IrrigationNZ news
SPRING 2021

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IRRIGATION NEW ZEALAND
WATER | FOOD | FIBRE | LIFE

www.irrigationnz.co.nz

Never lose sight of your value

Tēnā koutou e hoa mā,

Welcome to the spring edition of our wonderful magazine.

Covid has reared its ugly head again, and our country has had to be a team of 5 million once more. I remember standing before you at our 2020 AGM reflecting on the year that had been – a year of unprecedented times. Yet, here we are again, 12 months later, and Covid has changed normal as we know it. These times are, unfortunately, unprecedented no more.

As farmers and growers, and those who support you in what you do, we have the privilege of being an essential service. Thank you for doing what you do. Don't ever lose sight of the value that your hard work brings to New Zealand, not just in dollar terms, but in supporting each other, our communities, and the environment.

It has been a busy time for the team at IrrigationNZ, with plenty happening in the advocacy space. It is with a huge sense of pride that I can now say that we have a full team again at IrrigationNZ, who are collectively and cohesively representing our sector with mana in Wellington and the regions. IrrigationNZ also has its new permanent home in Wellington. We are very grateful to Federated Farmers for allowing us to share with them while we found our own space, but it is nice for the team to have their new home, and for IrrigationNZ to have a permanent presence there.

The board has recently reviewed the IrrigationNZ strategy which will be available at our AGM. Regular review of strategy is critical for any organisation, and especially so for us because we are in a fast-paced and constantly changing operating and regulatory environment. We need to be agile, and we need to be clear about why we exist and what we do. The reviewed strategy represents a reinvigorated IrrigationNZ, excited and positive about its future and the role that irrigation has in supporting a resilient, thriving Aotearoa.

Warmer weather is here and so is the irrigation season! Use your water well and make good irrigation decisions.

Kia mihi,

Keri Johnston
Chair of IrrigationNZ

Irrigation provides security for growers to produce food and fibre, even during pandemics and droughts. *(Photo: Adobe Stock)*

Controlling the controllable

As we head into the major irrigation season and gear up for the summer months, there is still ambiguity swirling around. As growers of food and fibre, we focus either directly or indirectly on the systems we use, the outcomes we are trying to achieve, and controlling the controllable elements as best we can. It can be distracting and concerning seeing so much changing and so much that is uncontrollable in the midst of a pandemic.

These past few months in particular have been hard. We have some of the biggest changes for farmers and growers being discussed, in the form Freshwater Farm Plans (FW-FP), changes to resource management approaches, and a climate change plan that doesn't yet have a lot of depth or certainty to it. We also have some of the worst weather we have experienced in a year, overlaid with a virus we thought we could contain, but which appears to be getting the better of us.

Like all businesses we manage risks – that is why we have irrigation. To smooth out the dry times and have water available for our plants when they need it. This crazy time needs more risk management than most, and at a time where we cannot get enough people to work in our businesses, this can be overwhelming. It's times like these that we need to simplify and work out what our focus areas are, what we can influence, and what we can control.

IrrigationNZ is here to help influence outcomes through advocacy and policy engagement, to try and get a better approach for our members, and farmers and growers generally. We do not believe in stopping progress or improvements, but we want them to be practical, workable, and outcome-focused, giving us time to work together and get it right. We are part of your risk mitigation strategy. We help support training and learning of new and better ways of working under new policy and regulation, and we support you to achieve the outcomes and plans required.

We don't always win, but we have your back and work with government policy and implementation teams to get better outcomes. A couple of those concessions happened this quarter. On the Water Services Bill* we worked with implementation and policy teams to get two years for implementation once agreed and a further five years to work through acceptable solutions. We have submitted, as have others, that for farmers and growers this needs to be part of existing planning frameworks like the mooted FW-FP, and therefore managed by the same auditors and certifiers. We would support the required training for consultants needing to understand that module of the plan.

A second similar win is the risk based approach to dams. A piece of legislation that has been 25 years or more in the making, which applies to all bodies of water that exceed dimensional thresholds. This will impact a lot of businesses. The risk assessment approach that we are working on with MBIE would significantly reduce the compliance activity and cost, and hopefully be implemented within the farm planning framework. By being in the tent we get to work through solutions. It's not us cosying up to the government, but working on your behalf with the government to ensure practicality in implementation. We all want healthy, sustainable waterways and clean drinking water, but we don't always agree on methods or timeframes when it comes to changing what was 150 years in the making.

With so much change and uncertainty during a nerve-racking pandemic, we all must mitigate our exposure to risks. We must also work together to achieve the desired outcomes in a manageable way, while supporting each other. Our grandchildren and great-grandchildren are depending on it.

Vanessa Winning
Chief Executive,
IrrigationNZ

**This is not to be confused with the wider Three Waters approach, which impacts local authority infrastructure asset management.*

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IrrigationNZ: out & about

TRAINING

We are heading towards the end of the year, and the last few months have been busy with training opportunities. We enjoy having the ability to learn and share knowledge and learn through a range of workstreams.

September saw a number of people attend Irrigator Advice Workshops which were held with FMG, in the North and South Islands, from Waimea (Southland) to Hororata and Culverden (Canterbury), and Hawke's Bay.

In late September module three of the New Zealand Certificate in Irrigation System Design was delivered to the 15 people attending the course in Hawke's Bay. This module looked at implementation phases of a designer's role, and included a field trip to Craggy Range and Delegates vineyards. The final module of the course was delivered in Christchurch, in late October, and mostly focused on hydraulic design elements.

Our Principal Technical Advisor, Stephen McNally, spoke at the Wairarapa Water Users Society AGM on 28 October to discuss water availability, security, and storage.

Early November saw the latest intake of the New Zealand Certificate in Irrigation System Performance Assessment take place in Hawke's Bay, which will carry on into 2022.

Both of these courses will be available again in 2022, beginning in February (the New Zealand Certificate in Irrigation System Performance Assessment will be held in Canterbury). For details, please see the *Events and Training* section of our website: www.irrigationnz.co.nz

Pictured: Photos from the Certificate of Irrigation System Performance Assessment course held 2–4 November.

AGM TO BE HELD ONLINE THURSDAY 18 NOVEMBER 2021

Unfortunately, this year our AGM doesn't really count as 'Out and About' because we are hosting the event online due to Covid restrictions.

Please go to page 9 for further information..

Pictured: Attendees at the 2020 IrrigationNZ AGM and IrrigationNZ CEO Vanessa Winning.

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IrrigationNZ: Advocacy and Achievements

2020 was a big year for IrrigationNZ. Having moved to Wellington in October, and bringing in our new CEO Vanessa Winning to grow our engagement with the government, policymakers, and implementation teams, we have achieved a lot in a very short period. With the support of Spear, particularly Ruth Lavelle Treacy, we managed to get in front of all the policymakers and politicians we needed to, and established dialogue.

Over the past year, we met with the Minister for Primary Industries Damien O'Connor, Minister for the Environment David Parker, Minister for Climate Change James Shaw, and Associate Minister for Conservation Eugene Sage. These meetings were about particular legislation that is underway. Members of the Opposition we met include Barbara Kruiger, Chis Luxon, Scott Simpson, and Simon Coult.

Our Chair, Keri Johnston, regularly meets with Prime Minister Jacinda Ardern and with Ministers for Primary Industries and the Environment through the Food and Fibre Leaders forum group. Quarterly discussions are held on the big issues affecting the primary sectors.

Water and water-related activity is relevant to pretty much all sectors of government. We have formed relationships with policy and implementation teams across many areas, including the Ministry of Business, Innovation and Employment (Dam Safety and Infrastructure), the Department of Internal Affairs (water services), the Ministry for Primary Industries (integrated farm plans, Sustainable Food and Fibre Futures projects, Water Availability and Security), the Ministry for the Environment (Freshwater Farm Plans), Regional Development, Climate Change, the Department of Conservation, Taumata Arowai, and the Department of the Prime Minister and Cabinet.

We have made several submissions on various policy/regulatory changes, including the Water Services Bill, Dam Safety implementation, climate change, Resource Management's proposed Natural and Built Environments Act (NBA), and earlier versions on Farm Environment Plans. We expect this year will be even busier as more policy is introduced.

