in a number of respects, not least because of the competition between different users (energy versus primary productive sector) for water. We then move on to discuss a recent prosecution for unlawful taking of water which is interesting in terms of the size of the penalty imposed. The last case we discuss, while not specifically arising in the freshwater context, raises cultural effects and process issues which will be relevant to other consent applications (including freshwater).

Variation 6 Decision

Carter Holt Harvey Limited v Waikato Regional Council[1], is a decision of the Environment Court in relation to appeals on Variation 6 to the proposed Waikato Regional Plan.

Variation 6 was developed as a means of managing freshwater allocation within the Waikato region given the increasing and competing pressure on these resources:

"[3] Because of the demand for water for different uses within many parts of the Waikato region, the point has been reached where demand for water has the potential to exceed sustainable supply. In some catchments the consents to take water already exceed the allocation limits. This has given rise to growing competition amongst present and prospective users of the region's freshwater resources. Variation 6 is the Council's attempt to meet this worsening situation."

The Court noted that while the Variation 6 document itself was fairly straightforward the complexity arose due to the number of, and interconnections between, interest groups[2].

Twenty six parties filed appeals to the Council's decision and 19 parties took an active part in the appeal proceedings. While some 28 issues were raised for the Environment Court's determination, the Court was helpfully able to group these issues into five essential categories:

- Whether Section 14(3)(b) takes can be constrained
- Protection of water for electricity generation and allocation preference
- Policy issues
- Issues relating to rules and standards
- Iwi issues

The key issue that we intend to focus on is the protection of water for electricity generation and allocation preference to such uses over agricultural uses as this was the primary issue for a number of parties in the case and it had flow on impacts in terms of policies, rules and standards.

To determine the appropriate approach to this issue (and indeed the other issues) the Court commenced with a discussion of the relevant statutory planning instruments. Of particular interest to the issue of electricity generation was the Court's finding that

"While the outcome of this issue appears to be an attempt to strike a balance between competing uses it is yet to be seen whether that balance is one that ultimately satisfies the parties' respective interests. We note that to date no appeals have been filed."

the preamble to the National Policy Statement on Renewable Electricity Generation 2011[3] did not require hydro electricity generation activities to always be accorded priority when making freshwater allocation decisions but that they could, in appropriate circumstances, be accorded such priority[4]. The Court also found that under the National Policy Statement renewable electricity generation was a matter of national significance which needed to be borne in mind when considering the issue of competing uses[5].

In terms of the degree of protection to be afforded to electricity generation, the arguments were around the level at which primary and secondary allocable flows were fixed[6] and who had priority in terms of using those flows. The Court succinctly summarised the issue as follows:

"[130] While the debate focused on dairy vs electricity, we consider this to be too narrow. The real issue is whether the water in the Waikato River above Karapiro should be more liberally freed up to enable uses other than for electricity generation – rather than effectively locking up all of the available water above 3.6% of Q5 exclusively for electricity generation.

...

[155] The strong policies proposed to support the electricity protection regime would effectively mean that no more water could be drawn for consumptive uses above Karapiro, and if Genesis succeeds with their relief, above Huntly including within the Waipa catchment."

Mighty River Power, which operates the Waikato Hydro Scheme, argued as a preliminary matter, that its consents for that scheme precluded increase of the allocable flow. The Court disagreed and found that:

"[162] ...Mighty River Power's consents do not confer a right to a physical allocation of water in the sense of granting rights to defined maximum rates and quantities of water. Hence, increasing the allocable flow is not precluded by non-derogation principles, nor by Section 34 of the Act."

In terms of the approach to determining the issue the Court confirmed that under Part 2, it was not a matter of determining winners or losers as between the competing uses but of what would ultimately best promote the sustainable purpose of the Act:

"[212] ... The evidence and submissions tended to focus on where the intersection points are between these competing section 5 values, and this assumed that the outcome must be a choice of winner or loser. Such an approach eschews the well established approach we should adopt when applying Section 5 and the guiding matters of the remaining sections in Part 2. This involves an overall broad judgment of what would best promote the sustainable management of natural and physical resources. This allows for the balancing of competing considerations in terms of their relative significance."

In coming to its decision on the competing uses issue, the Court while acknowledging the importance of electricity to New Zealand[7], found that locking up the variable flow in the Waikato River between Taupo and Lake Karapiro for electricity generation would not give effect to the purpose of the Act and that more water should be made available for future consumptive uses:

"[218] We are of the view that more water should be made available for future consumptive uses that could be of benefit to the social and economic well-being of the community. Such uses should not have to go through a contested non-complying activity process that would have to overcome a high bar created by the protectionist policies designed to protect electricity generation."

In terms of the quantum of the increase the Court considered that a primary allocable flow of 5% of Q5 to be appropriate:

"[224] We consider that an appropriate balance would be met by increasing the primary allocable flow to 5% of Q5. This would enable a quantity of water for a variety of other uses, including dairying investment for non-irrigation, together with some for irrigation. Setting the allocable flow at 5% of Q5 would result, according to the "upper bound", in a 1% loss of generation of 40 GWh/year from the Waikato Hydro Scheme. Overall this provides for a more efficient use of this important resource. It still provides strong protection to the electricity industry for all the available water above the 5% of Q5. However, it also provides a quantity of water for other users and it does not completely lock up the resource."

The relief sought by Genesis to limit the allocable flow above Huntly to the current allocation level was refused for similar reasons. The Court found that granting that relief:

"[251] ...would mean that no more water could be allocated from that stretch of the Waikato River, except for the specific recognition for municipal supplies, and also no further allocation for any uses from the Waipa River.

[252] ...To give effect to Genesis relief would require Objective 3.3.2 to be amended to give greater priority to the operations of the Huntly Power Station (Part (ca)) and to "trump" or further reduce the weight to be given to future uses to meet other social, economic and cultural needs (Part (e)).

[253] We find that such an amendment would not be appropriate..."

While the outcome of this issue appears to be an attempt to strike a balance between competing uses it is yet to be seen whether that balance is one that ultimately satisfies the parties' respective interests. We note that to date no appeals have been filed.

Canterbury Regional Council V Birchbrook

Canterbury Regional Council v Birchbrook Limited[8] is a case which involved the conviction and sentencing of a horticulture cropping company, Birchbrook Limited and its director Mr Court (together "the Defendants"), for the taking of groundwater without a resource consent. While the case does not break any new ground it is of interest as it very clearly outlines the matters that the Court will consider when determining the type and quantum of penalties to impose.

The offences in this case arose from the Defendants actions in taking approximately 104,000m^3 of groundwater over a five year period in order to irrigate crops on a block of land that the Defendants leased in Christchurch. The Defendants admitted that they were aware that a resource consent was required, but that after discovering the costs of obtaining such a consent (via transfer of an existing consent) were likely to be in the order of $40,000 to $50,000, decided to take water without obtaining the required

consent. After a Council investigation brought the issue to light the Defendants ceased the unlawful take.

As the Defendants pleaded guilty to the charges at an early stage the Court's decision focused on the appropriate penalty to apply. As a starting point the Court determined that it was necessary to take a global approach between the company and its director Mr Court:

> "[4] Mr Court, you are a director of and shareholder in Birchbrook and the offending occurred in your management of Birchbrook's cropping operations. I intend to take a global penalty approach between the company and you personally. I think that is in accordance with commonsense and common practice. As has sometimes been said, wherever the penalty falls, ultimately it will come out of the same pocket..."

The Court then moved on to discuss what factors were relevant to its decision on the question of penalty type and quantum.

An initial set-off argument raised by the Defendants, namely that the effects of the unpermitted take should be offset against the effects of a permitted take which had not been used, was roundly dismissed by the Court:

> "[10] Counsel for the Defendants suggests that some form of set-off of effects between the permitted and unpermitted takes should be factored into these penalty considerations. I do not think that is appropriate for at least three reasons:
>
> - Firstly, because the two takes are in different allocation zones under the Regional Plan;
> - Secondly, because the take consented under permit 940245 was consented after a proper assessment of its effects on neighbouring wells whereas there has been no such assessment in respect of the illegal Ryans Road take;
> - Thirdly, because the illegal take of water at Ryans Road raises a number of other issues beyond its physical effects which I shall consider shortly."

In terms of penalty type, the Court confirmed that while the company could only receive a financial penalty, Mr Court could be sentenced to community service instead of or as well as a fine. After considering the Defendants financial capacity to pay a fine as well as the Mr Court's likely inability to complete a community service sentence (given his current work commitments), the Court determined that a financial penalty was more appropriate.

In terms of the quantum of the financial penalty to be imposed, the factors the Court considered as supporting a higher quantum comprised:

- The deliberate nature of the offending;
- Its duration over a five year period;
- The effect of unpermitted takes on the integrity and viability of water allocation schemes;
- The need to hold offenders responsible for their actions and deter them and others from committing similar offences; and
- The cost to the Council in investigating and bringing the action.

Mitigating factors or factors tending to support a reduced quantum were:

- The early guilty plea by the Defendants;
- The Defendants participation in the restorative justice process;
- That the discernable physical effects of the illegal take were minor;
- That the offending ceased immediately following detection;
- The Defendants ability to pay; and
- The donation the Defendants voluntarily made to Lincoln University for research into effects on groundwater.

The Court's starting point in terms of quantum was $30,000. However, after considering all the factors noted above the Court determined it was appropriate to reduce this amount to $20,000 with each of the Defendants being responsible for an equal share of the fine. The Defendants were convicted and sentenced accordingly.

Te Runanga O Ngai Te Rangi Iwi Trust v Bay Of Plenty Regional Council

In Te Runanga o Ngai Te Rangi Iwi Trust v Bay of Plenty Regional Council[9] the Environment Court was tasked with considering whether the Port of Tauranga's applications for resource consent to widen and deepen the entrance to its entry channel to allow use by larger ships should be granted. The key issue with which the Court was grappling in this case was the competing interests of the Port and local iwi:

> "[1] How do we integrate the competing interests of the Port of Tauranga... while recognising and providing for the legitimate cultural concerns and relationship of relevant local iwi...
>
> [2] In this decision we examine these questions in the context of the Resource Management Act (the Act), and consider a breadth of scientific, cultural and metaphysical concerns. This case highlights many of the tensions inherent in the Act and the need to exercise careful value judgments in order to achieve sustainable management as that term is defined in the Act."

While ultimately finding that consents should be granted subject to an amended set of conditions, the Court made some interesting comments in terms of the process followed by the Port and also the relevance of cultural concerns.

In terms of the process, the Court criticised the Port using their previous dredging application (which was pre the RMA) as a template for their current application and more importantly of the failure of the Port to consult with iwi prior to lodgement of the application.

> "[40] This application did not have an auspicious beginning. The Port, for unexplained reasons, decided to repeat the dredging application, updating for the new width and depth, they had made in 1989 prior to the enactment of the Resource Management Act 1991. Around one month prior to the hearing of the application before the Council, the Port was advised that it at least needed to consult with tangata whenua.
>
> [41] Unsurprisingly, tangata whenua were both surprised and disappointed at the way in which the Port consulted well after the application was filed..."

In its final comments section the Court, as well as making some strong criticism of the Ports actions (or perhaps more accurately inaction) went onto note that other infrastructural companies had sometimes displayed a lack of cultural insight in RMA matters, and cautioned that in future such actions may lead to refusals of applications for consent:

> "[315] This case highlights to us the yawning chasm in cultural insights sometimes displayed by major infrastructural companies. The Port should have had a Cultural Liaison Officer, or such persons, on retainer. This position would never had arisen if the Port had sought early cultural advice. Mr Mikaere was retained after the Council decision and prior to the Court hearing. That was far too late.
>
> [316] For our part we have concluded that the Regional Coastal Environment Plan contemplates a major infrastructural applicant preparing and filing an

application after extensive discussion with tangata whenua, and probably, with some level of understanding as to how on-going issues relating to Te Awanui should be addressed. Some 20 years after the enactment of the Resource Management Act, it is surprising that an infrastructural company of the size of the Port would not have been aware of its obligations in terms of the Regional Coastal Environment Plan, the New Zealand Coastal Policy Statement 2010 and the Act.

[317] During the course of this hearing, the Port has done a great deal to try and address this situation. However, we feel obliged to note that further examples of applications made without proper approach and consideration of the requirements of the relevant national and regional documents could lead to refusals of applications for consent.

[318] Put simply, a publicly listed company working in a highly sensitive area identified in all relevant national and regional documents, cannot purport that it has no obligation to consider tangata whenua issues or consult with the relevant parties. This is not the case of a small business having no specific provisions and regional plans relating to it. This is the case of a major infrastructural company which has been dealing with these issues constantly for the last 50 to 60 years since its inception, and prior to that the Harbour Board. To pretend that these matters are not being addressed through the Waitangi Tribunal (and having repercussions for on-going operations) is not in our view a reasonable position to take."

In terms of the relevance of cultural concerns, the Court confirmed that while cultural effects are not a veto to a development, they are effects which must be balanced against other matters in Part 2:

"[298] ... the provisions of Part 2 of the Act dealing with Maori interests where well founded in the evidence, give no veto power over developments under the Act. Rather, these interests must be balanced against other matters listed in Part 2 and the overriding purpose of the Act under Section 5 to promote the sustainable management of natural and physical resources."

> "The Act manages natural and physical resources to enable people and communities to achieve, to the fullest extent possible when balanced with other factors, their social, economic and cultural wellbeing.Social and cultural well-being may, in a particular case, involve relationships and metaphysical factors, particularly under provisions such as Section 6(e) of the Act. "

The Court also refuted the arguments put forward by the Port that only physical effects could be taken into account and that conclusive evidence of adverse physical effects on the values underpinning the iwi relationship was required.

"[299] We do, however, reject the submission made for the Port that only physical effects must be taken into account by this Court, as clearly cultural effects include a range of impacts including those that may affect historic, traditional and spiritual aspects of the relationship Maori have with their ancestral lands, waters, waahi tapu and other taonga, and their kaitiakitanga...

...

[302] We conclude that the Port opening missed entirely the basic premise of the appellants' cases. Namely, that they have a long established, well-recognised, and vital relationship with Te Awanui and Mauao, Te Paritaha and Panepane.

[303] It was accepted, and we have concluded, that the modification to these areas will adversely impact on that relationship. The Port's original opening case did

not even acknowledge the rangatiratanga of iwi. This focuses under Section 5 of the Act in two ways:

(a) Enabling the cultural values of tangata whenua by recognising and providing for the relationship (Section 6(e)); and

(b) Avoiding, remedying or mitigating any adverse impact on that relationship to such an extent that we are satisfied the application with conditions meets the purpose of the Act.

[304] The Act does not dismiss relationships or metaphysical issues at all, as is noted in Bleakley v Environmental Risk Management Authority and confirmed in Friends & Community of Ngawha Incorporated v Minister of Corrections. The Act manages natural and physical resources to enable people and communities to achieve, to the fullest extent possible when balanced with other factors, their social, economic and cultural wellbeing. Social and cultural well-being may, in a particular case, involve relationships and metaphysical factors, particularly under provisions such as Section 6(e) of the Act.

[305] We have concluded that Ms Hamm's proposition in opening is too simplistic. Small physical changes may have more serious consequential effects on historic, traditional and spiritual aspects of the relationship Maori have with their lands, waters, waahi tapu and other taonga."

What is particularly interesting about this case in our view is that the legal findings of the Court in terms of consultation and cultural effects are not new, they represent a consistent approach of the Court for many years now, and yet arguments are still being mounted that such obligations do not exist or that applicants are unaware of them. We consider that the strongly worded criticisms of the applicant in this case show that the Court is losing patience with such arguments and that the comments serve as fair warning that in future taking such an approach may jeopardise the grant of consent. ■

Footnotes

[1]Unreported, Environment Court Auckland, [2011] NZEnvC380, 30 November 2011, Whiting J.

[2]Refer paragraph [12].

[3]The relevant part of the Preamble states:

"...

This national policy statement does not apply to the allocation and prioritisation of freshwater as these are matters for regional councils to address in a catchment or regional context and may be subject to the development of national guidance in the future."

[4]Refer paragraphs [58] and [59].

[5]Refer paragraphs [62] and [63].

[6]Refer paragraph [119] where the Court indicates that under Variation 6 primary flows were proposed to be fixed at 3.6% of Q5 above Karapiro and no secondary allocable flow above Karapiro was proposed.

[7]Refer paragraph [215].

[8]Unreported, District Court Christchurch, CRI-2010-009-011694, 22 September 2011, Dwyer J.

[9]Unreported, Environment Court Auckland, [2011] NZEnvC402, 21 December 2011, Smith J and Fox J.

Water Reform – Getting to First Base

Paul Luckman – Creative Decisions Ltd, Auckland

Introduction

Reform of the water industry is certainly not for the faint-hearted. Water is so integral to our wellbeing, on so many fronts, and the politics is so intense, as to frustrate even the most determined rationaliser. But while the debate has been continuing for some time now, it remains quite shallow. Of course, reform must address both structure and process, and give clarity on sources of authority and the direction the industry is to take. But it must also address root causes and concerns if it is to avoid politically expedient solutions, or to even happen at all.

A concern for sustainable management of water, and sustainable services delivery, must lie at the heart of the reform process. Consequently, a clear statement of the requirements of sustainability is crucial if reform is to get to "first base". In this short discussion, we review some of the issues around reform and show how a modern view of sustainability provides a platform for the way forward.

The Issues

In support of last year's 'Advancing Water Reform' Conference in Rotorua, *Water New Zealand* very helpfully prepared a discussion document, "The Future Face of Urban Water Services in New Zealand". This document was intended as a 'straw man' that would stimulate debate. It presented the views of some of the industry's leading figures, and identified the main issues as:

1. An outdated policy foundation
2. Extraordinary complexity, involving many institutions
3. Fragmentation within the industry, with too many providers
4. Variable performance of providers – although the size of the country's 'infrastructure deficit' remains unclear
5. Insecure and limited funding
6. A need for improved transparency and accountability

A plenary session of the Conference was dedicated to the reform issue, and participants gave verbal testimony to the validity of these concerns.

Central Government is also interested in the health of the water industry, and has established the collaborative Land and Water Forum to advise on a way forward. The focus of the Forum, and Government, however, is at present more on water for primary industry than water services for urban areas and other settlements. Especially it is concerned about ways of sustainably managing land use intensification, including the growth of irrigated dairying. Through entities such as the Treasury's National Infrastructure Unit, it is however also interested in the health of water, wastewater, and stormwater services to the country's towns and cities. Given Auckland has recently undergone governance reform, and the process for Christchurch is subsumed in the larger one of recreating the city in the wake of the earthquakes of 2010 and 2011, it is understandable that the Government is less focused on 'urban' water services.

While *Water New Zealand*'s 'straw man' focused on reticulated water and wastewater services, discussion at the Conference showed that stormwater is also an area of concern.

Behind much of the debate at the Conference was clearly a concern about big vs small, centralised vs decentralised, and corporatised vs non-corporatised services, and the associated questions of transparency and accountability. These are old chestnuts, and attempts to resolve them in the abstract invariably lead to ideologically-based positions. The current political climate favours pragmatic and performance-driven solutions, providing the opportunity for a more dispassionate view of the issues that makes no assumptions about an optimum scale for management.

Concerns about transparency and accountability are used to support different positions on governance. There are those who see a more business-centred approach as a means to provide improved efficiency, transparency, and accountability, and those who see a more corporatised approach as potentially leading to the opposite result. There is little discussion on precisely what service providers should be accountable for. In reality, there is no clarity on this, beyond respect for a range of national standards, for drinking water quality, fire flows, and so on. This is at the heart of the real issue, which is how to assess performance.

Assessing Performance

At the Conference, numerous participants, ranging from the representatives of Treasury's National Infrastructure Unit, to some of the consultants, argued that water reforms need to be anchored in performance assessment. A baseline is required, including a statement of financial performance. Visions and goals can be established with reference to improvements beyond this baseline, and, later, the effectiveness of the reforms can be determined from repeat assessments.