We are part of implementation groups for several technical advisory activities, including Water Availability and Security, Farm Environment Plans, Integrated Farm Plans, He Waka Eke Noa, Te Tai Tokerau Water, water metering, and the Food and Fibre Partnerships Group. We expect our work within these groups will increase as more policy nears implementation stage.

ACHIEVEMENTS 2020-2021

*Calendar year July 2020 – June 2021.

TRAINING

220+

Over 220 people attended our trainings

E-LEARNING

130

Almost 130 people completed online e-learning

WEBSITE

25,000

Over 25,000 visitors to our website – up 20% on the same period the previous year

New website visitors **83.7%**

Returning visitors **18.3%**

IRRIGATION NEW ZEALAND

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IrrigationNZ AGM

Held online 4–6pm, Thursday 18 November 2021

Register to attend via www.irrigationnz.co.nz

Message from the Chair

It is with pleasure that I formally invite you to attend our AGM on Thursday the 18th of November 2021. This year we have a lot of successes to share as we move in our new strategic direction and focus on advocacy, training, and leadership activities.

Unfortunately, due to the uncertainty of hosting events in the current Covid environment we are unable to hold our AGM in person this year and have decided to host it online. We hope we can host next year's AGM and other future events in person.

This year we have two board members up for rotation/retirement – Jared Ross and Ivan Knauf. Jared is going to stand again, however, Ivan has decided to retire. Ivan has contributed significantly to the board over the past four years as a passionate and considerate member whose efforts have been greatly valued. Ivan will leave having completed the mammoth task of completely overhauling our outdated constitution into the new legal framework for incorporated societies, with significant support from our long-term supporter, Anderson Lloyd.

We are very fortunate to have guest speaker, economist Cameron Bagrie, joining us to talk about the economic impact of the global pandemic, and the impacts of our current housing, export, and infrastructure activities. Cam is always entertaining and tells it how he sees it.

Please register on our website to receive the link for joining the AGM online.

– Keri Johnston

IrrigationNZ: Membership Statistics

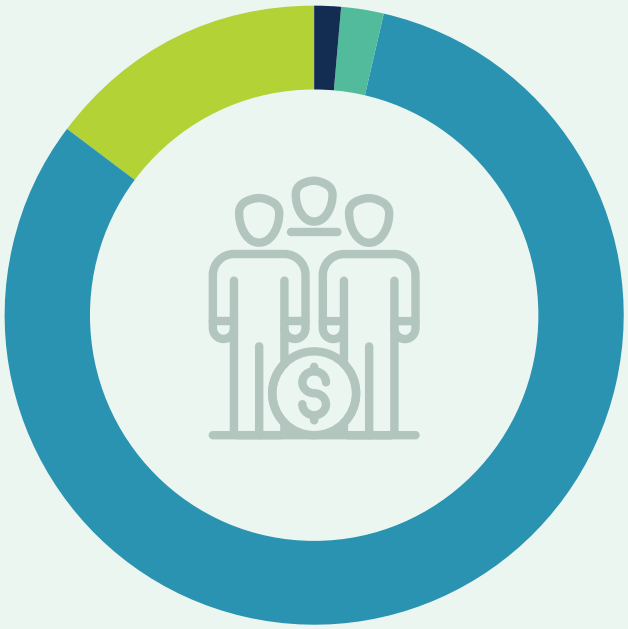
MEMBERSHIP BY CATEGORY

- Government
- Research Institution
- Retirees
- Irrigators and Schemes*
- Service Industry

*Schemes counted as being a single member therefore this number does not represent the total number of irrigators represented by IrrigationNZ.

FEES PAID BY MEMBERSHIP CATEGORY

- Government
- Research Institution
- Retirees
- Irrigators and Schemes
- Service Industry



Calendar year July 2020 – June 2021.

Water – its value to New Zealand and the importance of storing it

View from Here with Barbara Kuriger, MP for Taranaki-King Country, National Party Shadow Minister for Agriculture, Energy and Food Safety.

Water is the most important asset to each and every one of us in New Zealand. We have plenty of water, but for a range of reasons people treat water supply with a scarcity mentality. The reason for this is that in the past few decades we have failed to store enough of this abundant resource.

We need to store more of it – it will benefit us economically, socially AND environmentally.

Well over 90 percent of our water runs straight out to sea. Water is renewable, we can use it over and over again. We must respect water and our waterways and keep them clean. In doing that, the essence of life will provide us with intergenerational wellbeing.

Until three summers ago, every time water storage was mentioned one could hear the pushback about water storage being for the farmers and the concept of more farmers wasn't an option that many of the public were too excited about. Then everything changed. Auckland suffered an ongoing drought and the ability for them to source water became much more limited, which created a tense dialogue between Auckland and the Waikato.

Over our most recent winter we had extremely low levels in our hydro dams and a drop off in the amount of natural gas available. These factors led to importing hundreds of shiploads of Indonesian coal. This puts our climate change targets at huge risk. Wholesale electricity prices were horrendous, rising at one point by four times where the affordable level should be.

Stored water has been used for increasing river flows for fish passage in times of severe drought where the levels are so low that we can't sustain the normal fish life. Being able to top up these waterways is hugely beneficial to our environment.

It is high time in New Zealand that we learned again to value our natural resources. As well as water, we have a great climate for agriculture and plenty of weather that is amenable to renewable electricity.

Our farmers provide food at the lowest rate of climate emissions in the world. We still have some work to do on our environmental challenges, and I've seen a good deal of change in the most recent decade. With the use of smart technology that we now have access to, the ability to irrigate our land at optimum rates is significantly increased. In some areas of our country, especially the East Coast areas of both islands, advances in irrigation technology will add value to our export offerings, while at the same time protecting our precious environment.

> "Anything can be grown with water and nothing can be grown without it."

Some diversification from dairy will take place, with some land being converted to horticulture creating a great mix of products for the local and global food bowl. I have seen some really good reservoirs recently that can be used to support horticulture.

As we search for climate solutions and find new ways to produce both renewable electricity and renewable energy, I believe some smart minds will be able to get together and work on ideas for some multiple water storage infrastructure projects. I am not an engineer, but those who are more knowledgeable than I in this field will potentially design projects that will be able to simultaneously support energy, agriculture, urban supplies and our environment. We can have it all, if we work to understand what is needed and design systems that have the ability to provide us with a strong water resource, creating a great fresh water future.

We have now seen proposed water storage projects stopped or stalled a number of times, due to regulatory restraint, cost, or uncertainty. We only use around two percent of the water that falls on New Zealand. The rain doesn't fall evenly, often with either too much or too little, but we have the power to balance it out. We have to be thinking about our long term future and educating the public about what is possible. Now that we have a third of the population constantly short of running water in our largest city, we must create a joint understanding.

We have managed now to find common ground regarding water quality. Finger pointing has been put aside, and everyone now knows that there are issues in both urban and rural areas. Closing Auckland beaches each summer due to the poor quality of the water is no more acceptable than having rural rivers that are not swimmable.

Taking into consideration projected climate change effects, it is estimated that by mid-century in some areas it will take 15 percent more water just to continue with our present-day activities, due to less rainfall and increased evaporation.

We used to pride ourselves on being a can-do, number eight wired country. We are turning into a country of 'can't do' and 'not allowed to do', strangled in red tape. Anything can be grown with water and nothing can be grown without it.

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Three schemes in three years from a standing start

View from Here with Greg Standford, a consultant in Tasmania.

Irrigation development and the economy are flourishing in Tasmania. It was quite different in 2008 when the then Chief Minister Paul Lennon adopted a vision to power Tasmanian agriculture by irrigation development. This followed the Chief Minister commissioning an innovation think tank to come up with ideas to rejuvenate Tasmania's economy following the closure of several industrial plants and the uncertain future of several more. This vision was inspired by the outstanding success of horticulture in the Coal River Valley northeast of Hobart based on irrigation water from the Craigbourne Dam, which was built in 1987. From here large quantities of salad greens were being supplied to supermarkets in southeast Australia. There were also a variety of other horticultural enterprises including apricots and viticulture.