Unfortunately, there is no universal agreement across the industry on either the need for performance baseline assessments, or the form they should take. Many of the providers who have not participated in the past may have had concerns about how the information would be used. Benchmarking processes also tend to have embedded within them concepts of best practice that presuppose significant specialist inputs, such as tend to be accessible mainly to larger providers. Smaller water services providers, who make less use of consultants, may challenge the implied dependence on expensive specialist inputs, and be disinclined to participate in a benchmarking process that is shaped externally and contains little that reflects their own views and priorities.

If a performance baseline is a prerequisite to successful, evidence-based reform, what form should it take, and what should be its scope? It seems clear that some form of audited self-assessment is required, but, if there is to be any level of buy-in and ownership to be attached to the results, providers need to have more input into the form of the assessment. This means that the Water Services Association of Australia (WSAA) benchmarking, for example, may not be the best foundation for any reform process. Allowing the form of the assessment to be influenced more by the providers involves additional costs, whether it is through guidelines or greater involvement in preparing a standard tool to be used across the industry. However if it brings the industry together and means that the baseline is more useful and reliable, this is likely to be worthwhile.

Sustainability – the Fixed Point for Performance Assessment

Given the divergence of views regarding what constitutes an adequate performance baseline, it is important that 'fixed points' are recognised and incorporated into the process. The ideas of sustainability, and sustainable development, have historically been associated with such vagueness and contestability that we might not expect them to provide anything like a fixed point. This vagueness has led to the search for alternative concepts that may motivate systems and process improvement, and be more useful operationally. Consequently, we see that the focus of attention in much high level planning is shifting to the idea of resilience.

Resilience, however, is a reactive concept. Organisations exhibit resilience in their response to, and recovery from, some severe test,

"Resilience, however, is a reactive concept. Organisations exhibit resilience in their response to, and recovery from, some severe test, or shock, or series of shocks. Managing for resilience comes down to a form of risk management that doesn't enquire deeply into overall purpose. It encourages thinking that looks at current systems and processes and envisions the factors that would limit their ability to be sustained in the presence of shocks. Sustainable development, in contrast, is a more proactive concept."

or shock, or series of shocks. Managing for resilience comes down to a form of risk management that doesn't enquire deeply into overall purpose. It encourages thinking that looks at current systems and processes and envisions the factors that would limit their ability to be sustained in the presence of shocks. Sustainable development, in contrast, is a more proactive concept.

It raises the possibility of a state of being where development is continuing, and sustainable. As such it is a term that reflects today's reality of ongoing change in communities and businesses, and has greater potential for motivating improvements.

Resilience, of course, can be defined more expansively, as an enabling characteristic – that is, in enabling sustainable development. We are then required to anticipate the circumstances or shocks that would challenge our ability to achieve sustainable development. And that puts us back in the position of having to understand what sustainable development really is – and in particular, what it means for a provider of water services.

In light of recent research, sustainable development is now easier to operationalise as a concept. This comes from being clearer about what is to be sustained. From the perspective of the water service providers, they themselves have to be sustainable. They can also help to create sustainable communities and ecosystems. Seen from this perspective, a sustainable service provider, like any organisation, has to maintain its internal systems and processes, and weather out external change, disturbance, and shocks. It has to continue to deliver, over a long period of time, functions and services that are needed by society, the economy, and the environment. In short, it must be nurturing, supportive, and stable. It has to make a positive contribution. It has to be clear about its mission or direction. It has to respond to change when it occurs, and if the change won't go away, it has to adapt to it. This line of thinking leads to a simple set of seven axioms that describe the behaviour of healthy, sustainable providers. These provide ample basis for working with stakeholders to produce a set of performance measures that can define a performance baseline assessment. In summary, a healthy services provider is:

1. **Contributing** – it provides goods and services that are needed by communities and the environment. It is not wasteful or draining, and is not a source of harmful constituents or activities
2. **Nurturing** – it is safe, caring, and regenerative
3. **Supportive** – it respects the roles of its constituents, is non-inhibiting, fulfilling, maximising potential, and equitable
4. **Stable** – it is strong, not fragile, continuing, protective, respectful and honouring of traditions, and not in any way capricious
5. **Responsive** – it is reactive and resourceful, and has a strong capital base
6. **Directed** – it is purposeful and self-organising. It is also energetic, inspired, motivated, self-sustaining, and confident
7. **Adaptive** – it is resilient to change, accommodates change, and is innovative

In assessing the contribution of a provider to the community, we need to see how it impacts the health and sustainability of that community, expressed in terms of the same seven axioms.

An organisation, or a community for that matter, is at once a business (an economic system), a family (a social system), an ecosystem (an ecological system), and a system of knowledge, beliefs, and practices (a cultural system). Our seven axioms apply irrespective of which perspective we take. Consequently they provide the basis for a complete 7 by 4, 28-sector, quadruple bottom line, systems health model. Creative Decisions has been promoting this as a future NZ2100 standard for sustainability reporting for this country. In reality it is just an expression of common sense, that nevertheless asks searching questions about the health and sustainability of any entity.

In order to prepare a sustainability-based performance assessment, providers must first decide what each of the 28 cells in the performance matrix means for them, then choose performance measures, not all of which will be truly quantitative. The assessment will consist of statements or scores showing levels of compliance with the axioms in each of the 28 areas of performance, together with the evidence, in terms of the chosen measures.

Benefits of Sustainability Performance Assessments

With this sustainability-based performance assessment approach, we learn about the organisation not just from the assessment results, but also from the measures that were chosen. These choices will have been informed by guidelines prepared in association with providers.

The benefits of the approach are:

1. It contains no embedded bias towards large systems and high levels of professional specialisation. It is completely scale-independent.
2. In providing a clear operational definition of sustainability, it provides a fixed reference point and common yardstick for the industry, which then has a goal as well as a means of measuring progress.
3. It is customisable, to reflect local realities, and is entirely compatible with existing principles- or values-based management approaches.
4. Basing all assessments on the same high level NZ2100 framework, facilitates comparisons.
5. Performing the assessments in itself creates a collaborating community across the industry. Providers need to work together to decide how it is to be implemented in a way that reflects their interests and concerns. This sense of working together represents getting to 'first base" in the reform process.
6. Providers are left with a sustainability assessment framework and internal competencies that can be used to integrate assessments for all the other functions of local government – including stormwater. Thus we have a means for accommodating all three waters in a way that avoids preconceived notions of interactions and synergies.

So, what are the drawbacks? The approach requires work, but could be completed collaboratively, for the entire industry, within a

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relatively short space of time, including training and developing the necessary guidelines. Being axiom-based, would it lead to pressure for local government as a whole, or even the agencies of central government, to be assessed similarly? Would the process become unmanageable? Would it point to the need for changes to legislation such as the RMA and LGA? Quite possibly, these pressures would emerge, but in all cases this would be healthy for government, and for New Zealand.

Implementation

Apart from an application for Waitakere City Council, in support of their inaugural (2005) Assessment of Water and Sanitary Services, the axiom-based model has not yet been used in New Zealand. Although accolades from planners are not always seen as a good thing by engineers, the approach was praised by the New Zealand Planning Institute in their 2006 World Town Planning Day press release: "pioneering an ecosystem-led approach"... "holistic approach"... "minimises politicking"... "highly compatible with planning practice". A presentation to the 2006 Adelaide Conference of the Environment Institute of Australia and New Zealand led to 'best paper' recognition, and inclusion in the Institute's professional journal.

This country now has considerable institutional expertise in indicator-based performance assessment, and we would expect competency-related impediments to uptake to be minor. Training requirements can easily be identified and met, along with preparation of the necessary guidelines for assessment and audit. Crucially, after completion of the assessment, the industry will have changed. Providers will be more collaborative, and speaking a common language, and they will have a basis for shaping, in a constructive way, the next stages of the reform process.

Conclusion

In conclusion, progressing reform within the water industry requires adopting a common language which can underpin a common assessment approach, and higher levels of trust. Applying some rigour to the concept of sustainability leads to seven sustainability axioms that can provide this common language. Applying them will help to build the collaborative competencies and sense of purpose and direction that will be needed in the future. By putting all three waters under the same scale-independent performance assessment framework, it contributes to integrated, collaborative management. The axiom-based operational definition of sustainability provides the fixed point that the industry has so far lacked, but can now proceed to acknowledge and apply with confidence. ■

Footnote:

Dr Luckman is a former manager of Engineering Services at Auckland's Metrowater. Further information on the axiom-based sustainability approach can be obtained from the paper he presented to *Water New Zealand*'s November conference, entitled "Risk governance for sustainable management of water". The paper is included on the CD of the Conference Proceedings and, with the permission of *Water New Zealand*, can also be downloaded, along with other relevant resources, from the Creative Decisions website, at www.creativedecisions.co.nz/free_public/downloads.cfm

CAENZ Workshop Calls for Greater Availability of Water Quality Data

Mark Milke – Department of Civil and Natural Resources Engineering, University of Canterbury

In July 2011, the Centre for Advanced Engineering New Zealand (CAENZ), along with the Waterways Centre for Freshwater Management and the Universities of Auckland and Canterbury, held a workshop of leading water practitioners and academics to identify key changes needed to lessen water pollution by 2030. Hosted by the Department of Civil and Natural Resources Engineering at the University of Canterbury, the workshop developed a number of valuable suggestions. The most significant of these was a need for greater availability of water quality data.

Great efforts are made by a wide variety of organisations to collect data on water quality. These include:

- NIWA Rivers programme, which monitors 77 sites on 35 rivers.
- IGNS National Groundwater Monitoring programme, which collects data on 120 wells.
- Regional Council assessments of water bodies under Section 35(2) of the Resource Management Act.
- Regional Council funded special assessments of water quality, which are usually part of a process of investigating specific problems or providing background to the development of a local water management plan.
- Water quality data submitted by project proponents as part of assessments of environmental effects for proposed activities, which become publically available during the consent application review.
- Water quality data submitted by resource consent holders as part of consent conditions, which becomes public data upon submission to the relevant regulatory authority.
- Water quality data collected by non-governmental organisations, which could be large corporations interested in internal environmental audits or small neighbourhood groups investigating local streams with simple measurement equipment.
- University and other organisations' research and investigation projects.
- Geographic diversity in New Zealand makes it a challenge to gather enough data to give accurate assessments of the quality of specific water resources. Each catchment and water body needs a rich dataset to allow local assessments of potential long-term effects. Only by combining appropriately large amounts of data from targeted locations will we be in a position to identify and address long-term water issues.

A number of initiatives are underway to make data collection more consistent and representative, and to allow for more robust environmental assessments. The New Zealand Ministry for the Environment has published State of Environment Reports in 1997 and 2007. The next one is due to be compiled in 2012. To develop better State of the Environment (SOE) reports, the Ministry for the Environment is looking at ways to standardise surface water monitoring that is conducted by Regional Councils, which will ensure effective use of these data for national reporting alongside the NIWA Rivers data.

In addition, the Government has released a discussion document that proposes assignment of State of the Environment reporting to the Parliamentary Commission for the Environment, and also proposes changes to the Resource Management Act to mandate consistent monitoring and reporting requirements for the regional councils.

Although good steps forward, they need to be extended to include the data collected via methods 4 through 8 above. We need to recognise that water quality data collected for one purpose can be of great value later for another purpose. Today, regional councils might say that unearthing data from files is of too low a priority. However, if the data had been gathered using some form of protocol, and an easy system of access to data could be arranged, the opportunities to use data can increase dramatically. The national cost for collection of water quality data via methods 4–8 above has not been estimated, but is likely to be in the tens of millions of dollars a year, dwarfing the budget expended for collection of data via methods 1, 2, and 3. This is too large a cost for the country not to maximise the use of these data.

There are encouraging signs that the various levels of government recognise that change is needed. The Environmental Data Management Policy Statement, released by MoRST in April 2010, promotes a vision where "In 2015, open access to environmental research data from public funding is easy, timely, user-friendly and preferably web-based". This clearly recognises the need for more openness to data, and also a view towards fomenting broader use of data. The vision here is too narrow and the need is for access to environmental data from public sources, thus including not just research data but compliance and assessment data, and including all data in the public domain.

The current Government's Digital Continuity Action Plan shows a willingness to work toward a future where other types of public sector data are stored appropriately, accessible to the public, and collected with a view towards a range of possible uses. Water quality data needs to be recognised as another form of public sector data where greater access is needed. The future for water quality data

"The current Government's Digital Continuity Action Plan shows a willingness to work toward a future where other types of public sector data are stored appropriately, accessible to the public, and collected with a view towards a range of possible uses. Water quality data needs to be recognised as another form of public sector data where greater access is needed."

should be one where local and central government work within an accepted, wider, public transparency and accountability regime.

Any effort to develop a data clearing house must deal with the issues of inconsistencies and different methodologies head-on. For example, sampling or analysis methods can vary from study to study (e.g., filtered or unfiltered metal concentrations), the accuracy of data can vary between methods, between practitioners, and over time. The medical community has faced related problems with data sets of varying quality using variable measurement methods, but recent years have seen the rise of techniques in 'meta-analysis' that allow rigour in analysis of multiple datasets, while also accepting their variable precision and accuracy. The scientific community has grappled with similar issues when combining evidence on temperature change to examine global trends. It is time for water professionals to likewise turn our mass of dusty data into useable information and knowledge.

The future needs to be one where teams of people analyse together our large and complex data sets. The CAENZ Workshop identified a role for New Zealand universities where advanced students in water-related sciences and engineering could conduct analyses of data as project or research courses within their degree studies.

The 2011 CAENZ Emerging Needs Workshop on Water Quality was a small group of 20 water professionals from universities, consulting firms, and major New Zealand organisations. Discussion was stimulated by talks on emerging water quality needs by Garry Macdonald, Previous President of IPENZ and Beca Infrastructure NZ; John Russell, Fonterra; Stephen Esposito, Solid Energy NZ; and Mike Freeman, Freeman Environmental (now at URS NZ). Production of this document was led by Mark Milke and Mike Freeman, with contributions from many of the water professionals in attendance.

Our conclusion is that action is needed urgently to expand the availability of water quality data, and thereby encourage the analysis of water quality monitoring data. To effect change the following are needed:

1. A nationally consistent framework and strategy needs to be developed to maximise value of all surface and groundwater quality data. This strategy should have as its goal free-access, user-friendly, web-enabled, water quality databases.
2. A national water quality monitoring strategy needs to be integrated with the Ministry of Science and Innovation's Environmental Data Management Policy Statement, and include research organisations, universities, national and regional government. ■

Sustainable Roof Water Harvesting After Earthquakes

Stan Abbott – Director Roof Water Research Centre, Massey University & Tony Thorn – General Manager, WaterGain Limited

Introduction

Rainwater tanks can provide a number of benefits to the householder and the community if properly installed and maintained. Rain tank water can be an invaluable alternative water supply in disasters such as earthquakes and fires (Abbott 2008; Male 2011). Many areas in New Zealand are vulnerable to large earthquakes because there are major fault lines running the length of the country. As such, many areas are at risk of being isolated due to the potential disruption of water supply lifelines that could adversely affect large areas for weeks to months after an earthquake (Abbott, Moore & Golay 2011).

The October 2005 earthquake in Northern Pakistan was the most devastating natural disaster that Pakistan has ever faced. It has been estimated that more than 73,000 people lost their lives, 570,000 houses were damaged rendering 2.8 million people without shelter, and over a million people lost their sources of income, while approximately 70,000 were injured (Amin & Han, 2009). The earthquake caused severe damage to over 4000 community owned drinking water supply systems, 25km of sewerage lines, and drains, street pavements, public toilets and solid waste management systems. Water and sanitation facilities in 420 health facilities, and 5857 educational institutions, were destroyed. Many small and simple, economically-feasible rainwater harvesting systems were installed in relief camps in earthquake-affected areas in Pakistan. A simple, locally-designed household sand-filter proved efficient in improving drinking water quality for communities, with a positive impact on health effects and economic outcomes (Mahmood et al. 2011).

Rainwater harvesting (RWH) was encouraged as a sustainable alternative water supply in tsunami-hit Banda Aceh in 2007 (Song et al. 2008). From a technical perspective, the RWH was found to be particularly useful for the following reasons: (a) the materials used could be obtained easily and cheaply in the area; (b) its design and installation was simple and replicable, using locally available technology; (c) maintenance was easy; and (d) the expected volume of collected water was considerable (Han 2007; Song et al. 2008).

In the 19 months since the earthquake and tsunami-hit Samoa in September 2009, the Samoa Red Cross Society procured and installed 350 rainwater tanks (Red Cross and Red Crescent Operations, 2010), providing considerable social welfare benefits to affected communities.

The January 12, 2010 earthquake in Haiti damaged or destroyed homes, schools, government buildings and roads and approximately 230,000 people were killed and 300,000 injured. The earthquake exacerbated an already inadequate health situation, with the collapse of at least eight hospitals and health centres in the capital, Port-au-Prince. In Haiti much of the population live below the poverty line and few people have a direct water supply to their homes. Water supply in the city prior the earthquake was either by the municipal water distribution system (35%), from private water vendors (35%) or untreated sources from low lying areas (30%) After the earthquake the majority of the people had to travel to local water distribution points where long queues formed for the available water (Barton & Henriques, 2010). In October 2010 a massive cholera epidemic erupted in Haiti and at the time of writing more than 7,000 people have died from cholera in an epidemic which has become one of the worst in modern history to effect a single country.

A huge $746 million campaign to improve Haiti's supply of drinking water, sanitation and hygiene is currently in progress and includes chlorination of all piped water supplies, distribution of water purifying tablets to homes throughout the country, and provision of water storage vessels and soap (Tappero & Tauxe 2011).

The Christchurch earthquake of 22 February 2011 was a powerful natural event that severely damaged New Zealand's second-largest city, killing 184 people in what has been described as one of this country's worst peacetime disasters. The earthquake caused widespread damage across Christchurch, especially in the central city and eastern suburbs, with damage exacerbated by buildings and infrastructure already being weakened by the earthquake of 4 September 2010 and its aftershocks. Of eight main water reservoirs, seven had been damaged and/or emptied during the February event, and some of the structural damage to reservoirs and pipes was severe (canterburyearthquake.govt.nz; ccc.govt.nz 2011). Fonterra provided milk tankers to bring in water, the Army provided desalination plants, and bottled supplies were sent in by volunteers and companies. While more than 80% of the Christchurch water supply was restored within two weeks of the February earthquake, boil-water notices remained in place city-wide until April 2011. Some communities in Christchurch were still without mains water supply more than 100 days after the February earthquake and at times people waited for up to five hours (Figure 1) for water tankers to arrive at some welfare centres (Dearnaley 2011).

Figure 1 – People waiting for water supplies at Redcliffs School in Christchurch after the February 2011 earthquake

Photo: Iain McGregor / Fairfax NZ


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"Rainfall frequency in a particular region, specific tank sizes and water demand will of course influence the total amount of rainfall available for use. In some instances there will be overflow from the tanks during a rainfall event and in other cases the tank will be empty through lack of rainfall or overuse."

Benefits of Installing Rainwater Tanks

Currently more than 10% of New Zealanders rely solely on roof-collected rainwater for their drinking water – especially in rural areas that are not served by municipal town supplies. However, even in urban areas some local authorities are now encouraging home owners to install domestic rainwater tanks, not only as a mains-water saving measure but also to reduce the adverse effects of storm-water runoff. In districts such as Kapiti, Waitakere, North Shore and Rodney, home owners are offered rebates to install rainwater tanks to new or existing houses so that the rainwater can be used as a secondary source for toilet flushing, in washing machines, and outdoors for uses such as garden watering, car washing, and filling swimming pools (Abbott 2008; Abbott 2010).