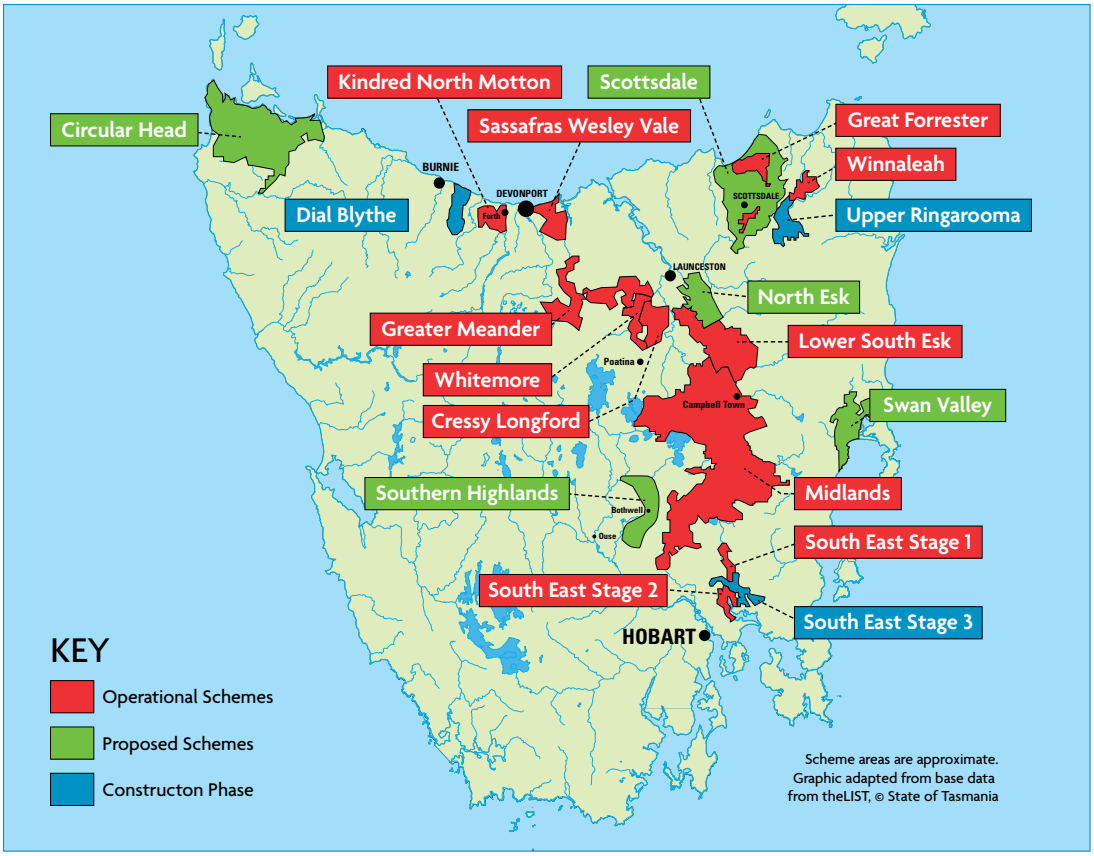
To facilitate his vision, Paul Lennon sold the Hobart Airport for AUD$80 million and put the money together with a AUD$140 million conditional grant from the Commonwealth to create funding of AUD$220 million. In July 2008 the Tasmanian Irrigation Development Board (TIDB) was set up as a state-owned company using a very experienced and skilful board in which four out of five directors were from the private sector. The board was instructed to develop 11 specific schemes concurrently using private sector methods. Later, in July 2011, legislation was put in place specifically to facilitate irrigation development and the TIDB became Tasmanian Irrigation (TI), much to the chagrin of an existing local on-farm irrigation support company called Irrigation Tasmania. This, of course, caused confusion in the accounts payable sections of both companies.

The board appointed Jock Chudecek as chief executive in mid 2008. As a previous director of John Holland Group, Jock was an engineer of renown with immense big project experience. I got to know Jock on a multi-billion-dollar pulp mill project in Tasmania immediately prior to his appointment, and I was delighted when he approached me to work with him. I commenced work with the TIDB in November 2008 as the Deputy CEO and General Manager - Technical. Most of the staff from the government department elected to return to the department once they understood what private sector methods meant in practice, including no 'flexing off' for good surfing weather. It was made clear that the only thing protecting our jobs was the delivery of irrigation schemes.

We then needed project managers as we were to progress all eleven projects at once. At that time there was a sharp contraction in the forestry industry where I had previously worked. I knew many of those who found themselves without employment. We quickly employed nearly a dozen highly competent and experienced people who we would not have been able to afford at any other time.

Later in 2009, less than a year into the project, it was announced that Jock could not continue as chief executive as he was terminally ill with mesothelioma. He died in April the following year. This left me as acting chief executive trying to manage the political posturing, funding and external relations, in addition to the project management, engineering, approvals and construction. At this time we were still recruiting and developing systems and were doing everything for the first time. We had not yet built an irrigation scheme. The experience and knowledge required to plan, acquire approvals, and construct these irrigation schemes did not yet exist. Chris Oldfield was appointed as chief executive in July 2010 and things really started moving as he demonstrated his mastery as a political strategist and skilful tactician. This left me free to concentrate on project approvals and engineering. At that time construction appeared relatively easy when compared to finding a pathway through the myriad approvals required and the commercial challenge of establishing a credible product to sell as water entitlements.

A business case meeting both state and federal government requirements was the key document required to release public funds. It was resolved to build it on three pillars: viz. economic, social and environmental sustainability. This included showing that the economic net present value (NPV) was greater than zero. Economic modelling could only use farm gate returns from farm practices



Tasmanian Irrigation Schemes. *(Source: theLIST)*

that were already present in the study area, or developments that could be proved were likely to proceed from those purchasing water. In other words, the modelling was not allowed to include any blue-sky returns. The bar was seemingly low, but the modelling was heavily shackled by a sceptical treasury and therefore engineering the project within tight budgets became key to achieving the necessary economic performance.

The social sustainability could be shown in part by the successful sale of the water entitlements. The prices were considered very high at that time by a market that was used to paying little, if anything, for water. There was a mind-set that water should be free. It was also recognised that where little was paid for water entitlements economic development was slow, as had been shown on two earlier schemes. In addition, to attract high value investment, high reliability water entitlements were required. The board therefore decided to price the water as high as the market could stand. Ironically, without this high pricing of the water, the utilisation of the water and therefore the economic benefit was slow at reducing the economic NPV and undermining the economic viability of the project. For the first schemes, the starting price for a megalitre (mL) of water* was AUD$1,130. At the time this was seen as outrageously high because there was not a good understanding of the value of having water reliably available when it was required, even in drier years. It has since been priced as high as AUD$2,700/mL and more recently in Queensland, at Stanthorpe at AUD$6,000/mL. Through the sale of the water entitlements designed for a reliability of 95 percent a further AUD$90 million was raised to fund construction, making a total fund of AUD$310 million for tranche one. Once a scheme was operating for a year or two a common complaint from landowners was that they should have purchased more water, but I rarely heard of anyone saying that they wish they had purchased less.

Environmental sustainability was assessed at both the state and federal levels, including referrals under the Environmental Protection and Biodiversity Conservation Act on an individual scheme basis. There are four approval paths under this legislation, and it was necessary for TI to use them all. It is likely that TI became the most experienced organisation in Australia at that time in referring projects under this legislation. This is highly likely because it achieved the second approval using a Strategic Assessment in Australia in the little more than a decade since the legislation came into force, as well as by all other approval paths multiple times. These approvals were done in-house, which managed the costs effectively.