Studies in Australia (Coombes and Kuczera, 2003; Lucas et. al., 2006) on the performance of 1000 litre and 10,000 litre rainwater tanks have shown that depending on the roof area and number of occupants in a household, the use of rainwater tanks resulted in annual mains water savings ranging from 18,000 litres to 55,000 litres for 1,000 litre tanks and from 25,000 litres to 144,000 litres for 10,000 litre rainwater tanks. Coombes & Barry (2008) have also demonstrated that roof catchment systems supplying rainwater tanks were significantly more resilient to natural variations in climate and unexpected climate change than water supply catchments supplying dams. Furthermore, these authors showed that decentralised rainwater harvesting from roof catchments in cities has the potential to supplement centralised water supply strategies to create an overall more resilient urban water supply.

Rainfall frequency in a particular region, specific tank sizes and water demand will of course influence the total amount of rainfall available for use. In some instances there will be overflow from the tanks during a rainfall event and in other cases the tank will be empty through lack of rainfall or overuse. Obviously the ideal situation for rainwater harvesting – especially in emergencies – is consistent rainfall for dependable water usage, preferably higher usage only during times of higher rainfall.

The Wellington Emergency Preparedness Guide (CDEM 2010) suggests 3 litres of water per person per day is required to meet drinking needs, and more for cooking, hygiene and pet care. However, World Health Organisation studies state that 40–50 litres per person day per day as the minimum recommendation and having less than 20 litres per person per day as a significant health risk (Howard & Bartram 2003).

In a recent Wellington study it has been shown that the strategic placement of large (≥ 25,000 litres) rainwater tanks at accessible sites (such as at schools, churches and designated distribution centres) presents several advantages to affected communities – not least that the critical lifeline of water is immediately available during an emergency response (Abbott, Moore & Golay 2011). However, while the installation of a large rainwater tank is relatively straightforward and simple if it is carried out by a competent plumber who has expertise in installing tanks, tank and installation costs and available ground space can be disincentives to home owners wishing to install their own emergency rainwater tank. Therefore consideration must be given to the feasibility of home owners installing small rainwater tanks themselves that are inexpensive, easy to install, and capable of effectively collecting and storing an adequate amount of roof water for emergency uses.

Installation of Small Emergency Rainwater Tanks

This was a collaborative project between Massey University's Roof Water Research Centre (Wellington) and WaterGain Limited (Auckland). The aim of the project was to encourage home owners to install rain water tanks *before* an earthquake strikes Wellington so that they can have a steady supply of emergency water that they can use for drinking, oral hygiene, utensil washing and food preparation.

Twelve home owners were randomly selected and provided with:

- 250L water tank
- 80mm water collector diverter
- 1m garden hosepipe
- 2 x hose connectors
- 1 x tap
- 1 x bottle of tank water disinfectant
- Installation instructions
- Feedback questionnaire

The questionnaire asked respondents how easy and how long it took the home owners to install the rainwater tank as well as how efficiently the system was in harvesting the roof water (Figure 2).

We made it clear to all the participants that the water they were collecting in the rainwater tank was intended for emergency use only and as such it should be boiled for 1 to 5 minutes before using or alternatively the water could be disinfected very quickly and safely with the tank water disinfectant that we provided.

Figure 2 – A 250 litre rainwater tank connected to down pipe via debris screen and water diverter

"Roof-collected rainwater can contribute significantly to a sustainable water strategy during disasters like earthquakes, when the lifelines of centralised water infrastructures are compromised. The findings of this pilot study show that rainwater harvesting by the home owners themselves can be a realistic option for a safe water supply, in terms of costs, simplicity of installation and maintenance."

All but one of the participants found the installation instructions easy to follow. Ten of the twelve participants took less than one hour to install the rainwater tank and but two participants took more than two hours because they had to build a wooden stand for the tank to sit on. Three participants had to each purchase and install two downpipe adapters to fit the 80mm diverter but these, they stated, were readily available at hardware stores. All 12 participants stated that their tanks filled up properly with roof-collected rainwater but two participants stated that once their tank was full of water the water did not overflow back properly through the diverter to the stormwater drain. This was due to the diverter being installed in the incorrect position – the correct position is shown in figure 3.

Figure 3 – Correct arrangement of diverter and inflow and outflow pipes

Conclusions

Roof-collected rainwater can contribute significantly to a sustainable water strategy during disasters like earthquakes, when the lifelines of centralised water infrastructures are compromised. The findings of this pilot study show that rainwater harvesting by the home owners themselves can be a realistic option for a safe water supply, in terms of costs, simplicity of installation and maintenance. Installing a small rainwater tank is a straightforward process and can be done by a "home handy man" within one to two hours.

This includes the time necessary for cutting the down pipe, installing the water collector/diverter and linking the rain harvesting the system to the tank. This simple roof water harvesting system is capable of effectively collecting and storing an adequate amount of roof water for emergency uses. In the system described in this study the diverter chute (when open) can be used not only for cleaning debris from the gutters but can also be used for collecting more water in buckets or other containers when the rainwater tank is full of water (Figure 4).

Figure 4 – Full tank and additional water being collected in buckets via diverter chute

For use as emergency water supply, the rainwater can be easily disinfected or boiled, so that there is minimum health risk when using the water for drinking, food preparation and washing. We recommend that the local authorities take a more proactive

approach to encourage home owners to install their own rainwater tanks before an earthquake strikes. Financial and other incentives for home owners should also be considered by authorities. ■

For more information please email S.E.Abbott@massey.ac.nz or tonythorn@roofguard.co.nz

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Ruataniwha Dam – Another Step Ahead

Hawke's Bay Regional Council

Hawke's Bay Regional Council (HBRC) has been given confirmation that a proposed 90 million cubic metre water storage dam on the Makaroro River site is geo-technically feasible. This is a key milestone for the project.

The Makaroro River flows from the Ruahine Ranges into the Waipawa River and then into the Tukituki River, below the towns of Waipukurau and Waipawa in Central Hawkes' Bay. The rivers cross the wide Ruataniwha Plains, which is the hub of cropping, dairying, sheep and beef farming and other productive land use. HBRC has carried out considerable scientific work on the interaction between the underground aquifers and the rivers crossing the Ruataniwha Plains. Some parts of the Tukituki River catchment now have water sustainability and allocation issues and some minimum flows in rivers may be considered to be too low. It could be desirable for the river flow to be naturalised to protect aquatic life and maintain acceptable water levels.

Storage dams are considered a possible solution to providing long term certainty and security to existing irrigators as well as recreational users of the river system. A major focus is improving environmental outcomes for the river through improved summer flows. In the past two years, many potential dam sites have been examined. In August last year a site on the Makaretu River was ruled out because of serious geological and geotechnical flaws, including unstable foundation material, which would have made dam construction there too difficult and expensive.

The go-ahead on the geo-technical feasibility for the Makaroro site has allowed Hawke's Bay Regional Council to provide more certainty in informing the environmental studies and work programmes. Over the next few months, HBRC will be working with a number of consultants and experts on a raft of new environmental and non-science studies to pin down key issues around the site, the project and the environment, and better confirm project costs and possible effects.

The current provisional cost of the project is $170 million plus for dam construction and reticulation (getting water under pressure to the farm gate), however this is not final. The project team continue to revise and refine estimates and budgets as engineering and environmental works continue at this stage. They are also looking at business and finance models as HBRC turns its attention to capital raising and the lodgement of related resource consents during 2012.

Community Consultation

While there is a good deal of support in the community for the water storage project and its irrigation potential generally, affordability will be critical to ensure uptake by farmers and other land users. This is an important part of the economic evaluation currently being undertaken, and will inform the Council when ultimately deciding if the project should proceed to the next phase. A wide range of people have also expressed concerns about potential en-vironmental impacts, particularly around the impact of run-off on waterways from increased irrigation over a larger productive land area.

HBRC is working with a Strategic Leadership Group and an informed Stakeholders Group to ensure wide community involvement in the investigation and options. Landowners and those involved in the groups are kept informed of decision milestones, and contribute feedback through the groups.

"Whether or not this project to construct a large water storage dam goes ahead is still in question, but we are pleased to have support for this next stage from the government's Irrigation Acceleration Fund," said Graeme Hansen, HBRC's project manager.

Irrigation Acceleration Fund

On January 25, Hawke's Bay Regional Council became the first organisation to sign up with the Ministry of Agriculture and Forestry's Irrigation Acceleration Fund. MAF's commitment of $1.67 million, on top of a previous $350,000 and HBRC's $2.8 million contribution will meet all funding requirements to complete the feasibility study. The total study cost of $4.8 million provided by this government/ regional government partnership covers all aspects of the water storage proposal, from land intensification and increased irrigation capacity to financial viability and environmental effects.

"Technically complex but feasible"

During November 2011, HBRC received from lead consultant Tonkin and Taylor an initial project description outlining technical details in the proposed Ruataniwha Water Storage Project. This comprehensive and complex information is a 'work in progress', but has served to summarise a number of studies completed to date:

- Water resources and irrigation demand studies
- Design arrangements for a dam at the Makaroro River site
- The potential for hydro electric generation
- The general headrace alignment corridor
- Relative costings and options assessment for a canal, piped or aqueduct head-race and recommended downstream distribution network
- Preliminary sedimentation estimate to determine the dam's dead storage requirements.

In essence, this project description showed that a water storage dam at the identified Makaroro River site would be "technically complex but feasible". The dam would be would be around 77 metres high and 510m wide, and capable of storing 90 million cubic metres of water. It would provide irrigation for between 17,000 and 22,000 hectares, depending on the type of land use, with hydro-electric potential for 6.5 megawatts of power generation.

Investigations Continue

In tandem with the technical feasibility study, a number of environmental studies are in progress, as listed in the following table.

STUDY NAME	LEAD AGENCY/S
Ground/ surface water flows – scenario modelling	HBRC Science Team
Effects of reservoir water quality on receiving waters	Aquanet & NIWA
Land use intensification effects modelling	NIWA, Plant & Food Research, AgResearch
Land use intensification effects – management and mitigation opportunities	Plant & Food Research, AgResearch
Aquatic ecology assessment	Cawthron Institute
Terrestrial ecology assessment	Kessels & Associates
River geomorphology assessment	Tonkin & Taylor
Social impact assessment	Taylor Baines & Associates
Historic heritage/ archaeology assessment	Clough & Associates
Recreation assessment	Opus Consultants
Traffic and road assessment	Opus Consultants
Noise assessment	Marshall Day Acoustics
Landscape and visual effects assessment	Isthmus Group
Cultural values assessment	Dr Benita Wakefield

Ruataniwha dam location

More than the Ruataniwha Basin

Water storage opportunities have also been investigated to identify potential options for the long term sustainable development of irrigation supply for the Ngaruroro and Upper Karamu catchments in Hawke's Bay.

A pre-feasibility study has been undertaken that focussed on surface water harvesting and the ability to service potentially irrigable land as well as improving security of supply for existing irrigated areas.

The next step is to undertake an on-farm economics study to further assess the viability of the proposal and to allow HBRC to consider the next phase for this project by mid 2012. ■

Dry Weather Spell Puts Glacier Country Water Supplies Under Pressure

Vivek Goel – Group Manager – Assets and Operations, Westland District Council

South Westland tourist destination Franz Josef ran into water shortages in early January this year. While the rest of the country experienced typical La Nina weather patterns along with New Year celebrations, 'Glacier Town's' water supply came under severe pressure to cope with demand.

Council had been monitoring the water situation and the town's water consumption was under warning. The current water source is from a creek which is gravity fed to the water treatment plant. The plant which is a combination of sand filtration, cartridge filtration and chlorination has a capacity to produce up to 650m^3/day of treated water. Three reservoirs of a total treated storage capacity of 1800m/day failed to cope with the instantaneous demand of dry weather. It took less than three hours to run out of almost 900m^3 of treated water.

With no telemetry controls, and no good flow meters other than an outflow meter at the treatment plant, assessing the true demand is a mere desktop assessment with raw data from a number of varied sources. The plant is scheduled for an upgrade in 2012–13.

At noon when the storage levels dropped to 50%, Council's management issued restrictions on water use which is a normal protocol. However, very soon the ineffectiveness of the communication systems was evident as even before all the local businesses could be warned, the higher ends of the town were seriously affected with low or no flows in the water pipes. The treatment plant could not produce enough to cope with excessive demand.

Action Taken:

- An immediate Boil Water Notice was issued and advised through communication channels
- The filters were bypassed, raw water was supplied directly with chlorine dosing from the plant, and supply was back on within 90 minutes
- Attempt was made to run a bi-feed to the treatment plant over off-peak hours to regain the storage

This event highlighted many issues. It was evident that a small town with such a huge tourist population influx would have minimal knowledge of water restrictions.

Council and community engagement and communications were put to the test. The fortnight following the event was a roller coaster ride for Council. Management was under pressure to restore the treated water supply as soon as possible, while for the customers obtaining the treated water and getting back to business with tourists coming in was a key priority. Management had further underlying issues to deal with; the plant was not producing enough, warm weather was ideal for developing cryptosporidium, and the town also had to cater for any emergency supplies, i.e. fire fighting etc. Moreover the puzzle as to how you would run out of one day's treated water in less than three hours remains a mystery. It has been attributed in the most part to the instantaneous demand during the peak hours. In absence of any telemetry controls, the outflows couldn't be monitored in real time.

Communications and Engaging with the Community

After appearing in the national media headlines – 'Glacier Town runs out of water' – a community meeting was held to discuss the way forward with local input. With a great turn out a number of options were discussed at length. It was a great experience to see how much information was available from the local resources.

The meeting resulted in the formation of a Franz Josef Water Committee representing the local business and resident community, Council staff and a local Councillor.

With the peak tourist season yet to arrive in three week's time, the Water Committee was tasked to come up with a management plan not only to avoid the situation occurring again but also to try to find a quick solution to meet the shortfall of treated water supply in the town.

The Committee agreed on a revised form of communication which appointed one point of contact between Council and local community. The members presented a number of options which included seeking help from the military. Options included provision of a potable filtration unit at the plant to increase the treatment capacity. As a back-up, storage of bottled water was also discussed. Since chlorinated water was available, water for drinking purposes was to be made available. It was agreed that being a tourist destination, any water restrictions would be unhelpful.

To begin with it was agreed continual monitoring of water levels would be in place until the situation recovered and treated water supply was restored. Daily reporting was in place to keep the community updated with progress.

The Plant

The current combination of multimedia treatment with sand filtration followed by cartridge filtration and chlorination means Franz Josef

is limited to producing up to 650m³/day. The source, surface water from a nearby creek, has been a reliable source to date, though this is also under investigation. A back up bore was drilled to a depth of more than 40 meters in close proximity to the Waiho River to serve as additional source of water in case of emergencies. In this event, though tested at the time of commission and initial phases, the bore produced no water. The source of water though was not the problem. It was the treatment plant capacity as to how much filtered water could be pushed through.

The plant was designed in late 1998 with estimated peak demands of 650m³/day. In the absence of proper planning and demand management strategies for water supplies around Westland, the upgrades have been predominantly planned as a result of the legislation change in Drinking Water Standards. Until 2010 any demand assessments have been on the basis of the population projections released by various organisations.

However with changing technology and an extensive development plan, Franz Josef has put the town water supply on a priority for an upgrade. The plant will be upgraded to a minimum of 1500m³/day of treated water capacity.

In the interim a quick solution had to be found to cater for the seasonal tourist population demand. Options for a potable filtration unit were costed to be around $125,000.

Filtec Technologies, currently involved in an upgrade of the Ross Water Treatment Plant in Upper South Westland, was contacted to provide an economical solution.

Filtec proposed CUNO High Flow Filtration system. The Highflow 1 micron media filter system could be installed parallel to the existing filtration units and would help to achieve at least an additional 400m³/day of treated water at the plant. This filtration unit has been tested at Massey University laboratories and was found to be compliant with a success removal rate of 99.97% for crytosporidium. Filtec Technologies offered a unit to be installed on loan until we resolve the situation and come up with a more commercial solution.

The unit is now installed at the plant with an additional four filters. If needed the unit can be actioned to top up the additional demand.

The plant is planned for an upgrade which will also include a telemetry control for better management and data collection for demand management.

Drinking Water Standards NZ and Upgrades for Small Drinking Water Supplies

While management revises its management plans and demand management strategies, the fact is that costly upgrades for compliance with revised Drinking Water Standards still haunts small water supplies. Westland in particular has small water supplies with resident populations ranging from 300–1000 people.

> "In the interim a quick solution had to be found to cater for the seasonal tourist population demand."

As per the revised criteria for funding under TAP and CAP schemes, towns like Franz Josef are particularly disadvantaged. Being a high value land profile and a tourist interface, the de-privation index as per the last study is around three. The town has an ordinarily resident population of about 500 and around 800 during the peak tourist season. The tourist population can grow up to 5000.

With a relatively small population base in Westland the costs to upgrade in order to meet the compliance practically becomes uneconomical. A typical example of a cost benefit analysis for upgrading a water supply for a resident population of less than 100 is Hannahs Clearing, which resulted in a referendum under S. 131 of Local Government Act. Following the referendum the water supply was shut down. Rainwater tanks are now primary source of drinking water with on tap solutions for treatment.

Similar cost benefit analysis will have to be applied for other small water supplies to assess the feasibility of upgrades.

Way Forward

Events at Franz Josef have brought about a series of changes both fundamentally and operationally. The management has a case to justify the upgrade of the water treatment plant and bring forward the CAPEX program.

The case to install telemetry controls at all water treatment plants is also justified. It is evident in the absence of any real time data things can go very much out of control.

Westland District Council is already mid-way towards the improvement and implementation of its asset management systems. It incorporates an advanced risk management module which is intended to become a key aspect of the performance management framework. Issues at Franz Josef water supply have changed the risk profile for the town and this has now been incorporated into the risk register. Scope for forward planning around demand management has been identified and will form the basis for the design of new upgraded water treatment plant. Council has also initiated work to improve customer interaction and community engagement. The key aspect – cost benefit for money spent on compliance with revised standards still remains an issue, which probably is similar for most of the small, similar sized water supplies around the country. ■

How Often Will Sewage Spill? Stochastic Analysis & Design of a Wastewater System with Large RDII Components

Stewart Sargent – Services Development Engineer, Marlborough District Council

Introduction

Hydraulic modeling tools are becoming more useful, but the threatening cloud of climate-change[1], and the desire for 'no overflows', necessitates some reality checks. But by definition, all models are wrong (some are just less wrong than others), because modelling can only be an approximation of reality – especially future loading. The stochastic nature of model loading and the consequences thereof can have a major effect.

For systems with large RDII (Rain Derived Infiltration and Inflow), classical methodology for estimating loads often portrays the false impression of a known ultimate design flow. The reality is that ultimate loads cannot be determined. The article[2] describes real-world modelling of a sewer-system backbone for a 'wet' area [1500mm/year rainfall located at the base of steep sided valleys] using stochastic methodology.

Earlier research [Reference (3)] showed RDII to be dominant. Figure 1 shows a typical time sequence during a rain event while Figure 2 shows the relative components of the peak flow.