The schemes only proceeding if they were economically viable meant that there was a risk of a lot of money being spent before it was found that a scheme was not viable. The engineering cost estimates for projects tended to come in very high unless there was incentive and control to keep the cost estimate modest, and then to give full control of the project to the project manager to manage the cost of construction. This was done successfully by producing a scope and a preliminary design and then tendering as a design and construct. The bidders were required to price the various risks into the lump sum contract. Along with the skill of the project managers this process proved successful in delivering the first ten projects on budget. To prevent investing too much into an unviable project, a first step was developed which we called a preferred option. It was a low-cost preliminary business case to see if there were any showstoppers and check that the community supported the scheme and was prepared to purchase the water entitlements.

A key aspect of these developments was starting with the water demand, not the dam. Each project commenced with the formation of an irrigator consultative group in a farming district. This group then assisted in obtaining Expressions of Interest (EoI) for the purchase of water. The preferred option was engineered on the basis of these EoIs and the scheme built only to service the delivery of the actual water sold. This was the only way the economics would work, as the take-up for large schemes without water sales in place before construction had proved to be so slow that the economic

** This is an annual supply but there is also an annual operational payment as well which is unique to each scheme and reflects the variable cost, operating overheads and renewal levies.*

Tamar River (Kanamaluka) in Tasmania.

NPV was insufficient to justify the scheme being built. Available water was then identified, a scheme concept developed, engineering estimates made, and the economic modelling carried out. Adjustments could then be made as necessary to make a scheme viable or, in some cases, the scheme discontinued.

The key success factors included the following: an organisation whose very survival depended on successfully building irrigation schemes, experienced personnel being available to be project managers, holding the project managers alone responsible for the delivery of a project, the successful building of trust with civil contractors, a government determined to see the schemes built, an experienced and skilful board which was not risk averse, experienced private sector engineers in the senior positions, progressing 11 schemes concurrently, and sufficient funds to be able to wait out delays in approvals.

Construction of the first three irrigation schemes was completed within three years of the commencement of the TIDB. These were the Whitemore, Sassafras Wesley Vale and Head Quarters Road (Great Forester) Schemes. The ten schemes of tranche one were completed, without overspend, by 2015 and of the five schemes of tranche two, by 2016 two were in construction and two further business cases had been completed. Momentum was strong. The five schemes of tranche two were completed in 2020.

The author, along with two other project managers, each having built three TI schemes, now work on irrigation projects across Australia as consultants GI Project Partners Pty Ltd.

A high view angle of the spillway.

Largest dam build in New Zealand in over 20 years making progress

Despite the occasional interruption due to weather and Covid restrictions, the construction of the Waimea Community Dam is making progress and is on track to be completed by mid-2022.

Waimea Water is a council-controlled organisation that is responsible for managing the construction, operation, and maintenance of the dam in the Lee Valley, about 36km southeast of Nelson. The Waimea Community Dam is a significant local infrastructure project to augment the supply of water and add to the sustainability of the region. Once the dam is in place, the reservoir will fill up naturally for several months. The lake created by the dam will contain approximately 13 million cubic metres of water.

Waimea Water Ltd is fully funded by its shareholders, Tasman District Council (TDC) and Waimea Irrigators Ltd (WIL), with a project budget of between $148 million and $164 million.

Slipway and fill bucket progress from above.

Aerial view of the site. Concrete face and embankment progress in foreground, spillway in distance.

Embankment.

Reinforced rockfill wall, and spillway to the right.

The project is now just over 60 percent completed. The reinforced rockfill section of the embankment was finished in June, and as of early October the main embankment (i.e., the dam itself) was 42 metres above river level. Its final height will be 53 metres.

Construction of the concrete face, spillway, and the flip bucket at the bottom of the spillway are also well underway. In July, 1,500m^2 of mass concrete was poured for the flip bucket, including the largest concrete pour on the dam to date. Starting at 3am, 480m^2 was poured over 14 hours, using 18 concrete trucks and more than 80 loads.

Progress has also been made on the plinth and the grout curtain, which is the primary foundation waterproofing for the dam.

In parallel, procurement of various mechanical and electrical components is almost complete. The most significant of these is a 160-metre-long stainless-steel outlet pipe and associated valving, which will be installed in the first half of 2022.

The project faces ongoing challenges due to unexpected geology, with treatment to foundation rock needed in some places, and better-quality rock and sand having to be imported. These elements are adding to the project's cost, as is the dramatic global escalation of mechanical, electrical, and other material costs.

The current projected completion date of the dam is mid-2022, with the reservoir filling over the spring in time for the 2022/2023 season.

Technical matters

By Stephen McNally, Principal Technical Advisor, IrrigationNZ.

While spring conditions bring us fresh growth, lambs, calves, and blossoms, the hard yards are still being done behind the scenes by our food and fibre producers.

Travelling through the countryside over the last few weeks I have had the privilege of meeting farmers, growers, and service industry members in several districts. Many are grappling with similar issues relating to producing food under the challenges of fickle weather and operational hurdles. IrrigationNZ is working actively on behalf of the irrigation sector as they navigate these complexities. We look for opportunities to advance technological developments, upskill people, and help you to understand the regulatory situations that influence irrigation management decisions.

In this column I will update you on some activities I reported in the winter edition, and provide information on new initiatives we are addressing.

DAM SAFETY REGULATIONS IN NEW ZEALAND

We are working closely with the Ministry of Business, Innovation and Employment (MBIE) to further develop guidance and information which will help farmers and their advisors in understanding the height, volume, and risk category for their dams. At the invitation of MBIE, we have assembled a small group of irrigation infrastructure specialists to join a wider MBIE dam safety technical working group. This group has been asked to assist in the refinement of an exposure draft of a dam safety guidance and discussion document. We are very pleased with the level of engagement and pragmatism of the officials we are working with. The joint aims between MBIE and IrrigationNZ are to ensure the right water storage structures are captured where risks are obvious, and to avoid unnecessary complexity for small low-risk dams, which are common in the farming sector.

THE WATER SERVICES REGULATOR – TAUMATA AROWAI

Significantly, for farming operations that provide water for human consumption outside of their own direct use, the Department of Internal Affairs has issued a further draft *Acceptable Treatment Solution for Small Rural Supplies*. IrrigationNZ is part of a working group examining these working drafts and the practicality of requirements under this legislation. It needs to be remembered that the Drinking Water Services Act is yet to pass its final reading, which is set down for early 2022. After the Act passes there will still be two years before the regulations take effect, and a further five years before compliance by small suppliers is required. That is seven years we have available to continue to refine practical solutions for farming enterprises.

THE RESOURCE MANAGEMENT (MEASURING AND REPORTING OF WATER TAKES) REGULATIONS

In late 2020 the regulations were amended to introduce a staged timeline requiring holders of consent to take and electronically submit their records to their council. Despite the complication of Covid restrictions, IrrigationNZ was still able to run an online engagement with the Ministry for the Environment, regional councils, and accredited Blue Tick companies to review refreshed guidance material that reflects the amended regulations. The

engagement sessions were positive, active, and effective. They were capably facilitated by Vicky Bloomer, whose depth of working knowledge in water measurement systems will be known to many of you.

FISH SCREENS ON IRRIGATION WATER INTAKES

A stage milestone has been completed in the research being undertaken on fish screen performance, with the Year 2 lab trial report now available on the IrrigationNZ website. The fish screen project is assisting in informing regulators and the industry as new innovative structures are being developed. The IrrigationNZ project is addressing the practical implications of design criteria on large infrastructure capital costs.

FERTIGATION

Fertigation, or the addition of soluble nutrients to irrigation water, is showing promising results in meeting the restrictions on synthetic nitrogen (N) use via the 190kg N cap. IrrigationNZ and its industry partners are finalising the analysis of two years of field trial results. A guidance document that will support an online information and training module is well under way, and due to be uploaded in late 2021.

THE WATER AVAILABILITY AND SECURITY ADVISORY GROUP (WASAG)

IrrigationNZ is one of the industry bodies providing valuable information to the Ministry for Primary Industries officials in the WASAG initiative. A full report has been presented by government officials to key Ministers, who are now considering its implications. Water storage can be demonstrated to have a major positive impact on freshwater management's ability to underwrite reliable food and fibre production. It is also important to provide focus on demand management and efficient water use, to help ensure storage is both optimised and pragmatic within the regulatory context.