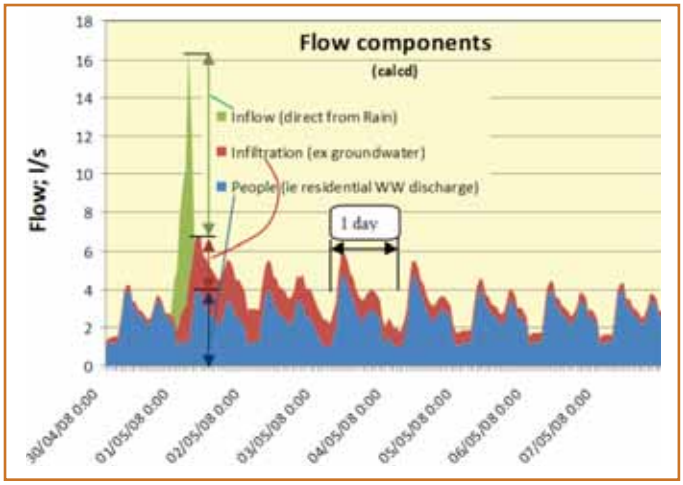

Figure 1 – Flow Components

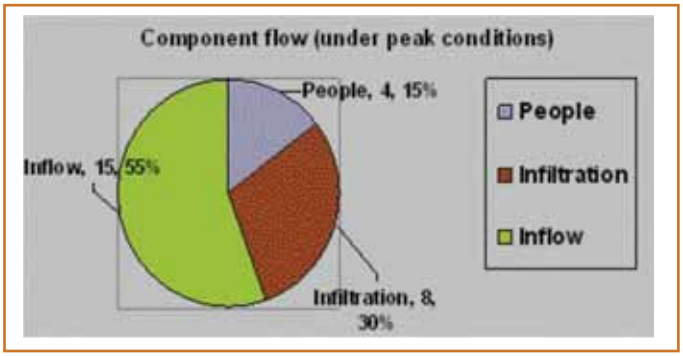

Figure 2 – Component flow under peak condition

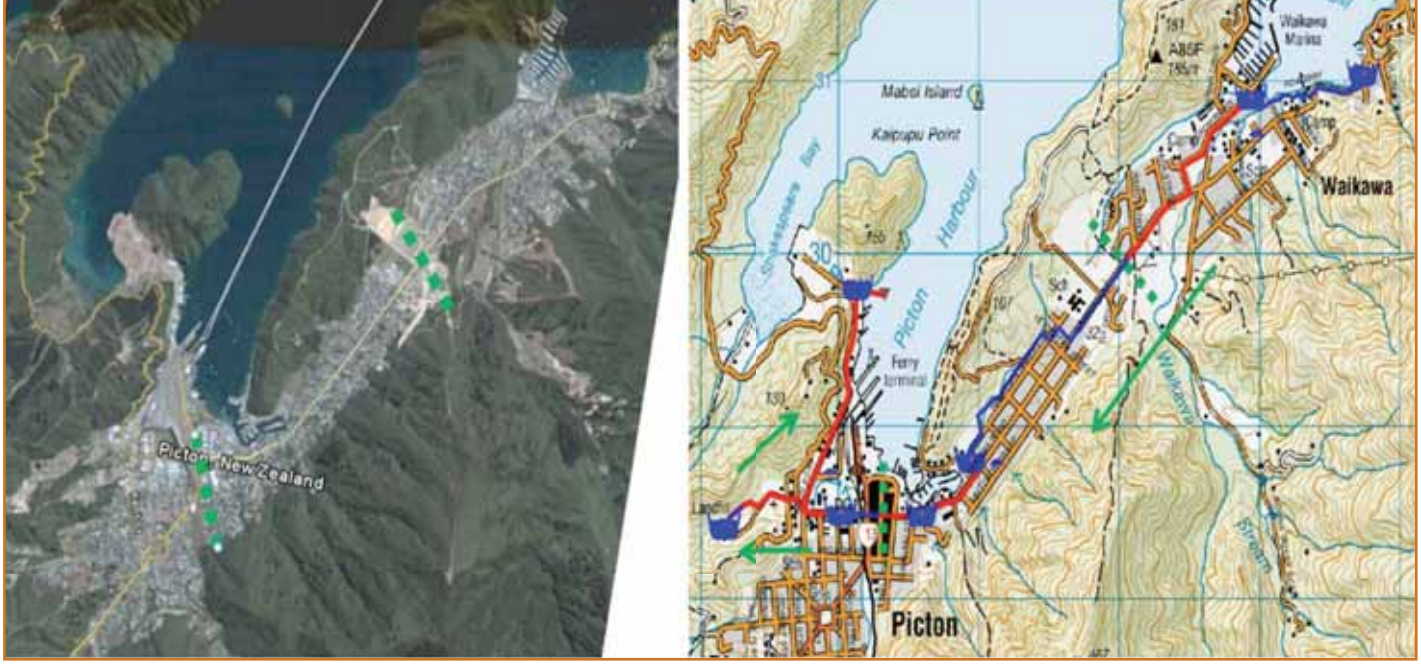

Figure 3 – Layout wastewater system Picton – Waikawa

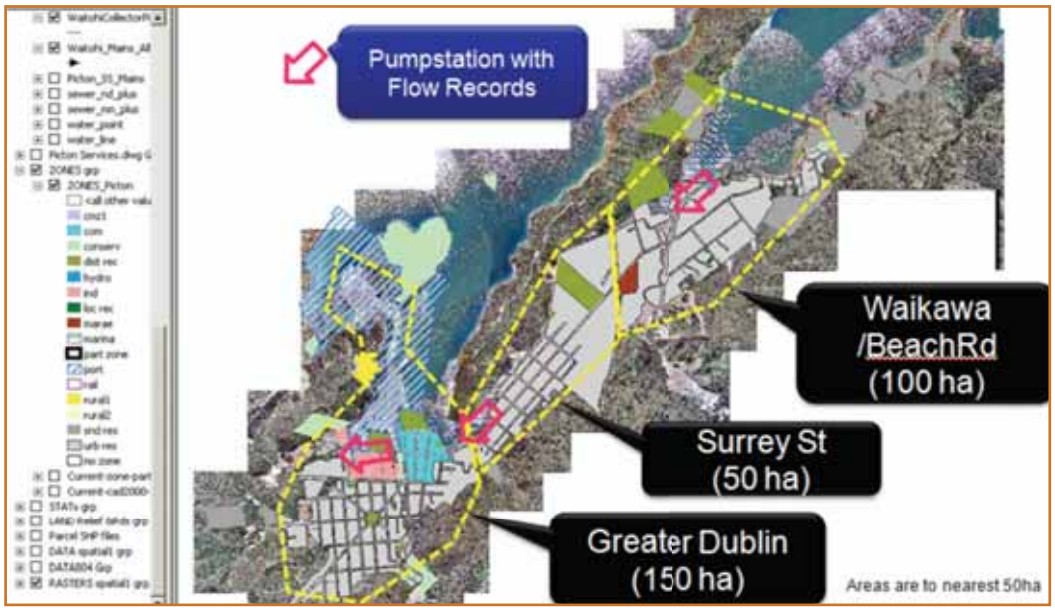

Figure 4 – Catchment groups and zones

Only 15% of the load comes from WW [Wastewater] discharges! The case study described below looked more closely at the RDII components on a stochastic basis, and then used the results for design studies.

The figure above shows the WW (Wastewater) system in question (Picton – Waikawa New Zealand).

The catchments are shown opposite in Figure 4.

Figure 5 – 3D view

Note the steep sided narrow nature of the Surrey St catchment highlighted in yellow in Figure 5 opposite.

"Modelling can only be an approximation of reality – especially future loading."

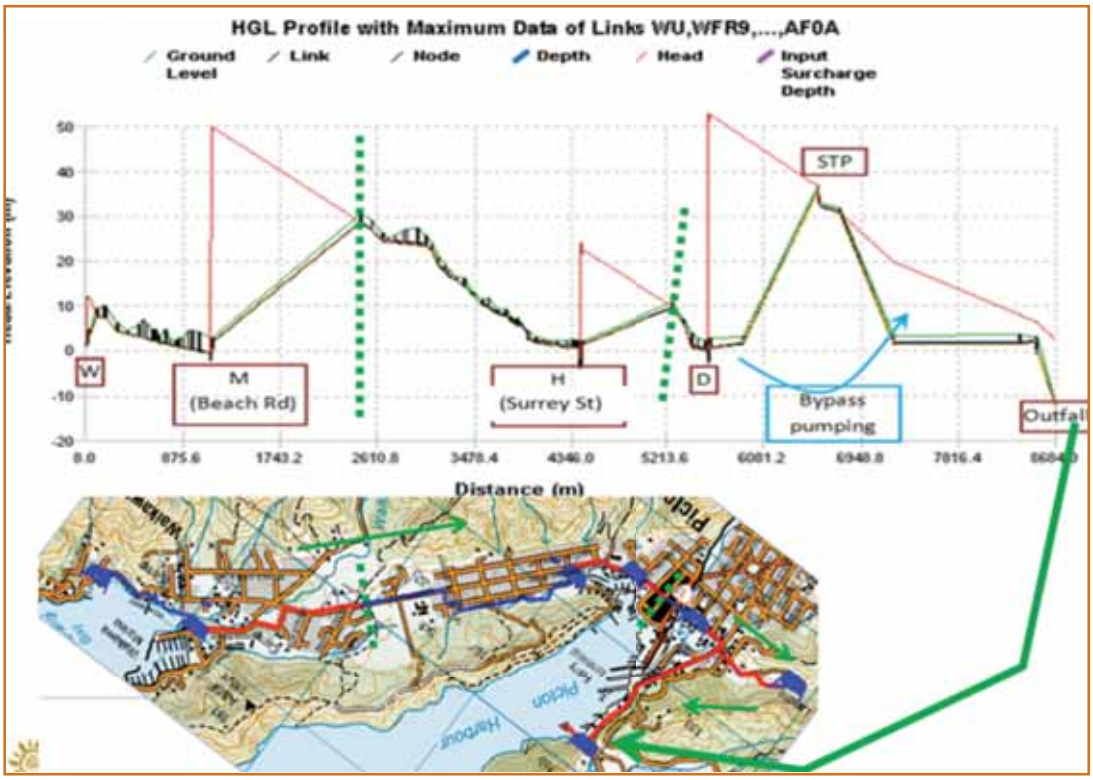

Figure 6 – Profile

Figure 6 opposite shows the profile along the backbone. Two pumpstations (M & H) lift the WW to ridge lines (green dotted lines) for gravity flow to the next pumpstation and finally at pumpstation, D, pumps to the STP. A gravity outfall pipe flows to the sea outfall and the bypass system is planned to handle (some) loadings in excess of STP capacity.

The existing population is around 7000 and the area 300ha. Allowance for growth is approximately 100% (for both metrics).

Situation

At present, along the backbone, there are: old pipes, failures, overloading, overflows & lack of spare capacity. Basically:

- The entire backbone needs to be replaced
- The question is: what should the design capacity be and what are the overflow consequences?

Case Study: RDII Analysis

Data

A typical data sequence is shown below. The large effect of the RAIN upon Level and Outflow can be clearly seen. Even a mild rain event trebles the outflow!

The data is not 'clean' (it never is) so it was necessary to use; local knowledge, field staff experience, and visual interpretation to identify clean sections with high flows, but dodge; overflows (which were not recorded), and bad or missing data.

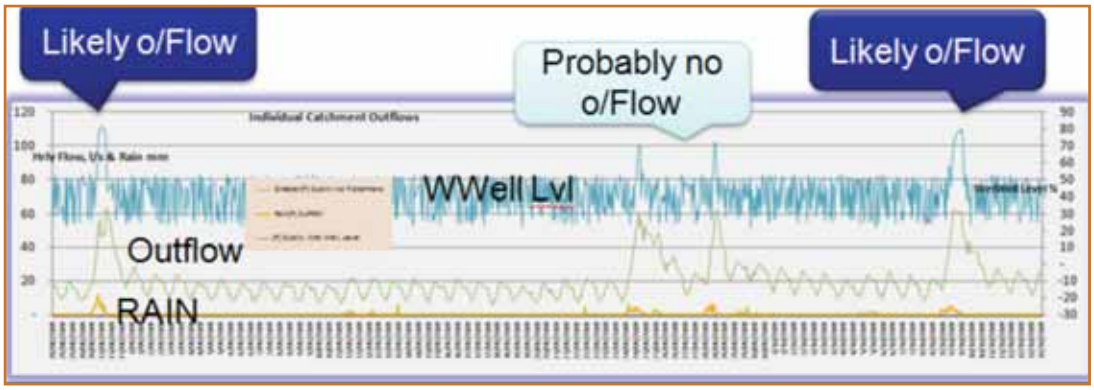

Figure 7 – Catchment: Rain, WetWell level and Outflow

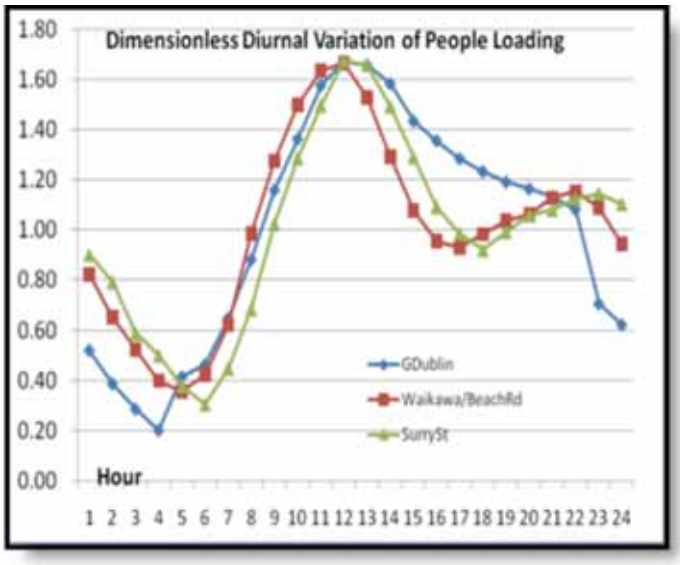

Figure 8 – Dirurnal Variation of People DWF loading. & Loading Metrics [GrdWtr = DryWeather BaseFlow]

DWF

Industry standard data analysis tools[3], as recommended by EPA in a 2008 study, were used to identify dry weather sequences and extract the typical diurnal flows.

The resulting dirurnal variation curves are shown in Figure 8 above. The pattern is very similar to that obtained by analysing water demand. The different shape for the Greater Dublin St catchment makes sense because the catchment has a siginificant commercial/ industrial component.

WW Components

Subtraction the DWF from the records gave the Wet Weather (RDII) components.

The correlation between Rainfall and RDII is quite clear as illustrated in Figure 9 opposite.

A non-overflowing period was used to generate a relationship (SUH) between rain and RDII. Applying this relationship to a longer record gives the comparison below. This tends to confirm the existance of an overflow. Peaks correlate well, recession not so well; but it is the peaks that are of much greater importance in this case, so the correlation was deemed sufficient.

> "Peaks correlate well, recession not so well; but it is the peaks that are of much greater importance in this case, so the correlation was deemed sufficient."

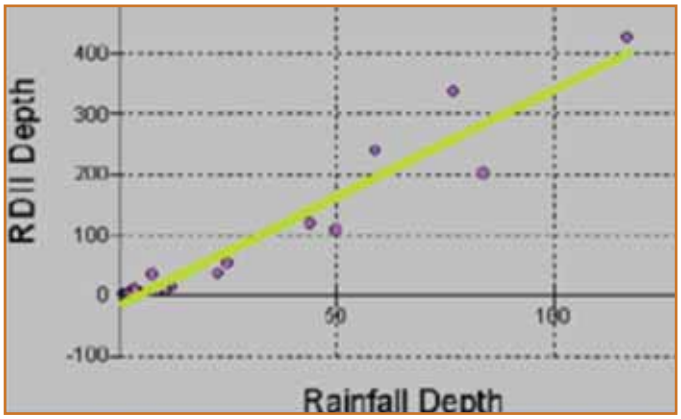

Figure 9 – Correlation

Note: for all of this analyis, ARIs are based on historical events and make no allowance for climate change. Indicatively they could halve with climate change. A 20 year event could become a 10 year event!

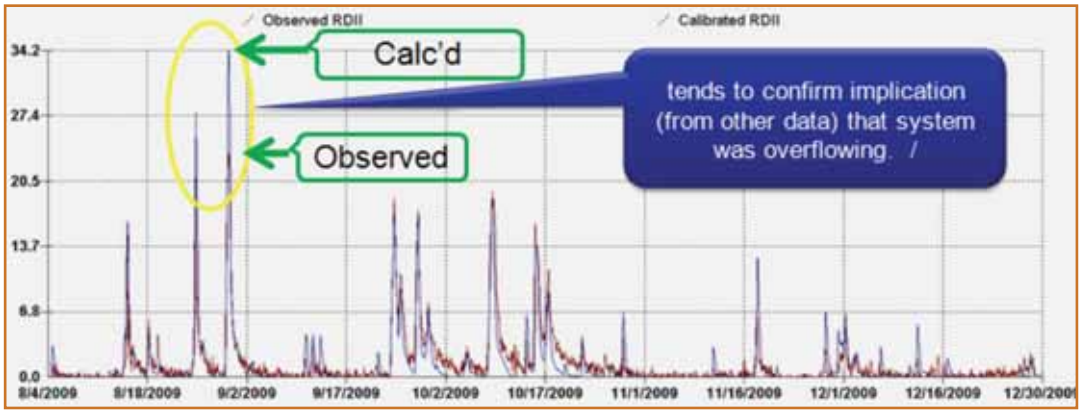

Figure 10 – Longer record (including likely overflow)

Results

To provide a comparison and to provide simple metrics, the results were converted to l/s / ha. Assumptions adopted for future design considerations were as follows:

- For growth allowance; first the existing area was in-filled, then growth areas were added. Infill assumptions were (from field info): 70% of I&I assigned to mains (ie existing) and 30% to service connections.
- A minimum of 0.4l/s /ha for 2 Year ARI was imposed (to align with information & loads used by others in similar NZ regions).
- Growth areas were assumed to have I&I rates = 70% of that for existing. [Comment: Analysis of recently installed systems has shown disturbing I&I only a decade or so after construction. A figure of 70% may still be a little high but given the nature of the topography, groundwater, and conditions in the area, a lower number was deemed to be too risky.]

Sensitivity analysis was also carried out to refine assumptions & check consequences. The overall effect was not highly sensitive to these assumptions.

RDII rates and the resulting total loads are shown in Figure 11.

Figure 11 – Total load by catchment

The following observation is made, the Surrey catchment has the highest I&I (per ha) – which is quite believable given the steep valley sides and general shape of the topography (as illustrated earlier in Figure 5 – 3D view).

[Field visits have observed overland and subsurface runoff down the valley sides at the same time as high inflow is observed pouring-in through joints in manhole liners and laterals].

Comparisons with Classical Metrics

Comparisons were made with NZS4404:2010 Land Development and Subdivision Infrastructure. The latter would call for a dry weather (DW) flow based on 180-250l/p/d times a peaking factor of 2.5 then an extra wet weather (WW) component is added:

- NZS4404 adds an extra 100% (ie PWWF = 2 x PDWF). [MDC NZS4404 addendum uses 200%], or
- Local practice often adds, instead, a specific extra I&I, eg 0.6l/s/ha applied to 75% of gross Ha

The comparison showed that even the MDC modified NZS4404 was only at or below the 1 Year ARI, and much lower than the load that is likely to occur for a 10 Year ARI[4].

Conclusion From the Analysis

The analysis lead to the following conclusion and targets:

For areas of high rainfall, and topography which directs stormwater onto the catchment, classical design parameters are likely to produce frequent and unexpected sewage overflows. Maybe yearly!

- NZS4404 loading is likely to result in considerable under-design (ie frequent overflows), for areas with high RDII (like Picton)
- Given the stochastic nature of the loads [very large rain derived components] – then overflow systems will need to be incorporated into the design
- Local version of NZ4404, for areas with high RDII threats need to be modified so: (1) at least sealed manhole joints and sealed lateral connections are mandatory and (2) designs must provide for higher PWWFs on a stochastic basis

Design needs to be stochastic and incorporate high I&I values. Overflows (by design) need to be planned for – so they occur only when and where the impact is acceptable and can be managed. Editor's Note – this is an edited version of a paper presented at *Water New Zealand*'s Annual Conference 2011 and received both the Modelling SIG Best Paper and Best Presentation Awards.

Acknowledgements

The following is gratefully acknowledged; clients, colleagues, practical engineers, operators and maintenance people – who tried to teach me to keep it real. Some have succeeded <grin>. A huge thanks is also due to the other MDC staff. Thanks also to Consultants; CH2M Beca Ltd, & CPG NZ Ltd. Officially though, the options and views expressed herein, are the author's and do not represent these organisations' views or opinions. ■

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"1 in 100 yr flood could happen every other decade"– Catastrophic flood events normally expected once a century – similar to those witnessed recently in Pakistan and Australia – can now be expected every 20 years. This is the view of around 300 scientists, policy-makers, economists and business people who gathered for an international conference hosted by the Canadian Water Network." www.web4water.com/news/news_story.asp?id=19477&dm_i=3KM,E0VM,16UO0C,146AP,1

EPA, RTK SUH, EPA www; www.epa.gov/nrmrl/wswrd/wq/models/ssoap/

Footnotes

[1]From Ref(6) "Wastewater systems are very sensitive to changes in rainfall patterns and the cost implications of climate change are large".

[2]Based on a paper of the same title presented at the WaterNZ Rotorua Conf, 2011. The paper won the Best Paper and the presentation won the Best Presentation modelling award.

[3]InfoSWMM RDIIA.

[4]Which may only be a 5 yr ARI after climate-change.

Water in Urban Areas: The Dutch Way of Thinking

Herman de Jonge – Consultant Urban Water Management, Royal Haskoning

Flood control is an important issue for the Netherlands, as half of the country is below sea level and about two thirds of its area is vulnerable to flooding (see Figure 1), while the country is among the most densely populated on earth. Natural sand dunes and man-made dikes, dams and floodgates provide defense against storm surges from the sea. River dikes prevent flooding from water flowing into the country by the major rivers Rhine and Meuse, while a complicated system of drainage ditches, canals and pumping stations (historically: windmills) keep the low lying parts dry for habitation and agriculture.

The Dutch Water City

Water management, land use organisation and urban development have always been mutually dependent over the course of the centuries. The territory of the Netherlands was formed as a delta by several big rivers and the North Sea. Alongside the centuries-old battle with water, our position between the land, water and sea has also resulted in great wealth for the country. As the first modern trading nation, the Netherlands had the densest urban network in the world during the 16th and 17th centuries.

Inhabiting this delta region was not without its struggles and sacrifices. In the middle of this period of early urban development a series of major storm surges took place. Between the 12th and 18th century the Dutch landscape changed to become a hydraulic system of dikes, dams, drainage channels, storage basins and windmills.

The formation of cities in this landscape builds on this hydrological technology. The main urban structure of the water city was in fact a combination of hydraulic engineering structures. Canals and wharfs formed the main traffic infrastructure, while dams were the most important public space.

After the middle of the 19th century, the map of the country changed dramatically. Town ramparts lost their military function and were pulled down. As a consequence of this, towns and cities began to expand. This was necessary to accommodate the growth in industrial activity and the growing population. With new energy sources such as steam and electricity, many large lakes and pools were pumped dry. At the same time, many canals lost their infrastructure function and were filled in. In the middle of the 20th century the coastline became a good deal shorter due to the construction of the Afsluitdijk and the amount of surface water reduced significantly. The urbanisation pattern ceased to follow the (remaining) water network, but primarily followed the logic of the new motorway network. It seemed that water had stopped contributing an organising role to urban development.

Figure 1 – Blue Areas are vulnerable to flooding

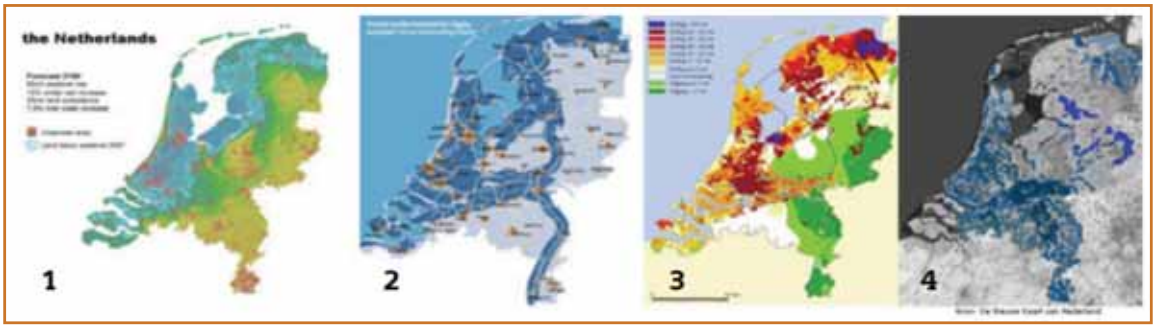
At the same time, it appeared that hydraulic engineering expertise had made it possible to permanently protect the land from flooding. Primarily after the flood disaster of 1953 it became official policy to focus on safety in favor of orienting towns around water. There was minimal interest in urban water management during the building explosion after the Second World War. Plans for water in urban areas were usually functional in nature. Water boards did not have any interest in the urban environment and municipalities had a department solely focused on the sewer system. There was no awareness at that time of urban groundwater. In reality, ponds were little more than an internal overflow for the mixed sewer system.

Dealing with Changes

Climate

- The temperature of the earth has increased over the course of the last century. Climate scientists believe that this is primarily caused by emissions of the greenhouse gas CO2. The warming of the earth has major consequences, such as an increase in:
- Flooding due to rising sea levels, drainage peaks into rivers and precipitation extremes as well as soil settlement due to drainage and natural subsidence
- Water shortages due to low groundwater levels, salt intrusion and saline seepage
- Heat stress in urban areas due to higher temperatures

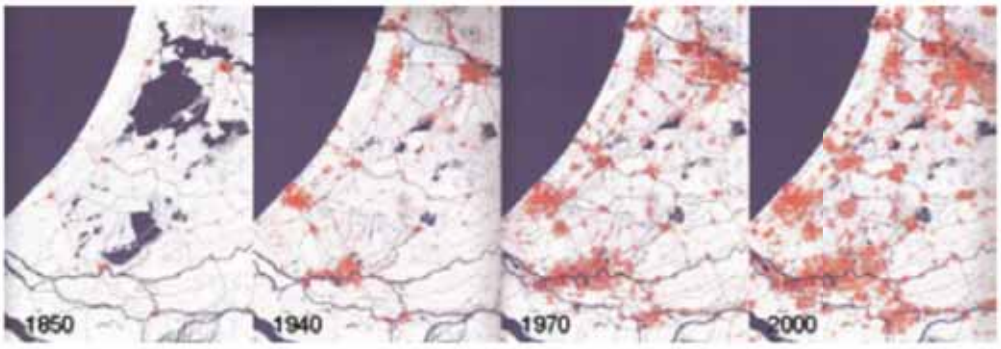
1. Sea level rise
2. River discharge
3. Subsidence
4. Search area water storage 2050



Urbanisation

For the first time in the history of the planet more people live in cities than anywhere else. The 21st century really is 'the century of the city'. This same phenomenon of rapid urbanisation is also apparent in the Netherlands, particularly in the Randstad conurbation. Today, we live in one of the most densely populated countries in the world.

Urbanisation often has detrimental effects for water management in an area. Precipitation can no longer infiltrate the ground and water runs off faster into canals, rivers and streams that range over the area. As a result, they have to drain away greater volumes of water, increasing the risk of flooding, or even dike breaches in the lower reaches of rivers.

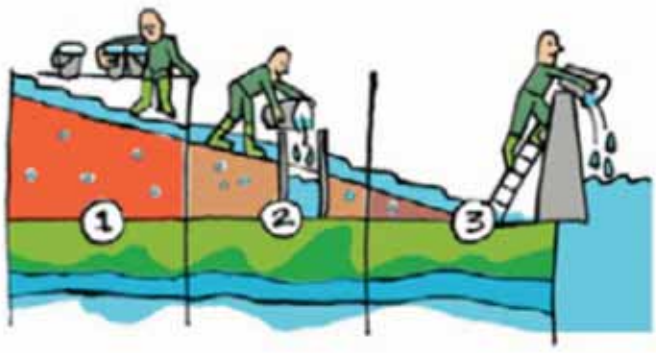


Urbanisation of the Randstad (Atlas van de Nederlandse Waterstad, 2005)

Water Management

The floods of the 1990's formed an important turning point in thinking about the relationship between hydraulic engineering and urban development. Changes in the climate and the consequences for water management have also been behind a series of new government memoranda for water management and new planning and design concepts for urban and land development. Seeking to achieve a safe, healthy and sustainable system of water management is in the national interest. Subjects such as 'water in the city' and 'water as an organising principle' and seeking to achieve 'sustainable and robust water systems' are included as key topics in national policy. This has resulted in two three-stage strategies for:

- Water quantity (retaining, storing, draining)
- Water quality (preventing, separating, purifying)



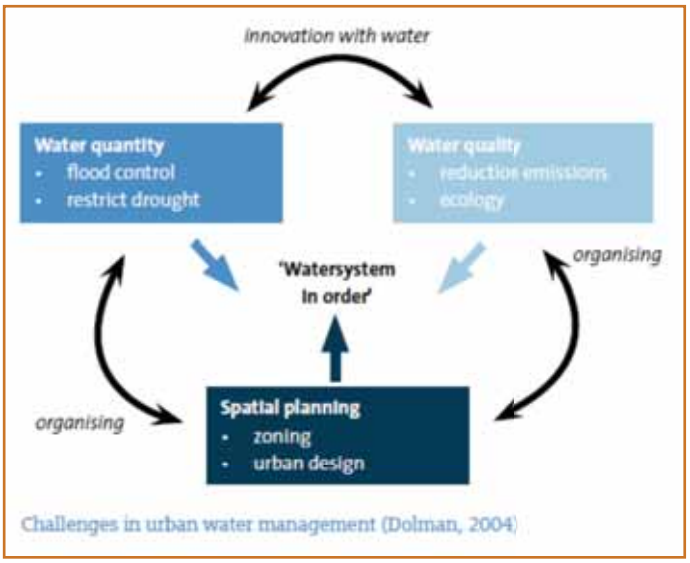
Three-stage strategy for water quantity (NW4, 1998)

Realising the goals and principles of the national water policy is a joint task. This was agreed within the current National Administrative Agreement on Water (NBW-current, June 2008) when it was signed by the government, the provinces in the form of the Association of Provincial Authorities, the Association of Netherlands Municipalities and the Association of Regional Water Authorities. Basic principles in the NBW-current are:

- More space for water ("dry feet")
- Stand-still situation: no further deterioration in current (2000) chemical and ecological water quality ("clean, healthy water")
- Preventing water problems being shifted to other areas and a later date

In accordance with the strategy and pre-conditions of the national water policy in the 21st century (WB21), this can also be referred to as fulfilling the water action plan. We pursue our ambition in the area of water to integrate the 'water action plan' and to bring solutions for pressure points to bear in the water system in a logical way.

Added value is created because the solutions chosen are sustainable and can easily be combined with other planning functions (protection, use, perception and management), not just those for water. Moreover, putting and keeping water management in order demands the organisation and coordination of interests so that solution can be produced.



Challenges in urban water management (Dolman, 2004)

Urban Water Management in Existing Areas

Beside preventing the country from floods as a consequence of developments, water management in existing urban areas is a 'hot' issue nowadays. Due to the climate change that has resulted in extreme and unpredictable rainfall pattern, the expansion of the paved areas and urbanisation leads to more surface runoff and less percolation and thereby results in insufficient storage and drainage capacity. In order to deal with the high storage volumes required, bigger pumps are required in the low lying areas, more storage areas are required upstream or just downstream of urban areas. The new strategy must prevent these problems in future, as every (small) development goes with a hydrological neutral principle: the hydrological situation after development may not decrease the hydrological situation. That means that water storage is required to decrease the peak flow and infiltration of rainwater into the ground is needed to fill up the groundwater table.

Most problems occur in the old existing urban areas because the surface water drainage networks are now old and incapable to convey the flows in order to avoid ponding in roads which implies that there is need for improvement and or reinstating them.

A lot of research has been done where the risks are taking place. The sustainability of the urban drainage systems depends on two factors, namely storage capacity and drainage capacity. This can be explained by two extreme examples; if drainage is not possible all the precipitation needs to be stored. If storage capacity is not available, the runoff needs to be drained. Both are important factors when carrying out a research.

"For the first time in the history of the planet more people live in cities than anywhere else. The 21st century really is 'the century of the city'. This same phenomenon of rapid urbanisation is also apparent in the Netherlands, particularly in the Randstad conurbation. Today, we live in one of the most densely populated countries in the world."

Urban Drainage Risk Map

One of the instruments to get insight in the possible urban drainage risks is the Urban Drainage Risk Map. Inundations are analysed in detail at the standards (return period once per 100 years) using a surface water hydraulic model. For the underground drainage network another hydraulic model is used to analyse the amount of water on the street during a design storm with a return period of two and five years. During interactive calculations, the locations and the amount of 'water on street' are mapped. Interaction between surface water and drainage systems occur when the surface water level has influence on the drainage capacity. This will lead to more problems relating to water on the streets and even damage of goods.

Figure 1 shows an example of the presentation of the results.

Investment Assessment

One of the main pillars underlying implementation of solutions for the coming years is the assessment of urban water drainage and conveyance. For the past five years, an analysis has been done in urban areas were were flood risk take place. It is highly desirable to have an insight into the expected additional hydraulic capacity required and the risk of flooding to ensure efficient management of the drainage system and of surface water. The drainage system that is currently constructed underground will remain in condition for an average of 60 years. It is often the case that solutions provided on the basis of theoretical models, are not always experienced as problems, consequently the investments related could be avoided. An increasing number of Local authorities are gradually becoming aware of the flooding risks and the effectiveness results in 'risk thinking', where the focus lies on the question; "What do we accept as a municipality and what must be avoided at all costs?" ■

For more information please visit www.royalhaskoning.com or contact h.dejonge@royalhaskoning.com

Oss – Piekenhoef

The Piekenhoef housing estate, lies at the boundary between the low lying Maas river valley and the higher-lying aeolian sand ridges of Brabant. It is important to infiltrate water directly into the subsoil in order to keep the housing estate green and to maintain the water table. It also prevents water related problems in the future during heavy rainfall.

Rainwater runoff and detention system therefore forms the principle starting point for the urban design and landscaping of Piekenhoef.

Piekenhoef also forms a hydrological link between Berghem and the extended nature reserve. This motivated the construction of five wadis, wide, grassy infiltration trenches that run through the residential area. The wadis allow runoff rainwater to percolate into the subsoil. They also establish a clear relation between the residential contexts and the surrounding landscape, and between the village and the forest.

Ductile Iron Pipe : Hamilton Ring Road Project

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Pipe on trailer on site

Pipe wrapped waiting inspection

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Specifications:

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Tauranga City Council – Making the Most of the Water Network Model

Cedric Papion – Water Network Engineer, MWH Global

Tauranga City Council (TCC) has been developing and updating a model of its water supply network since 2006. It has invested substantial funds and efforts into this tool to ensure that it remains accurate and reliable.

Over the years TCC has undertaken many studies based on modelling work, and the range of these studies is ever increasing. This has greatly contributed to keeping the tool up-to-date and the modelling processes relevant; it has also created economies of scale by making the most of an existing asset.

A Good Tool to Start With

Tauranga is one of the fastest growing cities in New Zealand: the current population of approximately 115,000 people is expected to almost double by 2051. In practical terms, this means that the city council is charged with the task of planning a second city beside the first one. In that context, the need for solid planning tools has been well understood for a long time.

When TCC Infrastructure Planning Manager Graeme Jelley commissioned MWH to build and calibrate an H2OMap model of the water supply network in 2006, excellent asset data was already available. The Geographic Information System (GIS) was comprehensive, well structured and most importantly, it was up-to-date. TCC's as-built plans are loaded into the GIS rapidly, and operational changes such as valves being opened or closed are recorded every day. This information was the perfect base for building a hydraulic network model.

"All these elements enabled a successful model build and calibration. At this point TCC had a tool that could explain the present. Once the projected population increase and proposed developments had been integrated in the model, TCC had a robust, rational way to plan for the future."

TCC implemented universal water metering and volumetric charging more than 10 years ago. The billing data system is therefore well tested and for modelling purposes, key information such as volume, location and type of usage was readily available.

Operational knowledge was extensive and available during the development of the model. This was critical during the investigations of discrepancies observed between model predictions and field results.

All these elements enabled a successful model build and calibration. At this point TCC had a tool that could explain the present. Once the projected population increase and proposed developments had been integrated in the model, TCC had a robust, rational way to plan for the future.

Figure 1 – Possible Development South of Tauranga

From Planning to Operations

The main driver for the development of the model was the update of the Council's Long Term Plan. MWH used the new model to undertake a series of reviews and optimisations of the proposed upgrades across different demand scenarios and five planning horizons, up to 2051. This led to substantial infrastructure deferment and millions of dollars in savings. The main outcome of this project was a staged capital expenditure programme for the water distribution system, referred to as the Water Network Development Plan.

Since then, localised planning studies have been done regularly and they are combined in a yearly update of the Water Network Development Plan. The TCC Infrastructure Planning team now has a very good understanding of the water network and how it will develop.

As early as 2008, the TCC Water Supply Operations team started requesting model outputs such as pressures and flows in specific sections of pipe to assist with the sizing of valves and meters. However, the model was not updated frequently enough to capture some of the important changes in operational settings, and these were required to be updated before each assessment. Operations needed a quicker turn-around for these assessments, and it became apparent that a different tool was needed.

The solution came in 2010 when the model was split into a planning model and an operational model. The operational model is the best available representation of the existing network and is kept as closely up-to-date as possible with GIS and operational changes. The planning model is coarser but contains future demand scenarios, future developments and planned upgrades.

The operational model is now routinely used to confirm pipe sizes, consequences of abandonments, fire flows, and the modifications of Pressure Managed Areas (PMA) or District Metered Areas (DMA). The model generally confirms the field operators' expectations and provides reassurance that nothing has been missed. As the model is already in a good state and the processes are well practiced, the delivery of these studies is quick and cost-effective.

Accuracy and responsiveness are critical factors for Operations to use the model. Peter Bahrs, Water Supply Manager at TCC comments, "We now have sufficient confidence that the operational model is up-to-date and accurate results can be obtained rapidly to support operational decision making. We often check modelling scenarios before planning our operational activities such as pipe replacements and sizing or abandonment or significant changes in valve settings."

The clarity of the output is also cited as a factor contributing to the continued use of the model. Time series graphs presenting a pressure drop or the water level within a reservoir, thematic maps of areas impacted by a valve closure, and 3-dimensional projections

of pressures in Google Earth all provide invaluable information to help understand the operation of a water network.

GIS and Asset Management

Although planning and operational studies remain the core of TCC's modelling work, further benefits have been derived from the tool.

As part of the regular updates, the latest GIS data is brought into the model and all PMA and DMA boundaries are identified. When simulations are run, localised GIS errors are often brought to light, such as missing connectivity, incorrectly opened line valves or missing pressure reducing valves. This is subsequently investigated by MWH's modelling team and TCC GIS staff, and both the model and the GIS are corrected.

Figure 2 – Pressures in The Mount Maunganui Supply Area

TCC is currently scoping a project focused on security of supply. It is expected that the model will be used to run 'what if' scenarios to simulate asset failure and operational responses. The aim is to identify critical facilities, quantify the impact of their failure and assess the operational responses. This information will be used to prepare risk management strategies, prioritise inspections and rehabilitations, and identify essential infrastructure development.

Use It or Lose It

As the model is used for different purposes, it is made richer from varied data (planned developments, pipe construction or decommission, DMA and PMA work, fire class changes, criticality) and is also challenged in various ways that contribute to increasing the confidence in its output. The more varied the uses the model is put to, the more trustworthy it becomes. The more people who trust it, the more uses it can be put to.