IRRIGATION TECHNICIAN/ENGINEER – NEW CAREER PATHWAYS

Irrigation technician/engineer are new career pathways. Competency framework is being developed by IrrigationNZ and the industry. Working with an industry training specialist we have largely remapped the competencies needed for this training program. Given the restructuring of the New Zealand Industry Training Organisations, we have undertaken a full scan of nationally and internationally available training, with a view to meeting these competency standards.

The training we are designing will be a mix of smaller block courses with online learning, and on-the-job training. It will cover the fundamentals of the practical aspects of the job, so that an employee can use tools of the trade safely and knowledgeably. New modules will be developed around industry-related areas such as Te Mana o Te Wai, which lays out the social responsibility we have as an industry to look after our freshwater, environment, and communities.

TECHNICAL ADVISORY GROUP

IrrigationNZ held the initial meeting of a new Technical Advisory Group in September. Arising from this forum a set of actions have been identified; to expand and diversify the membership of this forum, document some key objectives for 2022, and provide a communication pathway for significant issues facing the industry..

IrrigationNZ submission updates

In the past few months, IrrigationNZ has been busy addressing a schedule of submissions on relevant public or ministerial consultations. Our submissions reflect our specific expert knowledge built on wide industry and policy experience. We are deeply involved with a program of wide collaboration with government agencies, regional councils, and freshwater end users. Our knowledge and relationships enable us to present soundly based commentary and recommendations on how the regulations can be refined to allow practical implementation. We are focused on how our members can meet requirements for water resource efficiency and environmental management matters within their food and fibre production operations.

Some of the key consultation and advocacy work performed by IrrigationNZ includes:

SUBMISSION ON THE 2022 AGRICULTURAL PRODUCTION CENSUS CONTENT

Stats NZ and the Ministry for Primary Industries (MPI) led this consultation calling for considering any changes to existing topics to improve the survey's relevance and data quality. We offered recommendations on the inclusion of a better question definition for drawing out data that would be valuable to many parts of the irrigation sector, either as water users, equipment suppliers, and/or environmental regulators. A particular area of focus was suggesting the splitting of the recent wide adoption of solid set/fixed grid systems from other types such as flood and gun irrigators.

SUBMISSION ON THE REGULATORY REFORM OF ENERGY EFFICIENT PRODUCTS AND SERVICES

The Ministry of Business, Innovation and Employment (MBIE) currently manages a system that looks at energy efficiency labels you might more commonly see on household whiteware appliances. In this legislation change, there are future options to include high energy used for pumping systems in agriculture.

In our submission, we advocated for the adoption of existing best practice in irrigation system design and operation that already includes consideration of issues related to irrigation pumping efficiency. We expressed our support for a strong safety culture in the agri-sector and suggested highlighting safety labelling considerations with systems involving electrical energy in water pumping systems. Importantly, we mentioned our reluctance to see additional compliance inspections potentially imposed on the irrigation industry.

SUBMISSION ON PROPOSED COST-RECOVERY FEES AND CHARGES UNDER THE WATER SERVICES BILL REGULATIONS

This submission was part of the overall process the Department of Internal Affairs (DIA) is addressing on small rural drinking water suppliers. Whilst we agreed with the intent of the Taumata Arowai initiatives to ensure rural communities have access to safe drinking water and prevent unnecessary risks to human health, we had some reservations about the process sequence. We did not agree with the setting of any fees for small drinking water suppliers until the frameworks for activities and processes are agreed upon. Instead, we emphasised that any fee should reflect the scale of risk of activity, and without knowing what the activity is, setting fees is premature.

SUBMISSION TO MINISTRY FOR THE ENVIRONMENT ON THE DRAFT FRESHWATER FARM PLAN REGULATIONS DISCUSSION DOCUMENT

In this submission, IrrigationNZ supported the intention of the proposed Freshwater Farm Plan (FW-FP) regulations but presented some general statements of principle.

There was an emphasis on making the regulations workable in terms of getting buy-in (i.e., people accepting and using FW-FPs as a tool) rather than seeing the regulations as another compliance tick-box exercise.

Concern was expressed that highly prescriptive regulation may restrict changes that will need to happen in the future arising from innovation and externalities.

Further, five key points were highlighted as follows:

1. Certainty for the farming community will come from nationally consistent regulations but with flexibility in some regions to adopt and adapt well-established locally-focused farm planning processes.
2. Timing must reflect different regions and farming communities are at different stages of dealing with farm environmental plans. IrrigationNZ agrees that transition to a fully implemented FW-FP system needs to acknowledge existing processes and knowledge relating to those plans.
3. IrrigationNZ accepts the fundamental concept behind the FW-FPs as being the National Policy Statement for Freshwater Management – Te Mana o te Wai (TMoTW) principles.

These principles establish joint obligations of communities, tangata whenua, and regional councils of New Zealand to work together in a partnership. The TMoTW principles of environmental, social, and cultural concepts are stated in the encompassing languages of the Treaty partners, yet they are not the sole preserve of any one party. While the NPS-FM is quite directive towards the relationship between regional councils and tangata whenua as needing renewed effort, the NPS-FW does not require the only decision-making process to be between these two parties. The role of the community is highlighted throughout as being critical in establishing freshwater values and actions to address risks. The reference is clear in the NPS-FW Part 1, clause 1.3 (4) (d) Governance responsibilities and (e) Stewardship obligations – the onus is placed on 'all New Zealanders to manage freshwater'. The language and intent of the proposed FW-FP regulations need to be drafted to reflect the active role of the food and fibre sectors accordingly.

4. There needs to be a nationally integrated approach to capacity building, through training and accreditation of FW-FP certifiers and auditors to support the development of functional FW-FP regulations.
5. Finally, IrrigationNZ advocated that any regional plan drafting, and implementation timeframe should be in alignment with the nationally determined general regulations and guidelines to enable and ensure relative consistency of processes across the country.

ONGOING AND FUTURE SUBMISSION ACTIVITIES

- Currently, IrrigationNZ works on a submission under consultation process by the Ministry for the Environment (MfE) on Managing our Wetlands: a discussion document on proposed changes to the wetland regulations.
- IrrigationNZ is preparing to submit the NES-Drinking Water recommendations on issues relating to Surface Water Risk Management Area definitions and risk management practices that could affect land use upstream from a drinking water point-of-take.
- Further consultation processes are planned for early 2022 on Taumata Arowai small rural supplier acceptable solutions under the proposed Water Services Bill. Implementation of any action in this area is several years away.
- IrrigationNZ has been invited to be involved in an industry training consultation group to advise on irrigation programmes. This is arising as industry training organisations begin to merge in a process of programme unification. This consultation will add up to our work on creating a capability framework – adopting some of the training programmes delivered in the past but also extending our apprenticeship programmes into the industry. We have been working with training providers, including tertiary organisations to support this objective.

Water availability and security in Aotearoa New Zealand

IrrigationNZ has been working closely with the Ministry for Primary Industries (MPI) over the last few months in the development and review of this important report on Water Availability and Security (WAS) in Aotearoa New Zealand.

Cutting straight to the recommendations in the executive summary, the messaging within MPI is about the need to adopt a coordinated approach to strategic decision making on water availability and security. IrrigationNZ has long understood the key role of water storage in the management of freshwater resources. We support the key messages in the report that look to focus ongoing attention on water use efficiency and demand management as precursors to good water storage implementation decisions across a wide base of community users. We will also continue to present opportunities for integrated thinking on freshwater management, to help shape effective and pragmatic legislation and funding pathways.

The report sets out some key findings. Based on a technical assessment of water allocation, availability, security, and financial viability, the areas Northland, Waikato, Bay of Plenty, Gisborne, Hawke's Bay, Otago, Greater Wellington, Tasman, and Manawatū-Whanganui have been identified as having the greatest potential to grow the food and fibre sector by improving water availability and security. However, this growth needs to be carefully considered and placed within the context of Te Mana o te Wai (TMoTW) to incorporate wider community needs and expectations.