This positive dynamic makes the updates and revisions worthwhile. The relative cost of the model maintenance remains low against the value of the simulations and assessments it provides.

Often due to other financial pressures, many local authorities struggle to keep their model in use, documented and up-to-date. After a few years the confidence in the model is limited and an expensive exercise is required to audit, verify and update it, which can sometimes be as costly as the initial model build.

Keeping It Alive

The best way to ensure that a model is still accurate is to regularly compare predictions with field data, generally pressure logs. These verification campaigns assist in targeting areas where a recalibration is required: generally areas where substantial development occurred or where the network configuration has been modified.

Keeping the model accurate is one thing, keeping it traceable is another. For TCC, a separate copy of the model is created for every one of the thirty-odd assessments undertaken every year. TCC asked MWH to set up a model management manual to capture a set of procedures relating to updating, reporting and filing. This is vital as different people work on different models for different teams within TCC and MWH. This reduces the risk of inconsistencies, gaps or missing information that contribute to render a model unreliable and therefore unusable.

Conclusion

It requires a conscious effort from a local authority to maintain high quality data within the hydraulic model. Asset data, operational settings and demand data need to be known, and processes need to be in place for this information to be captured in the model rapidly.

The Tauranga experience indicates that to keep a model used, in particular by operational teams, model results need to be accurate and obtained rapidly. If a model is reliable and up-to-date, it will generate interest naturally and its value will increase as it gets used.

Because of the rapid population growth, Tauranga City Council had a strong incentive to invest in a robust water network model. It has subsequently succeeded in keeping a positive dynamic going, and is now considering new applications for its tool. This contributes to providing better value – better quality decision making for the water supply planning and operation. ■

For further information contact Cedric Papion at MWH: (04) 381 5780 or Graeme Jelley at Tauranga City Council: (07) 577 7000

Melbourne Water Model Validation – Identifying and Reducing System Uncertainty

Simon Pearce-Higgins – Manager Network Planning & Investigations, Melbourne Water and Marcel Bear – Principal Modelling Engineer, Opus International Consultants Ltd

In 2010 Melbourne Water and Opus International Consultants undertook the validation of the Melbourne Water bulk water transfer model. This article presents a case study of the project, focusing on the development of a robust methodology for validating a large and complex system that included setting realistic expectations for the validation and development of a field test plan.

This project involved the systematic recording of network information to identify, quantify and reduce data gaps to improve the model accuracy. Key to this process was the development of a system schematic. The use of this schematic enhanced the recording of data gaps and validation results whilst viewing the network on a single sheet of paper. This enabled an appreciation of the interaction of the various parts of the network, and allowed potential solutions for issues to be identified.

The systematic development of reservoir and trunk main balances gave a thorough audit of over 300 permanent flow meters that were used for the validation. Data gaps and inconsistencies identified through these balances provided guidance to the expected level of validation possible for the model.

"A field test plan was developed based on the validation results."

A field test plan was developed based on the validation results. The anomalies and uncertainties identified in the validation directed the field test planning. The field test data will be used for calibration.

This article summarises the methodology used to achieve the model validation and the field test plan. It will be of interest to modellers dealing with large networks and their managers, and will show a realistic pragmatic approach to model validation, field test planning and the simulation of a large and complex network.

The Project

The project has two stages: Stage 1 model validation and Stage 2 preparation of a field test plan.

In Stage 1 an existing model of the Melbourne bulk water network was validated for an historic summer day using data recorded on the 22 January 2006. The validation steps lead naturally to the development of the field test plan (Stage 2), and subsequent calibration, with the model validation providing a good platform to understand the system, its operation and the model representation of the network. The data gaps and anomalies identified in the validation have been used to guide the development of the field test plan.

Melbourne Water – Background

Melbourne Water manages Melbourne's water supply catchments, removes and treats most of Melbourne's sewage, and manages rivers and creeks and major drainage systems throughout the Port Phillip and Westernport region. It is owned by the Victorian Government, with an independent Board of Directors responsible for governance. The responsible Minister is the Minister for Water.

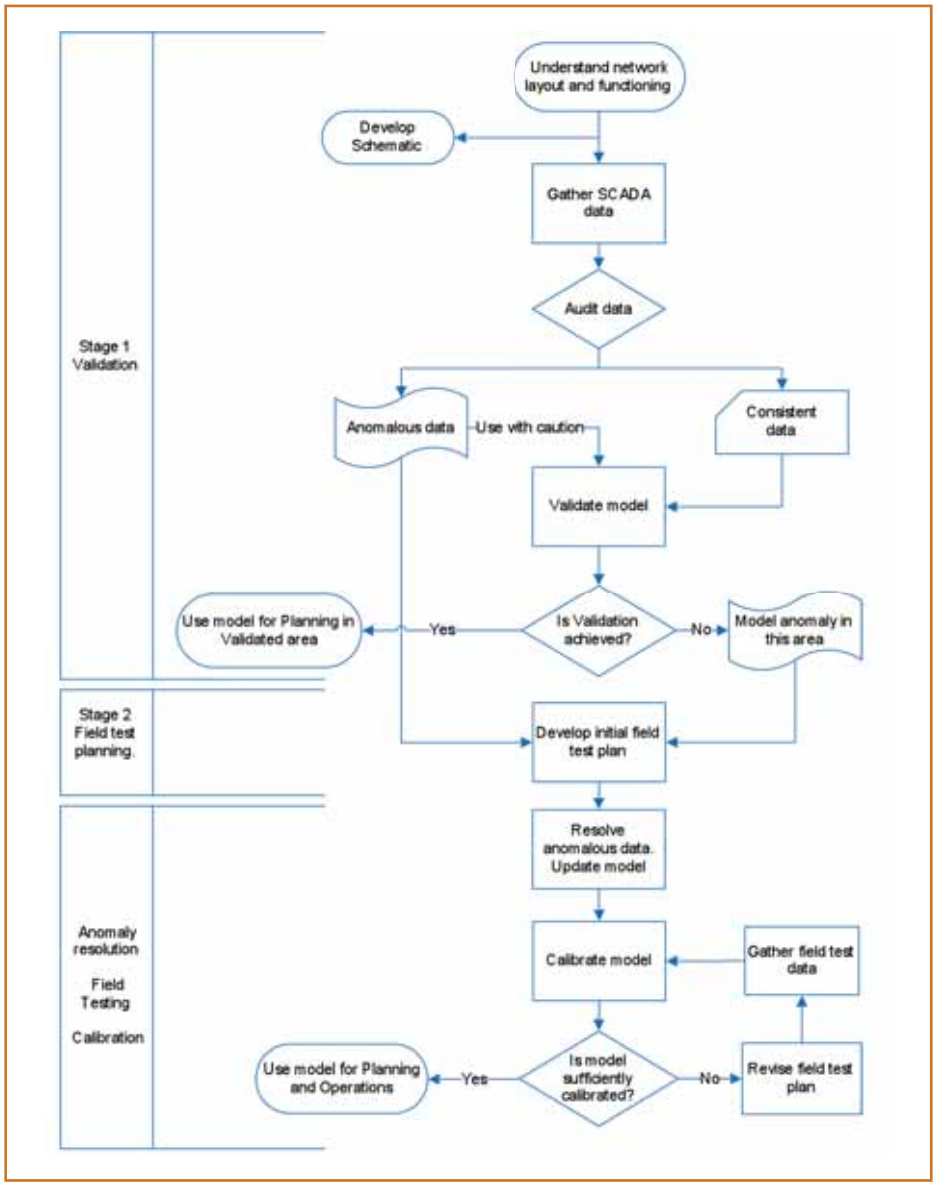
Melbourne Water is a significant business, responsible for managing $9.4 billion in water supply, sewerage and drainage assets, and is committed to looking after these in a way that protects and improves their environmental, social and financial values. Melbourne Water's annual operating revenue of more than $900 million is earned from water supply and sewage treatment charges, and drainage rates. It is used to fund operations and infrastructure projects including water, sewerage and drainage upgrades and water recycling schemes as well as works to improve and protect Melbourne's rivers, creeks, wetlands and bays. Melbourne Water's customers are the metropolitan retail water businesses – City West Water, South East Water and Yarra Valley Water – as well as other water authorities, local councils, land developers and businesses that divert river water.

Melbourne Water has made significant investment in network modelling over the past ten years. There is an ongoing need for network models to support capital investment decisions and the growing need for hydraulic network information from numerous internal and external stakeholders and customers – hence this project to improve confidence in the bulk water transfer model.

Project Process

Validation and field test planning for a network of this size is a significant undertaking. Successful completion has required a mix of back to basics and innovative thinking. Coming to grips with the network layout and functioning required the development of the network schematic, which is the central document developed and used throughout this project. The schematic is described and shown in the following section of this paper, but in essence it is the entire reticulation shown on a single sheet of paper.

Figure 1 – Project Process



As validation, field testing and calibration are essentially investigations, it was not possible to finalise the field test plan at this stage. Rather an incremental process has been established with milestones along the way, where the progress can be evaluated, options for further work considered and the way forward established. Some initial activities are considered essential (e.g. Data downloading, reservoir and trunk main balances, addressing unmetered off takes and anomaly resolution) while some future activities may not be required depending on the outcome of previous work. These activities and their relationship are shown in Figure 1.

The Schematic and Developing System Knowledge

The schematic is the key document developed and used in this project. On a single sheet of paper the entire treated water network has been laid out. It shows the water sources, pipelines, pump-stations, control valves, demand points and reticulation connectivity that make up the bulk supply network. See Figure 2 for two key parts of the schematic. Copies of the schematic have been overlaid with information to show validation day flows, the results of the data audit, the results of the validation and the field testing monitoring locations. As the whole network is viewable at a glance, an appreciation can be developed of the inter-relation of the components that make up the reticulation. A balance of clarity with detail has been struck using colour and symbols to maximise the knowledge available from the schematic. Developing the schematic proceeded in parallel with establishing knowledge of the system and an understanding of its functioning.

SCADA Download and Reservoir Balances

The SCADA records of flow, pressure and reservoir water level were extracted for the validation day (22 January 2006). These were used to develop the demands in the model, for reservoir and trunk main balances and to check the validation result.

The reservoir balances are a mass balance check of the flow and reservoir water level SCADA data. They consider the flow into and out of the reservoir and the change in water level. They are based on 24 hours of data and the balance is done at 6 minute intervals. This allows the reservoir level to be derived throughout the 24 hour period, and the derived level (based on inflow – outflow and reservoir size) has been compared with

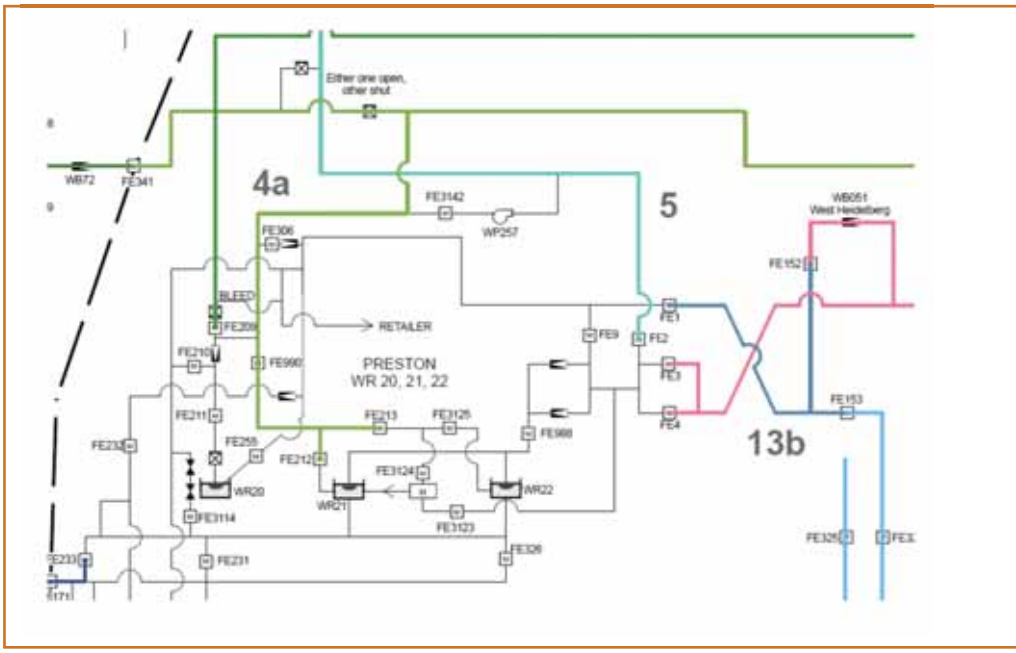


Figure 2 – two key parts of the schematic

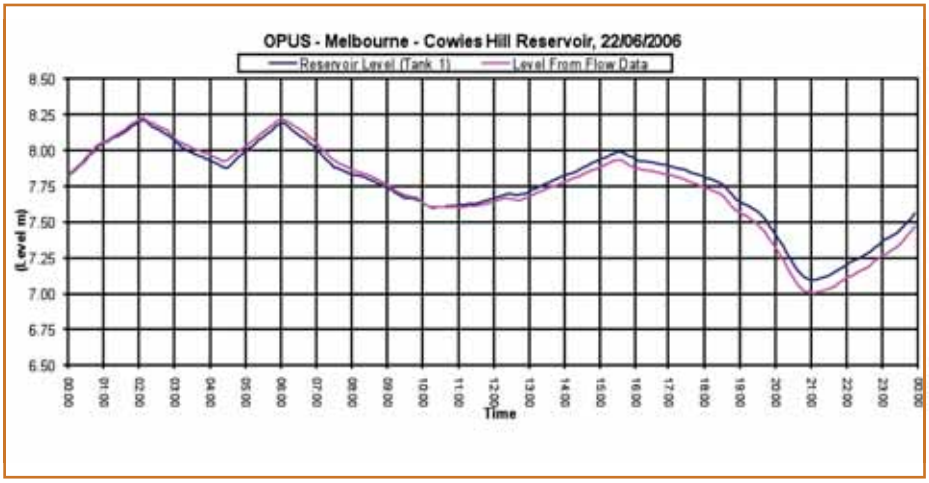


Figure 3 – Cowees Hill reservoir balance

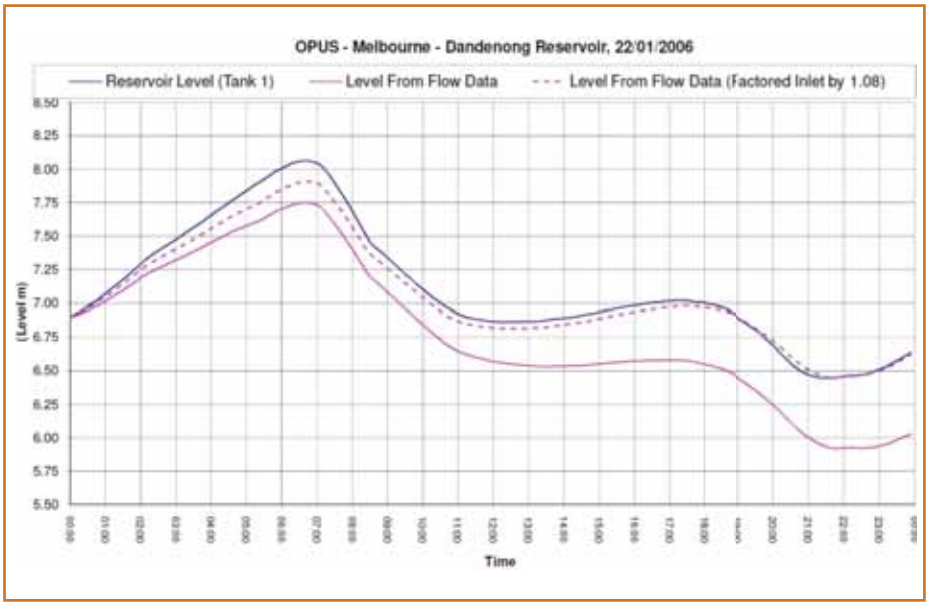


Figure 4 – Dandenong reservoir balance

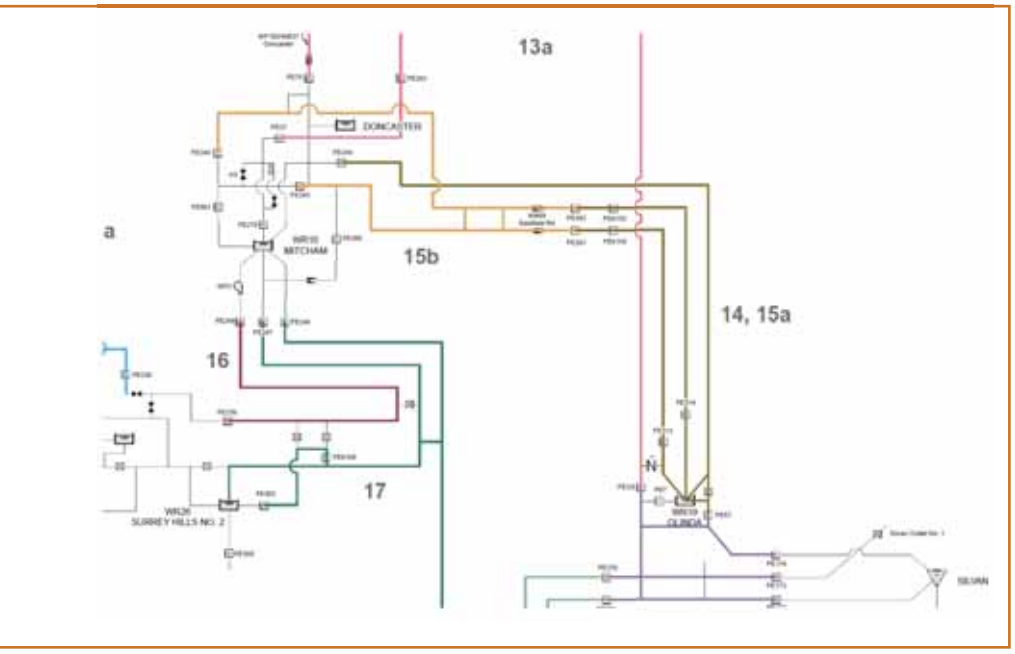


Figure 5 – Trunk main balance Line 28b showing a typical diurnal demand balance

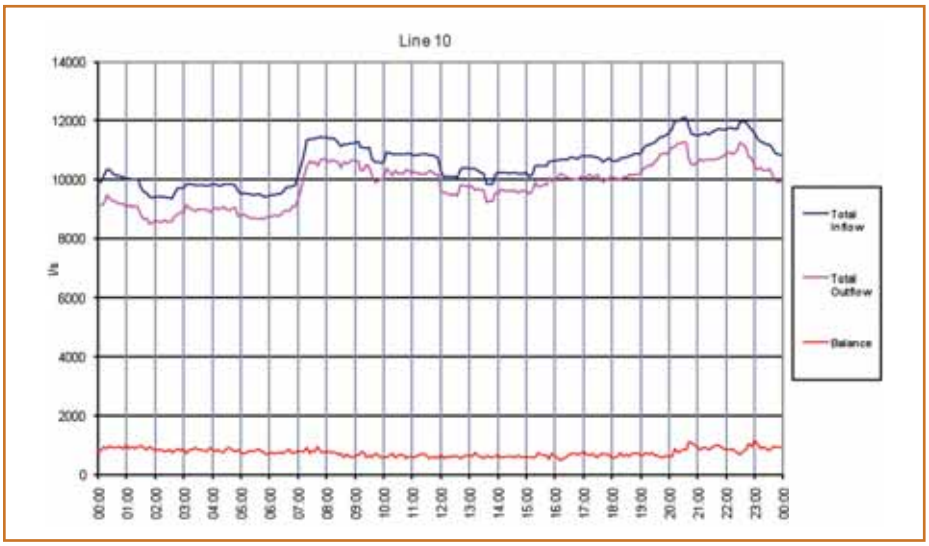


Figure 6 – Trunk main balance Line 10 showing effect of subtracting two large flows. Inconclusive result

"The reservoir balances are a mass balance check of the flow and reservoir water level SCADA data. They consider the flow into and out of the reservoir and the change in water level."

the measured level. This is represented graphically in the reservoir balances, see Figure 3. This allows a quick check that the flow meter and reservoir levels are consistent at a site, and the sensitivity of the balance to flow meter accuracy can be established.

Trunk Main Balances

The trunk main balances consider a subset of the network where all inflow and outflow is measured. The network was split into 48 individual 'lines' which were individually considered in the trunk main balance process. The metered flows over the 24 hour validation day have been used o check the mass balance. Where there is an imbalance this indicates either demand, leakage or flow meter error.

An example of a typical diurnal demand derived from a trunk main balance is given in Figure 5. Care was required when interpreting trunk main balances, as occasionally they required the subtraction of two large flows, which leads to the error in these flows being added. This can result in inconclusive balances being obtained (see Figure 6), which had to be used with caution in the validation.

Model Validation

Validation and Anomaly Identification

The validation was an iterative process of revising the model controls and demands initially input to improve the match between the live data and model outputs. It followed the same general sequence as the reservoir and trunk main balances, starting at the reservoir sites and then moving through the trunk system to cover the entire network. Live data (SCADA records of flow, pressure and reservoir water level) was used to graphically compare against the model outputs and to guide the validation and present the final results.

The system was broken down into smaller subsets where the boundary conditions are

known, e.g. a reservoir complex where the in/out flow meters, pressure sensors and reservoir levels define the water movement through the complex, or a section of trunk main where the inflows and outflows are known and pressures recorded. The SCADA record of the boundary conditions of each of these smaller areas was validated previously in the trunk main and reservoir balances (described earlier in this article). This shows the confidence in the boundary conditions and indicates the expected validation result in this area, i.e. a good trunk main balance indicates the model should validate in that area, and an imbalance indicates the validation will be difficult to achieve in that area.

The exercise served to generally decrease the level of uncertainty in the model, identify anomalous areas and increase the confidence in both the model use and the interpretation of SCADA data.

Anomalies

Areas where it was not possible to achieve a good or fair match were defined as anomalies. These anomalies have been discussed and generally confirmed with Melbourne Water Operations staff as known areas of uncertainty in the system operation. The anomalies were documented and displayed on the schematic to provide a further layer of understanding. The anomalies form an important input into the field testing planning, as particular attention will be paid to the anomalous areas to improve the understanding at these locations.

Field Testing

Field Test Planning

The water network is significant, with over 1000km of pipe up to 2m in diameter, and potentially over 1000 monitoring locations. To make the field test and calibration a manageable exercise, a staged sequential field test was proposed – using the understanding of the system and its anomalies gained from the validation to target the monitoring. The stages of the field testing are shown in Table 1. The network was split into five areas, each to be separately monitored for two weeks. One week has been allowed for establishment and disestablishment of the monitoring equipment which gives a total monitoring period of 16 weeks over the summer period. It is planned for 2013/2014. A number of loggers would remain at key points in the network for the entire logging period to provide continuity and boundary conditions between each area.

Stage	Description	Phase
1	Develop initial FTP	Planning
2	Address unmetered off takes	
3	Investigate and where possible resolve anomalies	
4	Finalise field test	
5	Undertake enabling works	
6	Monitor system – over a summer (peak) demand period	Execution
7	Audit and prepare monitoring data for calibration	Finalisation

Table 1 – Stages of the Field Test

The validation highlighted a number of anomalous areas of the system – where the operation and flows are unclear, unknown or contradictory to the best understanding of the system. It is proposed that these anomalies are investigated and resolved prior to the field testing to improve the consistency of the data gathered. This is an important step in the calibration process. It will reduce the risk of completing the field test and not being able to calibrate the model, due to contradictions in the data gathered brought about by the anomalies. It will also give the immediate gain of increased system understanding.

Field Test Implementation

Participants

The field testing will involve the following participants:

- Melbourne Water Planning – responsible for the planning, overall coordination and execution of the field test.
- Melbourne Water Operations – to provide guidance in the planning, support and assistance for the field equipment deployment and network operation during the test.
- Melbourne Water Mechanical and Electrical – to provide assistance with accessing the SCADA system and planning monitoring sites.
- Consultants – to plan, coordinate and manage the field test and audit the gathered data.
- Field Monitoring Contractor – responsible for the supply, installation and removal of the logging equipment and delivery of the monitoring data.
- Retailer companies – to provide access to the unmetered off takes – for flow monitoring purposes.
- A One Team approach will be adopted to involve all participants throughout the field test in the planning, execution and disestablishment phases. Regular, open and honest communication and a shared goal will ensure any issues are promptly identified and resolved to the satisfaction of all participants.

Summary

The model validation process involved a thorough investigation and audit of the bulk water system to develop an understanding of its components, layout and operation. This process has been captured in the documentation of the project, especially the schematic of the network, and transferred into the model.

The information has been checked for consistency, specifically in the trunk main and reservoir balances. Indeed, the whole validation process can be viewed as an audit. This has highlighted areas where there are gaps in the data – due to dubious or missing flow meter data, reservoir water level or dimensional data, system operational data or demand data. These areas have been identified to enable their resolution or capture during the field testing and calibration stages.

The trunk main and reservoir balances indicated areas where leakage may be present, either from the reticulation (Melbourne Water or Retailer) or from a reservoir. Reservoir drop tests were recommended at sites where leakage is suspected, to confirm the reservoirs' performance.

The preliminary field test plan is the first stage in a seven stage programme to complete the field test. Subsequent stages include addressing unmetered off takes, anomaly resolution, field test plan finalisation, enabling works, the actual field test and data checking.

The sites already monitored form the starting point for the field test plan. From this study 263 flow, 195 pressure and 56 reservoir depth monitor sites have been identified as currently being monitored in the entire Melbourne Water network. To improve the understanding of the network

"A generally successful validation was achieved within the limits of the data available. This provided a good platform to understand the system operation and model representation of the network. From the data gaps and understanding gaps identified (ie anomalies), a targeted field test plan has been developed which will lead to the calibration of the model."

and subsequent calibration of the model an additional nine flow monitors and 113 pressure monitors have been proposed. A suggested location has been given for these monitors, and the exact logging point will be determined following site investigation.

The field test plan has balanced the need to gather sufficient data to perform a reliable calibration of a complex and large trunk network system of this nature against the cost of data gathering. Some redundancy has been built in to allow for the inevitable logging failures. The data gathered will allow all pipes to be assessed for roughness and all sites (reservoirs, pumps and PRVs etc) to be calibrated for pressures, flow rates and depth changes.

Future Steps

The validation and field test plan are the first steps to implement the Model Improvement Strategy for Melbourne Water. The completion of these two tasks has materially increased the knowledge of the system, its representation in the model and knowledge of anomalies/areas of uncertainty. The project process (Figure 1) shows three tasks. The third task includes anomaly resolution, field testing and calibration. The work to date has provided a solid platform to complete these tasks, which will see the evolution of the model for planning and operational use for the entire Melbourne Water organisation. ■

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Water Network Model Improvement Project. Model Validation. Report prepared for Melbourne Water by Opus International Consultants. Reference 3AW733.00. May 2011

Water Network Model Improvement Project. Field Test Plan. Report prepared for Melbourne Water by Opus International Consultants. Reference 3AW733.00. May 2011

For more information please contact Marcel Bear marcel.bear@opus.co.nz

Unquenchable

Brent Clothier – Science Group Leader, Systems Modelling, Plant & Food Research

Deep in the Mojave Desert sits Las Vegas. The desert is a dry, torrid place that can quickly kill a person without water, but in Sin City a torrent of water flows freely in massive fountains, pirate lagoons, wave machines, and casinos. Meanwhile, across the United States in places that are not particularly dry or hot, communities, farmers, and factories are struggling to find water, and even running out altogether. America's self-inflicted water crisis is coming.

So says Robert Glennon, who has just completed a speaking tour of New Zealand sponsored by AGMARDT, with support from Water New Zealand, the Royal Society of New Zealand, and Plant & Food Research. The American issues he discusses, and the solutions he proposes, have parallels here for us in New Zealand, and we will do well to consider the options he outlines for solving America's water problems. Glennon describes himself as a 'glass half full sort of guy'.

During his New Zealand tour, Glennon gave well-attended talks on *Unquenchable* in Hamilton, Palmerston North, Wellington and Christchurch. In his talks he discussed:

- The crisis
- Real & surreal solutions
- A new approach

To highlight the crisis, Glennon cites cases from right across the US; not just in the semi-arid west, but also in the humid south-east of Tennessee, Florida and Georgia. The problem extends from the Vegas Strip to faux snow in Atlanta, from supersized bathrooms to mega-farms, from billion-dollar water deals to big time politics and personalities. The crisis and the responses are not being driven by the concerns of environmentalists, but rather by business, and in particular the Fortune 500 companies. Their business-as-usual practices are being curtailed, either by an inability to withdraw water from reserves, or to discharge wastewater back into reserves. Glennon considers that the American economy is not so much lubricated by oil as it is by water. He wryly adds that Washington's love affair with biofuels will turn to heartbreak once America realises that thousands of gallons of water are required to produce one gallon of fuel.

To highlight the pernicious nature of the crisis, he draws a parallel with the hydrological cycle, but noting that we tend to follow the "hydro-illogical cycle" which goes from drought to awareness, concern and then panic, followed by rain, apathy and then assuredly back to drought. This cycle makes for staccato and piecemeal attempts to address the crisis. One sees an interesting parallel to this in Australia with the drought-breaking record rains causing recent flooding due to La Niña conditions.

Glennon discusses the many surreal solutions that have been proposed to the water crisis. These include shifting state boundaries so one state can capture another's water, the building of dams, bigger pumps to reduce further groundwater levels, diversion of rivers, towing icebergs, and the use private pipelines to bring water down from the wetter north. The consequences of these surreal solutions, Glennon highlights with dramatic photos of land subsidence, dry rivers, anaerobic seawater in the Gulf of Mexico, and exhausted aquifers. Glennon considers that America's water woes will get worse before they get better because Americans are slow to change their ways, and because water is the overlooked resource. Wryly, he notes that Americans always end up making the right decision, but only after they've explored every other option!

Glennon argues that we cannot engineer our way out of the problem with the usual fixes or the zany. America he says must make

"The crisis and the responses are not being driven by the concerns of environmentalists, but rather by business, and in particular the Fortune 500 companies."

hard choices. Glennon's answer is a provocative market-based system that values water as a commodity and a fundamental human right. The latter aspect, water as a fundamental right, he notes is a small amount of water on a per capita basis. The focus he states should be on putting a price on the value of water as a commodity. Currently, Americans pay less for water than they do for cell-phone service or cable TV. That must change Glennon says. Furthermore, we must find ways of doing things better.

A better system of sewage is a prime example, he notes. Glennon takes square aim at the flush toilet and muses that there must be a better way to dispose of our waste. He begins by quoting Teddy Roosevelt who said that "… civilized people should be able to dispose of sewage in a better way than putting it in drinking water." Not using drinking water in sewage systems would greatly relieve pressure on our freshwater stocks, and thereby free up water for more valuable uses.

Agriculture, through irrigation, is America's biggest consumer of freshwater. Glennon notes that new approaches to food production, what he calls 'vanguard agriculture', are finding better ways to grow new products with less water. As one example, he cites the replacement of iceberg lettuce production, a profligate user of water, with automated mini-lettuce production that uses only a fraction of the water and which realises premium prices for the grower.

Finally Glennon notes that America is entering an era of water reallocation and demand offsetting. He likens our water reserves to a milkshake glass into which have been dipped an ever increasing number of drinking straws. When they are all sucked, it's a race to the bottom. Now, regulators are saying that no more straws can be added, and no more water can be sucked up any 'straw' unless that water is demand-offset and given up by another 'straw'. The resource must be protected, and its extraction needs to go to the highest value use. Glennon cites the sell-off of the assets of an obsolete and bankrupt steel smelter in Utah. The sale of the land, the plant, the ore and the pollution credits earned the liquidators some $100.2 million. The sale of the water rights to a prospective new user of this water realised even more – another $102.5 million.

Glennon's books, and his talks, provide a thought-provoking assessment of America's water crisis, and he calls for action across multiple fronts to solve it. The problems and his calls-to-action resonate with the issues we're facing in New Zealand.

During his visit, Dr Glennon met with University academics and students, Regional Council officials, policy analysts, the public, and even an Environment Canterbury Commissioner. Glennon was interviewed by the print media, plus radio and TV. As well, Robert was taken out into the field to meet with a potato farmer in the Manawatu who is passionately working to reduce the environmental footprint of his production system. This is part of a Plant & Food Research footprinting project being led by PhD student Indika Herath. ■

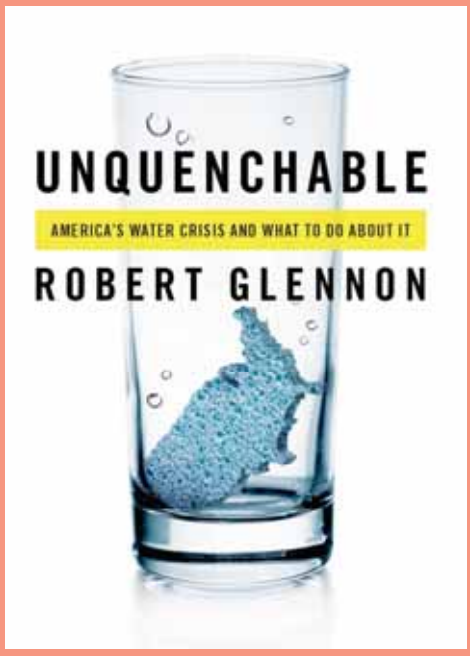
More information about Robert Glennon, his books, and America's water issues can be found through these websites:

- www.rglennon.com
- www.IslandPress.org/unquenchable

Prof Robert Glennon

Prof Robert Glennon is the Morris K. Udall Professor of Law and Public Policy in the Rogers College of Law at the University of Arizona. A recipient of two National Science Foundation grants, he serves as Water Policy Advisor to Pima County, Arizona; as a member of American Rivers' Science and Technical Advisory Committee; and as a commentator and analyst for various television and radio programs. He is also a Huffington Post blogger (www.huffingtonpost.com/robert-glennon).

Glennon is the author of the highly-acclaimed *Water Follies: Groundwater Pumping and the Fate of America's Fresh Waters* (Island Press, 2002). His latest book, *Unquenchable: America's Water Crisis and What To Do About It*, was published in April 2009.



Since then, he has been a guest on *The Daily Show with Jon Stewart, The Diane Rehm Show*, C-SPAN2's Book TV, and numerous National Public Radio shows. He's also published pieces in the *Washington Post*, the *Arizona Republic*, and the *Arizona Daily Star*. In 2009–2010, his speaking schedule took him to more than 25 states and to Switzerland, Canada, Singapore, and Australia.

In 2010, the Society of Environmental Journalists bestowed on *Unquenchable* a Rachel Carson Book Award for Reporting on the Environment and *Trout* magazine gave it an Honorable Mention in its list of *Must-Have Books* ever published on the environment. Glennon received a J.D. from Boston College Law School and an M.A. and Ph.D. in American History from Brandeis University. He is a member of the bars of Arizona and Massachusetts.

Customer Demand Management – Learning from Overseas Experience

Gord Stewart – Director, AQUAS Consultants Ltd

"Water is a worldwide problem and even wet places are starting to feel it," said Robert Glennon, in his opening comments in a recent public lecture.

Professor Glennon, speaking here in New Zealand on the crisis facing the United States in freshwater management, detailed the problem and suggested a range of solutions. In the solution 'mix', he noted, "Conservation is the low-hanging fruit."

A lawyer by training, Glennon is a specialist in freshwater management issues by choice. He also happens to have written the Foreword to the recently published Volume 7 of *The World's Water* series (see accompanying review).

Over the years, *The World's Water* has given due coverage to municipal water issues and customer demand management efforts in the US. This article – drawing on relevant volumes and chapters in the series – provides a brief overview to some of the policies, approaches, and practices.

They are offered not as strategies to be adopted 'as is', but rather as ideas, food for thought options to consider.

The Soft Path

Amory Lovins is credited with coining the term 'soft path' for energy use with his 1977 book, *Energy Soft Path: Toward a Durable Peace*. Peter Gleick acknowledges this, and the concepts it entails, and can be credited with bringing this same terminology to the area of water resource management.

'The Soft Path for Water' chapter in the 2002 edition of *The World's Water*, defines two paths for meeting water-related needs. The hard path, it notes, relies almost exclusively on centralised infrastructure and decision making: dams and reservoirs, pipelines and treatment plants, water departments and agencies. The soft path may use centralised infrastructure, but it also relies on decentralised facilities, efficient technologies, and human capital. It strives to improve the overall productivity of water use, rather than always relying on new sources of supply to meet increasing demand.

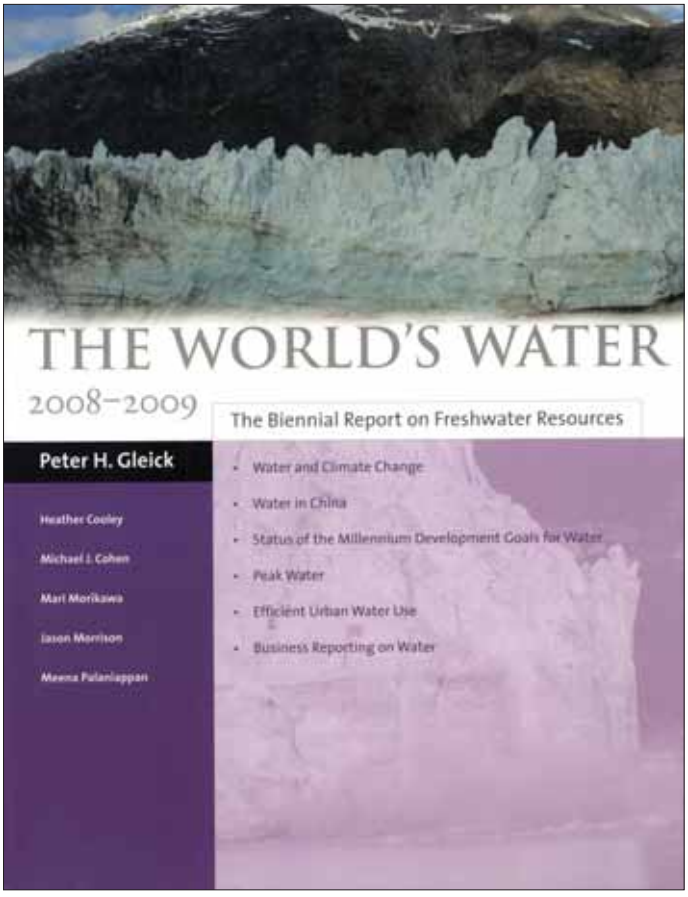
Wolff and Gleick (2002) note, "The adjective soft refers to the nonstructural components of a comprehensive approach to sustainable water management and use, including equitable access to water, proper application and use of economics, incentives for efficient use, social objectives for water quality and delivery reliability, public participation in decision making, and more."