For this to occur the report recommends:

i. MPI establish a Water Availability and Security Partnership composed of central and local government, iwi/Māori, food and fibre sector organisations, science providers, and community interest groups;
ii. the Water Availability and Security Partnership develops an action plan and business case for the design and implementation of a national water availability and security strategic approach that will work within the framework of TMoTW;
iii. the action plan needs to be supportive of the food and fibre sector, supportive of future science and technology (e.g., improving or developing technology and new systems related to efficiency, recycling, etc. and incorporating mātauranga Māori), guide practice change, and coordinate investment in water infrastructure (distribution and/or storage);
iv. any further investment in water availability and security made by the government should use Te Mana o te Wai as the guiding framework, and focus on the use of multiple purpose/multiple benefits models.

IrrigationNZ will continue to participate in the WAS working group. Our inputs and experience have been valued, and contribute to a wider understanding of the issues facing the irrigated food and fibre sector within a community values context.

We will be working with MPI officials to schedule information sessions for our members, enabling us to drill down on the details of the report and help MPI frame the further work program.

Putting a price on emissions

By Susan Kilsby, ANZ Rural Economist.

The main tool currently being used in New Zealand to manage greenhouse gas (GHG) emissions is the Emissions Trading Scheme (ETS).

The ETS is a market-based policy tool designed to reduce GHG emissions by putting a price on pollution. Participants are required to buy units to offset their emissions, while practices that reduce GHGs, such as planting trees, are rewarded.

It is acknowledged that the ETS is a rather blunt tool and will require support from additional policy for New Zealand to reduce our GHG emissions to the levels agreed under the Paris Accord. The ETS has the potential to encourage land use change, away from livestock and towards trees, and this may come with its own set of challenges. Planting trees to offset emissions is needed to reach our 2050 emission reduction goals, but if we rely too heavily on offsetting rather than reducing emissions, we are effectively passing on our emissions problem to the next generation.

The emissions units used in the ETS are known as New Zealand Units (NZUs). NZUs are initially allocated to the market by the Government, either through its auction mechanism or free allocation. Units are then able to be traded in the secondary market.

HOW DOES THE ETS RELATE TO OUR CARBON EMISSION TARGETS?

The ETS is designed to reduce GHG emissions by placing a cost on pollution. This provides an incentive to reduce emissions, and rewards practices that offset emissions, such as planting trees.

The ETS is now a cap-and-trade system. Over time the quantity of units available will reduce, and assuming demand doesn't alter, the cost of units would then rise. As the cost of emissions rise there is an increased incentive to reduce emissions rather than incurring the cost of off-setting emissions.

The cap on emissions is expected to decrease in line with the emissions budgets adopted by the government, which tend to be based on advice provided by the Climate Change Commission.

We have several different emission reduction targets to meet and unfortunately, they are not all calculated on the same basis.

Net emissions are projected to decrease from 58.5 metric tons of carbon dioxide equivalent (MT CO2e) in 2020 to 23.8 MT CO2e in 2050, a 59 percent reduction on 2020 levels by 2050. Net emissions are all emissions less all removal of GHG from forestry and land-use change.

Plantation forest with trees at various stages of maturity in Jollies Pass, Hanmer Springs, Canterbury. *(Photo: Adobe Stock)*

Meanwhile, our target accounting emissions are projected to decrease from 62.7 MT CO2e in 2020 to 39.4 MT CO2e in 2050, a 37 percent reduction on 2020 levels by 2050. When calculating target accounting emissions only some of the forestry offsets are allowed to be used. Offsets from forests planted before 1990 don't count, which is why this figure is higher than our net emissions. Changes to forestry accounting rules (with the move to averaging) also impacts this calculation. This change results in 2021 target accounting emissions being lifted to 68.9 MT CO2e in 2021 before then decreasing to 61.3 MT CO2e in 2030. If this method of accounting is then extended to 2050 that would see emissions reduce to 39.4 MT CO2e in 2050.

REGULATIONS CONSTANTLY EVOLVING

Regulation surrounding climate change initiatives, including our carbon markets, is constantly evolving and hence there is a high degree of uncertainty surrounding investments, not only in carbon markets but also more widely in how we use our land.

Later this year He Waka Eke Noa – the Primary Sector Climate Action Partnership – is expected to provide some clarity on how agricultural greenhouse gas emissions will be managed. While details are yet to be released, what is already clear is that farmers who can more efficiently produce milk and meat, relative to methane emissions, will be better off than others.

This will potentially change the economics of various farming systems. At the same time, we are seeing more differential in farmgate prices based on how farms are being operated, with increased rewards available to those who can meet specific targets which are mainly related to sustainability.

Further regulation is expected to mitigate risks of excessive planting of *pinus radiata*. The consensus amongst Kiwis is that more native plantings would be welcomed, but the faster growth rates of pines, and therefore greater sequestration potential (over the medium term) means they far outweigh natives on a financial return basis.

Recent changes to rules are one of the reasons why carbon prices lifted so quickly in late August.

RULE CHANGES PUSH UP THE PRICE OF CARBON

In August the government announced it would lift both the floor and ceiling price at its quarterly auctions. For 2021 the lower price limit is set at $20, and the upper limit set at $50. When the upper limit is broached (as occurred at the 1 September auction) this triggers the release of units held in the cost containment reserve (CCR) which, in theory, should help to offset the demand and therefore curb upward pressure on the carbon price. There were 7 million units in the CCR, but these were all released at the 1 September auction and still the price lifted to $53.85 per NZU. As the cost containment reserve has now been fully utilised for 2021 at the final auction for 2021 there will only be $4.75m units available, and there will be no mechanism available to dampen prices.

Table 1. NZ ETS Carbon Auctions 2021

Auction date	Volume of NZUs available*	Floor price	CCR trigger price	Clearing price	Participants	Successful participants
17 Mar 21	4.75m	$20	$50	$36.00	40	30
23 Jun 21	4.75m	$20	$50	$41.70	37	16
1 Sep 21	4.75m + 7m	$20	$50	$53.85	43	31
1 Dec 21	4.75m	$20	$50			

New Zealand has one of the widest reaching ETS schemes in the world, or at least it will do, when agricultural emissions are included. Emissions from livestock are likely to be accounted for through an alternative system, but it is not clear yet whether the pricing will be linked to the ETS. New Zealand is expected to be the first country to account for its agricultural emissions and in time this should prove a point of difference for our products when marketed globally.

GETTING THE POLICY BALANCE RIGHT

As the carbon price increases so do the potential returns from forests through carbon sequestration. With carbon now trading at over $60 per ton of carbon dioxide (/T CO_2) there will be few sheep and beef farms that can match these returns, at least in the short-medium term. Further government policy is needed if we don't want to see New Zealand fully planted in *pinus radiata*. Pines are a wonderful, fast-growing species and a great source of timber. Where timber can be sustainably harvested and replanted, carbon returns can provide improved cash-flow and increase overall returns. There are plenty of other species that would be more suitable for permanent forests, but these slower growing species don't sequester carbon as quickly, and therefore provide a smaller financial incentive than *pinus radiata*. Additional government policy may help to rebalance the incentives.

TELLING THE STORY

At present we are highly reliant on offsets from the forestry sector to meet our emissions targets. This is not sustainable as we need to actually start reducing emissions. If we want to achieve high returns for our produce in the global markets, then we must be able to provide a story that runs from the farm all the way to the consumer, highlighting changes that we are making to be more sustainable.

A method for comparing dripper performance

A fundamental requirement of any dripper is that it delivers an accurate and consistent supply of water over the lifetime of the crop being irrigated. While factors can derail this process, from poor equipment to poor water quality, the fact remains that a good quality dripper will continue to deliver a predetermined flow rate, accurately and constantly, over its lifespan.

In this article, Netafim outlines a way of evaluating and comparing drippers.

COMPARING DRIPPERS

Both the structure of a dripper and features that are designed to keep drippers clean and working are important to dripper performance.

The main structural features of a dripper, such as filtration area and labyrinth depth, width and length, are common to all drippers and are measurable. Design features such as anti-root intrusion and anti-siphon devices are unique to specific drippers and are not measurable.

This article goes through a method of quantifying these common features and formulating a scoring system that allows dripper quality to be compared with that of other drippers. The advantage of this method is that it makes it possible to choose a dripper that best suits a particular application.

The method involves two aspects, as follows:

- dripper turbulence coefficient
- net filtration area.

TURBULENCE COEFFICIENT

A dripper's structural features are an inlet filter, an inlet orifice, a flow path whose shape is a labyrinth with teeth, an exit 'bath' and an orifice made through the wall of the drip line where the water droplet enters the root zone.

The turbulence coefficient includes all these structural features except for the inlet filter. In essence, the higher the turbulence coefficient, the lower the dripper's sensitivity to clogging and the more it can maintain its constant flow rate over its intended life. This is achieved by the vortexes that develop in the labyrinth that create a self-cleaning stream which purges contaminants out of the dripper.

Calculating turbulence coefficient

The turbulence coefficient is calculated using the formula below.

$$K = \frac{254 \times P \times (W \times D)^2}{P \times Q^2}$$

Where:

K = turbulence coefficient
P = pressure differential through the labyrinth in metres
W = width of labyrinth water passage in mm
D = depth of labyrinth water passage in mm
N = number of teeth in the labyrinth
Q = labyrinth flow rate in L/hr

Note: 254 is a constant.

Rules of thumb for the effect of a dripper's structural features on the turbulence coefficient are as follows:

- the greater the depth and width of the labyrinth, the better (see example Dripper A)
- the shorter the labyrinth, the better (see example Dripper B)
- the better the quality and design and manufacture of the dripper, the higher the likelihood of effective differential pressure (see example Dripper C).

Example: Dripper A. For Dripper A, at 10 m pressure, the flow rate is 1.0 L/hr through a labyrinth with 44 teeth and with dimensions of 0.60mm (W) x 0.59mm (D). Using the formula, Dripper A's turbulence coefficient is 7.2.

$$K = \frac{254 \times 10 \times (0.60 \times 0.59)^2}{44 \times 1.0^2}$$

If Dripper A's depth and width were increased by 0.01mm to 0.61mm (W) and 0.60mm (D) and all other measurements were the same, i.e., the same pressure differential through the same number of teeth still produces a flow rate of 1 L/hr, the turbulence of the dripper must be greater. Thus, the turbulence coefficient would increase to 7.7.

$$K = \frac{254 \times 10 \times (0.61 \times 0.60)^2}{44 \times 1.0^2}$$

Example: Dripper B. Dripper B has the same flow rate as Dripper A at the same pressure – 1.0 L/hr at 10m. Because it has 82 teeth instead of 44, the flow path is longer, thus reducing the turbulence coefficient to 3.7.

$$K = \frac{254 \times 10 \times (0.60 \times 0.59)^2}{82 \times 1.0^2}$$

It is important to note that the higher the quality of design and manufacture of the labyrinth, especially the teeth, the higher the turbulence coefficient.

Example: Dripper C. The last feature to measure is the differential pressure through the labyrinth. If all Dripper A's features remained the same but the pressure differential to achieve 1.0 L/hr increased to 12m, then the turbulence coefficient would increase from 7.2 to 8.7.

$$K = \frac{254 \times 12 \times (0.60 \times 0.59)^2}{44 \times 1.0^2}$$

It may not, of course, be desirable to increase the required pressure, in which case to return to the original 10m pressure with the current labyrinth design, the manufacturer would change the labyrinth dimensions by reducing its length, i.e., reducing the number of teeth. This is because fewer teeth result in a higher turbulence coefficient.

Keeping all other measurements the same and only increasing the pressure differential as with Dripper C can only be achieved by dripper design and manufacture. It is a fact that the higher the quality and precision of manufacture, the shorter the flow path will be. Conversely, the lower the quality and precision of manufacture, the longer the flow path will be necessary to achieve the same pressure differential.

A shorter flow path means that there is less of a path to become clogged. More important, however, is that a shorter flow path indicates stronger turbulence and therefore better resistance to clogging.

EFFECTIVE FILTRATION AREA

At the entrance to a dripper's labyrinth is a filter whose total area is usually larger than the labyrinth's width x depth dimensions. It is a common belief that the true filtering area is the total area of the inlets. However, the size of the dripper filter is not necessarily an indication of the real filtering area. The effective filtration area is the area that the water passes through on its way to the dripper labyrinth. It is this value that is used to calculate effective filtration area (EFA), in mm^2.

Dripper quality score. The dripper quality score (DQ) is a comparative figure that is used to compare two drippers for the same application. The score combines EFA in square millimetres with the turbulence coefficient (see below).

Dripper quality score (DQ) = EFA + K

At this point, the exercise becomes subjective. This is because the EFA and K cannot be logically combined by simply adding the two values together as above, as the turbulence coefficient is a dimensionless value but the EFA is a value in mm^2.

As well, EFA and turbulence coefficient do not necessarily contribute equally to dripper quality.

To overcome this, the score introduces weighting (see equation below).

$$DG = (W1 \times EFA) + (W2 \times K)$$

W1 Filtration area weight factor
W2 Turbulence coefficient weight factor

The value of these two weighting factors is assigned by the user doing the comparison. The EFA is usually a value between 10 and 100mm^2 and the turbulence coefficient, a value between 1 and 10. Numerically, EFA is generally ten times that of turbulence coefficient.

To bring them into line and treat them as contributing equally to dripper quality, it would be reasonable to choose their values as:

W1 = 1 Filtration area weight factor
W2 = 10 Turbulence coefficient weight factor

Example: Comparing Dripper A with Dripper C and new Dripper E. All three of these are 1.0 L/hr drippers but have different EFAs and turbulence coefficients.

Dripper	A	EFA = 24.0mm^2, K = 7.2
	C	EFA = 47.2mm^2, K = 3.9
	E	EFA = 36.3mm^2, K = 2.4

By applying the same weight to EFA and K for the three drippers, the following will be the result.

Dripper	A	DQ = (1 × 24) + (10 × 7.2) = 96.3
	C	DQ = (1 × 47.2) + (10 × 3.9) = 86.2
	E	DQ = (1 × 36.3) + (10 × 2.4) = 60.3

This means that if we decide that ETA and K contribute equally to dripper quality, then Dripper A scores the best.

If we decide that the EFA contributes much more to dripper quality than K, say double, then the weight for EFA would be 2 instead of 1.

W1 = 2 Filtration area weight factor
W2 = 10 Turbulence coefficient weight factor

The above result would then change, as follows:

Dripper	A	DQ = (2 × 24) + (10 × 7.2) = 120.3
	C	DQ = (2 × 47.2) + (10 × 3.9) = 133.3
	E	DQ = (2 × 36.3) + (10 × 2.4) = 96.6

In this case, Dripper C with a larger EFA but lower K than Dripper A scores best, because of its EFA, but Dripper E, which also has a larger EFA than Dripper A, does not score higher because its turbulence coefficient is not high enough.

If we decide that K contributes more to dripper quality than EFA and weight it accordingly, then we could double its original weighting from 10 to 20.

W1 = 1 Filtration area weight factor
W2 = 20 Turbulence coefficient weight factor

The calculations would be as follows:

Dripper	A	DQ = (1 × 24) + (20 × 7.2) = 168.7
	C	DQ = (1 × 47.2) + (20 × 3.9) = 125.2
	E	DQ = (1 × 36.3) + (20 × 2.4) = 84.3

Dripper A has a much higher K score, as expected, making the ranking the same as when the two weighting factors were more even.

CLASSES OF DRIPPERS

When comparing one dripper with others, it is also important that they all be from the same class. There are four classes, as follows:

Class 1: high-end pressure-compensating dripper. These are drippers that would typically be used for longer than ten years in orchards and the like, over varying terrain, slopes and long distances, as well as with water of questionable quality

Class 2: standard pressure-compensating dripper. Similar to Class 1, but the required lifetime may not be as long: ten years or less, e.g. subsurface drip on sugar cane. (Dripper F is a Class 2 dripper.)

Class 3: high-end non-pressure compensating dripper. Similar to Class 1 for lifetime (ten years or more), but without the ability to handle slopes, distances and questionable water quality.