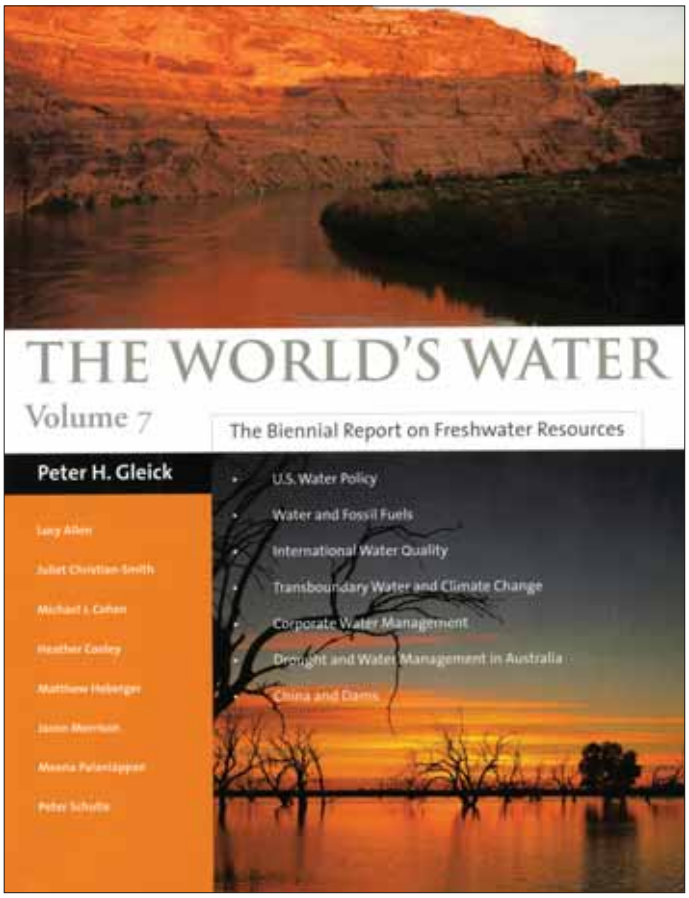
Customer demand management – promoting water-use efficiency and conservation – is one dimension of the soft path in municipal water use. Innovative water suppliers are turning increasingly to soft-path measures to help meet the needs of residential, commercial, and agricultural customers they serve.

Water Rates & Pricing

The 'Urban Water Use Efficiencies' chapter in *The World's Water* (2009) offers good coverage of water pricing. It notes that smartly designed rate structures allow the supplier to cover the costs of:

- Operation and maintenance
- Procurement/development of additional supplies and treatment to meet future demands





Above – The World's Water volume 7, and Top – The World's Water 2008–2009

"Conservation pricing policies vary in the US, with agencies using one or some combination of uniform, seasonal, and increasing block rate structures."

- The social and environmental 'opportunity costs' of losing or protecting other benefits of the water and natural waterways.

Cooley and Gleick (2009) suggest that "integrating all of these social and environmental values into rate structures better approximates the true cost of water and provides an economic incentive for customers to use it efficiently."

Conservation pricing policies vary in the US, with agencies using one or some combination of uniform, seasonal, and increasing block rate structures. Uniform pricing (same cost per unit regardless of total use) is the most common. Seasonal pricing uses a higher unit price in the summer months when outdoor water use can put pressure on supplies.

With increasing block rate pricing, the unit price of water (and sometimes wastewater) increases as the volume of water used goes up, with prices set for each 'block' of water. Properly designed structures protect lower income customers by making sure they can meet their basic water needs at an affordable cost, while providing an incentive to high-use customers to conserve.

Water rate structures for a number of cities and counties are noted, including Las Vegas, Atlanta and Seattle. The rate structure in Seattle sends the strongest signal to customers, using both seasonal and increasing block pricing. It employs a modest price for the initial block to ensure essential indoor uses (cooking, cleaning, bathing) can be carried out at a reasonable cost. Subsequent blocks have per-unit prices that rise substantially to send a strong conservation signal.

Comparing per-capita use and pricing in the three cities noted above, Seattle is reported to have the most aggressive conservation rate structure and the lowest per-capita-use rate. Conversely, Las Vegas has the weakest incentives and the highest use. For wastewater services, some US jurisdictions use high fixed charges or volumetric pricing as a part of their suite of instruments for demand management.

With fixed rate (annual charge) pricing the norm in New Zealand, a uniform rate typical wherever conservation pricing is employed, and volumetric wastewater charges uncommon, Councils giving thought to pricing as a demand management tool have lots of room to manoeuvre.

Indoor Water Use

Two chapters on 'Urban Water Conservation' in *The World's Water* (2004) provide case studies of residential and commercial/industrial water use in California. These add further detail to the information in the 2009 volume (noted above) which also covers indoor and outdoor conservation efforts, including rebates and incentives.

The chapter covering residential issues notes that efforts to reduce wasteful use of water have been underway for many years in some areas, and that this has contributed to reliability of supply and reduced the pressure for increased water takes.

Promoting water-efficient showerheads and toilets is often a first step, given their ease of installation and short payback period. With improving technologies, water-efficient washing machines and dishwashers have come into their own and are now standard in new construction and renovations. Reduction in hot water use has the obvious additional benefit of reduced energy use and cost.

"Customer demand management – promoting water-use efficiency and conservation – is one dimension of the soft path in municipal water use. Innovative water suppliers are turning increasingly to soft-path measures to help meet the needs of residential, commercial, and agricultural customers they serve."

Programmes targeting older homes can be highly effective, given many of them will have older, less efficient fixtures and appliances. The Seattle-Atlanta-Las Vegas comparison noted above is a good example of this. Of the three cities, Seattle provides the best incentives for upgrading fixtures and appliances, covering nearly all items for residential customers. So even though it has the highest percentage of older homes, it has the lowest indoor water demand (pricing helps as well, as noted above).

Residential leak rates have been documented in a number of US studies, confirming a further opportunity for improvement. One study cited estimated leakage at 5–13% of total indoor water use. Another study put average leakage at nearly 13%, with the 100 homes with the highest water use having leak rates of over 24%. In all the studies, toilets were identified as the leading 'leakers'.

The chapter covering commercial and industrial water use suggests that opportunities for savings vary tremendously by industry and end use. Detailed tables show the potential for reduced water use, with paper and pulp operations at 44%, for example, schools also 44%, and commercial laundries as high as 50%.

Customer water-use profiles help water utilities target their efforts and the same can work here. In some settings, a comprehensive residential programme may be a logical focus. In others, where a few commercial customers take most of the supply, for example, a more targeted effort makes sense.

Gardening & Outdoor Use

Outdoor water use in the US is significant, what with the American obsession for expansive lawns and with golf courses as green oases in the desert. This has driven seasonal and peak water use at times and in areas where supplies are severely constrained.

By necessity, Las Vegas and other areas in the US Southwest have been innovators in outdoor conservation programmes. These have included incentives to reduce turf areas, install rain sensors and irrigation timers, and use pool covers.

Xeriscaping practices (i.e. water-efficient landscaping) have increased in popularity, driven by water costs and local policies. The benefits have been quantified in a number of studies, including some conducted by the North Marin (California) Water District. Their research found that an appropriate selection of plants and careful landscape design could reduce water use up to 54%.

We're fortunate here with our relative abundance of water – certainly compared to the US Southwest – and our seemingly more reasonable approach to outdoor water use. Real gains can be made with 'low tech' solutions, such as favouring native plants in landscaping and generous mulching of gardens to reduce evaporation loss. Rainwater harvesting and greywater reuse deserved serious consideration as well. Seasonal and as-needed water restrictions also have their place.

Getting the Right 'Mix'

This brief review of practices in the US confirms the range of options and opportunities available for water-use efficiency and conservation. Various sources categorise these options in different ways. One helpful way is to divide them into measures and instruments as shown in the accompanying Figure 1 – Customer Demand Management Options – At a Glance.

Measures involve the use of specific devices or actions that result in reductions in water use. Instruments are supportive elements that encourage adoption of a technology or a change in habits or practices.

Key to a successful customer demand management programme is the use of measures and instruments that suit the local situation. Economic, social, cultural, and environmental factors all come into play and will help determine the right approach. ■

Gord Stewart is a water use and conservation specialist. He works on projects for district, city, and regional councils and for industry clients and non-profit organisations. He is the author of *Water New Zealand's* publication, *The Case for Demand Management in Council Water Supplies*.

Figure 1 – Customer Demand Management Options – At a Glance

Measures

Technologies & Practices Indoor	Technologies & Practices Outdoor	Water Capture, Reuse & Recycling
Residential *Fixtures and devices* *Appliances* *Audits and Retrofits* *Water-use practices* Industrial/Commercial/ Institutional (ICI) *Fixtures and devices* *Production processes and practices*	Residential *Moisture gauges, timers and shut-off devices* *Irrigation systems* *Water-saving landscapes* *Water-use practices* *On-property leak detection* Commercial *Irrigation* *Broader management practices*	Water capture/rainwater harvesting Storm water management Greywater reuse Wastewater recycling

Instruments

Information & Education	Regulatory Mechanisms	Metering, Pricing & Other Incentives
General Communication *Information/educational material* *Media/advertising* Personalised Information *Water bill information* *Interactive tools and calculators* *Water-use audits* Personal Contact *Displays and events* *Presentations and workshops* *Interaction in the community* Promotional efforts *Demonstration gardens* *Cooperation with retail plumbing* *Water conservation awards*	Bylaws, regulations and restrictions Planning control/ building code Support for legislative reform	Meter Installation Pricing Strategies *Flat rate* *Uniform (or constant) rate* *Increasing Block Rate (IBR)* *Peak-load pricing* *Wastewater charges* Financial Incentives *Rebates and subsidies* *Loans and savings schemes* *Giveaways* *Direct Installation* *Subsidised/free water audits* *Cash payments*

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The World's Water: The Biennial Report on Freshwater Resources
by Peter H Gleick and others, Island Press, Washington DC

The seventh volume in *The World's Water* series, published every two years since 1999, is now available. Authored by Peter Gleick with colleagues at the Pacific Institute for Studies in Development, Environment, and Security in Oakland California, each book in the series addresses key issues and trends in water management and provides comprehensive data on the world's freshwater resources.

Peter Gleick, who is well-known internationally for his contributions in the water resource management field, notes the goal of *The World's Water* series in his introduction to the current volume: "To help improve global understanding of the water challenges and the availability of solutions."

Each volume in the series follows a similar format, with half dozen or so lengthy chapters and several 'Water Briefs' as text along with a set of Data Tables (nineteen in the case of the current volume). The text and set of tables each take up about half of the book. Gleick notes that the text "explores a subset of the many pressing water issues based on timeliness, urgency, and our own experience and priorities." Some of the content is based on work done by the Pacific Institute for the United Nations Environment Programme.

Chapters in the current volume cover topics ranging from corporate water use and transboundary water issues to drought, dams and water policy reform. Topics included in previous volumes are wide ranging, including groundwater, water and privatisation, peak water, water and climate change, desalination, ecosystem services, and bottled water.

The Data Tables cover a variety of topics. Some tables – 'Freshwater Withdrawal by Country and Sector', for example – appear in each volume of the series, allowing changes over time to be tracked.

Each book includes the tables of contents for all previous volumes in the series and a comprehensive index covering all volumes to date.

I look to *The World's Water* for updates in my own area of interest, information on complementary topics, an international perspective, and insights on emerging trends.

– Gord Stewart

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"In addition, support specialists are available in Murten specifically to provide backup support for our subsidiaries where specially qualified professional forces supply local training and support. Support staff are multilingual and expert in their work."

CD Lab has two sister companies; WinCan™ Deutschland GmbH is located in Langenargen at the Lake Constance, Southern Germany. It organises the distribution and support of WinCan™ in Germany, Austria and all eastern European countries. WinCan™ Europe Ltd was established in 2000 and is located in the south of London (Woking). It organises distribution and support for the United Kingdom as well as for many territories using UK based (WRC) standards.

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For information on WinCan™ V8 CCTV pipeline inspection and Data Management software please contact seca@seca.com.au or visit www.seca.com.au

Work Flows for Harrison Grierson

Harrison Grierson

Glen Cornelius

Winning the design contract for the $30 million sewerage upgrade for the city of Mount Isa in Queensland was a great start to the year for Harrison Grierson's new Managing Director.

Glen Cornelius, who became Managing Director of the Australasian engineering company on 1 January, said the Mount Isa project, which includes concept and detailed design, tender invitation for construction work, construction supervision and contract administration, reinforces the company's strategy for growth in North West and North Queensland.

"Targeted growth in Australia is a key goal in our strategic plan for the company", says Glen, who has been with Harrison Grierson for over 16 years and a Director since 2008. "There are significant opportunities in Australia from increased demand for services arising from growth in the resources sector.''

Despite the company's 127 year history Harrison Grierson has only had a presence in Australia for a relatively short time. Glen believes it was the service commitment and the engineering innovation that gave the bid team for the Mount Isa project the winning edge. The company also recently completed the design contract to upgrade all the chemical dosing systems for the conditioning and treatment of the raw water at Brisbane City's Water Treatment Plant at Mt Crosby. Glen is delighted that these, and a number of other projects, mean the company has built a solid base of experience which is resulting in ongoing opportunities for work in the water sector across Queensland.

> "Worryingly, the world is running out of clean, freshwater and the demand for it is growing. This means that the need for experts in all aspects of water management, such as hydrologists, geologists and people who can model aquifers etc is increasing and will continue to do so."

Harrison Grierson's New Zealand offices are in Auckland, Manukau, Tauranga, Whakatane, Wellington and Christchurch. The company provides professional services in the market sectors of Water & the Environment, Land & Buildings, Utilities and Transport.

Glen admits it's challenging times for business with the global economic situation currently compounded by problems in the Eurozone. "In New Zealand, the limited availability of funds and weakened business confidence is keeping the market flat causing ongoing uncertainty. Talking with competitors, things are tight across the market and with Local Government and Councils reduced spending to keep rates down and the Government putting money into roading but little into anything else, it's a tough time for everyone."

Glen is optimistic about the future and says that in New Zealand, providing structural engineering services to a wide range of clients in Christchurch and other earthquake-prone parts of New Zealand is counteracting the slowdown in local and central government work and keeping many of his staff busy. Once the money flow increases for rebuilding in Christchurch that will also provide work well into the future.

Water is another sector which will keep Harrison Grierson busy. "Water has been a strong part of our business for a long time,'' says Glen.

"Our Water & the Environment division has remained busy throughout the downturn and the Mount Isa project is a strong case in point that water continues to be a huge issue, locally and globally. Stormwater, wastewater and water supply are all issues Councils need assistance with and the issues in New Zealand regarding irrigation are well known. Worryingly, the world is running out of clean, freshwater and the demand for it is growing. This means that the need for experts in all aspects of water management, such as hydrologists, geologists and people who can model aquifers etc is increasing and will continue to do so."

Harrison Grierson's work in this sector in New Zealand has focussed on water treatment and supply and wastewater treatment and disposal across all regions in the North and South Islands. Glen has personally undertaken hydro-electricity work on projects in the central North Island.

Only a few weeks into his new role, Glen says he's had a fantastic first month. His focus for the rest of the year will be on the implementation of an annual operating plan that contains key actions and timeframes to underpin Harrison Grierson's five year strategic plan. ■

Harrison Grierson Announces Two New Directors and a Senior Principal

Stephen Finnemore

Stephen Finnemore has been appointed a Director after heading the water and wastewater section of the Engineering Division of Harrison Grierson since 2005.

Harrison Grierson is one of the leading water and wastewater design companies in New Zealand.

Stephen is a Chartered Professional Engineer with a BSc in Chemical Sciences and a Diploma in Business Studies and has extensive expertise, in the United Kingdom and Australasia, in water and wastewater design. Stephen is based in Auckland.

Poul Israelson

Poul Israelson has been appointed a Director and moved to Harrison Grierson's Brisbane office in June 2011. Poul has significant experience as a planning specialist and project manager leading teams of consulting professionals on projects in the utility, infrastructure, development, rural and education sectors. Poul has a Masters of Regional and Resource Planning (Distinction) and a Diploma in Business Administration.

Andrew Thompson

Andrew Thompson has been promoted to Senior Principal. Andrew has led the Buildings and Structures section of the Engineering Division of the company since 2006. Andrew is a specialist in analysis and design of heavy civil structures and commercial and residential buildings. He has been very active providing structural engineering services in Christchurch following the earthquakes and throughout New Zealand where earthquake prone buildings are being reviewed and strengthened. He has a degree in Civil Engineering and is a Chartered Professional Engineer.

Lack of Investment in Rainwater Harvesting Systems

"Attitude" is the word used by Justin Jordan of Timbertank Enterprises to describe why more Kiwis don't invest in economical rainwater harvesting systems for their home or business properties.

"The public and industry want to harvest rainwater because its good for the environment and to save money, and industrial concerns are also keen to reduce wastewater consents and costs," says Justin. "However most Councils do not see why the public should harvest rainwater when town supply is so cheap.

"The public needs more guidance from Councils as to the volume of storage they are happy with, so responding to public keenness to harvest rainwater. It's a disgrace that over 50% of potable water in New Zealand is flushed down the loo", he says.

"We simply can't afford to keep on this slippery path.

"Currently Councils feel the burden on water stocks when we have a dry spell – small tanks run out and people switch to town supply, when town supply is running short too. It's a double whammy. So we need to slow this water cycle down."

"In dry summers, people are calling out for rain, then when it comes, they don't conserve it. But if people had at least a 20m³ tank at home, or a decent installation – say 100m³ – at their industrial site, there would be a huge saving of a precious resource."

The key question to be answered is, how much water storage is enough? The answer depends on the needs of the water user. Enquiries from industrial concerns who want to become better 'green' users and cut down on their water use – particular wastewater, are resulting in Timbertanks increasingly providing effective rainwater harvesting systems to reduce use of Council provided water.

"In dry summers, people are calling out for rain, then when it comes, they don't conserve it. But if people had at least a 20m³ tank at home, or a decent installation – say 100m³ – at their industrial site, there would be a huge saving of a precious resource."

"We have developed a system using downpipe surge collection to divert rainwater from different shaped roofs into holding tanks, which are then piped to be used for flushing lavatories etc.

"We have recently done two major installations in Auckland – one at the Auckland Prison in Mt Eden, with two 100m³ holding tanks, the other at Auckland Domestic Airport, with a 70m³ tank."

Part of the investment problem is having economical systems available. Justin says costs vary according to the size of the installation, but a typical downpipe connection is estimated at $600, plus the cost of the holding timber tank and plumbing. For a standard 20m³, 3.5m diameter tank for home use, cost would be in the vicinity of $12,000 – 15,000. The company is also able to offer elevated gazebos over water tanks as an attractive garden asset.

"More rain falls than you could ever use, so the key to the success and the payback is to install the biggest tank you can afford," says Justin. "I believe that flushing your loo with premium drinking water is almost criminal! Why not save the environment and money at the same time?

A different approach to utilising a rainwater harvesting tank at the Kerikeri Riding School. A viewing platform/gazebo has been erected overlooking the equestrian dressage arena on the newly constructed 45m³ Timbertank. Water is collected from the roof of the adjacent indoor arena and piped to the tank.

"Depending on the installation, a water bill can reduce by at least 40% and up to 60% in some cases – payback is 5–7 years. It is particularly cost effective for industrial situations. And for industrials we would expect their use to grow, so Timbertank systems are planned to allow tanks to be rebuilt to a larger size, for a small cost." ■

Water New Zealand Conferences & Events

***Water New Zealand's* Stormwater Conference 2012**
10 – 11 May 2012
Amora Hotel, Wellington, New Zealand

***Water New Zealand's* Annual Conference & Expo 2012 'Water – Challenges & Opportunities'**
26 – 28 September 2012
Energy Events Centre, Rotorua, New Zealand

For more information on *Water New Zealand* 2012 conferences visit www.waternz.org.nz/events

Other Conferences

2012 NZ Land Treatment Collective Conference
28 – 30 March 2012
The Sebel, Trinity Wharf, Tauranga, New Zealand
For more information contact:
marie.heaphy@scionresearch.com

Australian Water Association Conference – 'Ozwater 2012'
8 – 10 May 2012
Sydney Convention and Exhibition Centre, Darling Harbour, Sydney, Australia
For more information visit www.awa.org

85th Annual Water Environment Federation Technical Exhibition and Conference
29 September – 3 October 2012
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