Class 4: regular non-pressure compensating dripper. Similar to Class 3, but are only required to last a few growing seasons, i.e. less than ten years. (Drippers A, C and E are Class 4 drippers.)

In the previous example comparing drippers A, C, E and F, Dripper F is a high-end dripper. Its output is still 1.0 L/hr, but its labyrinth is so short that it has only 11 teeth and its turbulence coefficient is 9.3. It has a large EFA of 42mm^2.

If we weight the comparison calculation with approximately equal contributions to dripper quality, Dripper F wins hands down.

W1 = 1 Filtration area weight factor
W2 = 10 Turbulence coefficient weight factor

The calculations would be as follows:

Dripper	A	DQ = (1 × 24) + (20 × 7.2) = 168.7
	C	DQ = (1 × 47.2) + (20 × 3.9) = 125.2
	E	DQ = (1 × 36.3) + (20 × 2.4) = 84.3
	F	DQ = (1 × 42) + (10 × 9.3) = 134.8

Dripper F is a pressure-compensating dripper intended to irrigate a field crop over a five- to ten-year period, while the other three are non-pressure-compensating drippers that are intended to irrigate a field crop for no more than two or three seasons.

This is where the application and crop are important considerations. There would be no reason to consider Dripper F in comparison to the other three drippers if it were being used, for example, for a few seasons of vegetables. This is, unless Dripper F was less expensive, which is highly unlikely given that it is pressure-compensating.

COMPARING EQUALS

It is necessary to have a system of defined dripper classes and only compare scores within a given class.

Such a system of quantifying a dripper's quality and using that measurement for a specific situation, as defined by the class, allows you to compare apples with apples. Or rather, drippers with drippers.

Constructing a calculator would be the next logical step, where a user simply inputs the parameters as defined above for as many drippers as they choose to compare, and a score is immediately calculated.

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NZ Landcare Trust has launched a new collaborative catchment groups map. The map encompasses every catchment and Landcare group across Aotearoa that the Trust is aware of. This map has been a collective effort between Trust staff, catchment group leaders, and environmental community group leaders. This map is intended to visually represent all the extraordinary work being done across the country.

"We created this resource to inspire people to take action, connect, and get involved in a local Landcare group. This map is a living document that reflects changes within the catchments and Landcare community," said National Catchments Manager Bridget Jonker.

NZ Landcare Trust, established in 1996, is one of the leading independent organisations working across New Zealand to support sustainably run farms, and local stewardship of land and water resources and their connected communities. A dedicated team of catchment coordinators with ecological and farm system expertise works directly with rural land users. They currently provide extension support to over 100 catchment groups across the country.

To check out this brilliant resource, visit NZ Landcare Trust's website: www.landcare.org.nz/resources

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IRRIGATION NEW ZEALAND CHAMPION

Growing something different – a journey to starting an asparagus business

After a career involved in dairy farming, a Canterbury pair wanted to do something different. Access to water for irrigation allowed them to do just that.

The long-awaited first crop of asparagus is finally ready for Bronwyn and David Marsh, who have recently established My Farm Fresh, selling their home-grown vegetables. Growing asparagus is a change for the pair who have spent most of their lives involved with pastoral farming. The idea came about after they had purchased land on the outskirts of Ashburton.

"Growing food is important to us, but after many years of dairy farming and me being a stock agent we decided we'd do something different that didn't involve animals, and looked into what we could grow out of the ground instead," Dave said.

After tossing up a few ideas the pair decided on growing asparagus, and with that there was a mad rush to get everything organised and planted, Bronwyn said.

By early November 2019 they had three hectares planted and last year they did another four. It has been a waiting game for them but now they can finally begin to pick the first three hectares they planted. They are only picking for a month, to retain energy in the young growing asparagus. Next season it will be able to be picked for ten weeks. They have planted three varieties of crown.

"It's hard work waiting to get something from it," Bronwyn said, "but it's certainly satisfying seeing it grow."

Turning their hands at something different meant they asked for lots of advice, Dave said, and one of the pieces of advice they were given was to use drip irrigation and fertigation.

They installed irrigation with planting in 2019. "We wanted to be water savvy, and we wanted a system that could fit in with how we wanted to run our overall system."

Across the seven hectares, there are 42 lineal kilometres of dripline, equivalent to the length of 3,500 rugby fields.

Dave said, "We chose drip because we could get the water exactly where we want it and we didn't have to worry about shifting irrigators." He said an unintended benefit of that was they weren't having as many weed problems as they thought they would. Because the asparagus plants were getting the water, the soil elsewhere was dry so didn't grow many weeds.

Asparagus are planted similarly to potatoes in beds. They can be planted as crowns, which are one year old roots or seeds. From crowns they take two years to mature. Once an asparagus plant is mature the seasonal vegetable can provide harvests for over 15 years. The asparagus season in New Zealand is July to December in warm areas and September to December in cooler areas.

Their water was sourced from Ashburton Lyndhurst (ALIL) irrigation scheme, and they said without it and without reliable water for irrigation they wouldn't have done it.

"It's a big investment and we wanted to make sure we could grow a good crop whatever the weather."

The amount of water required by the asparagus was, of course, weather and soil moisture dependent, which they measured, Dave said. However in the drier months an individual mature asparagus fern could need up to 50ml of water a week.

Their irrigation season was late November to March, give or take, and they also put on nitrate-based fertiliser and sulphate-based fertiliser through the fertigation system.

"You don't want to overwater. There's a lot of individual plant management required, a bit different to growing grass like we're used to," Bronwyn said.

Being a new business, building their brand had also been important. The name My Farm Fresh didn't come easy and they had tossed up a few for a while. "We chose this because it's all about eating food fresh from the farm." Dave said, "Asparagus is best eaten fresh."

"It's been a big learning curve, setting up a website. We have been lucky to have great people to help and advise us."

They said it was great to have lots of people excited about what they were doing. They planned to sell locally at markets and their roadside stall, and already had a few restaurants interested.

Alongside building their brand they also had to build their packing house and develop packaging.

Bronwyn said when they were busy, they would have six extra people helping to pick in the morning and pack in the afternoon.

Being a reasonably small industry, everyone had different set ups and following advice they had set up what they thought would be best for them, Bronwyn said. They were also trialling different packaging methods with the goal being zero waste.

The pair said that from now until early November they would be busy picking and packing, and they hoped the frosts stayed away.

"Once the plants are out of the ground, they can't really handle temperatures below zero, so that's a challenge for us," Bronwyn said. Like for many other businesses Covid had been a challenge for them, especially the most recent lockdown.

"We needed to get permits to sell and whatnot, and during lockdown we still needed to make sure we got these in time otherwise we wouldn't have been able to sell, and the asparagus was still coming out of the ground."

Being their first harvest, they said they had a lot to learn and agreed it would be a matter of trial and error. We're looking forward to seeing what they achieve and enjoying plenty of asparagus to eat along the way.

"We love to eat it which hopefully means everyone else will too."

Bronwyn picks asparagus, which is physically demanding and requires extra sets of hands during busy times.

David and Bronwyn Marsh.

Fertigation for the future

The recent introduction of fertigation to Summit dairy farm in Oxford, Canterbury has been an exciting project for owner Cam Henderson, who said the investment was all about providing resilience for the future to his pastoral farming operation.

Summit dairy farm is a 238-hectare property, 215 of which is under irrigation and home to 730 cows. Mr Henderson converted the farm to dairy in 2011. He has a background working in automation, so the idea of simplifying and being able to remotely control fertilising and irrigation appealed to him. This, coupled with seeing progress from a neighbouring farm, encouraged him to install his own fertigation system. They had installed fertigation, enabling them to reduce their nitrogen use, which had a flow on effects on spending.

"We spent a lot on fertiliser spreading every year and were finding it financially unviable to spread less than 50 kilograms (kg) per hectare of urea* by truck. We are on very light soil so we thought a 'little and often' approach would be more suitable for us than large periodic applications."

After investigation into the systems available, in January this year Mr Henderson installed a fertigation system on two of the three pivots on his farm. The third pivot has recently been decked out with a fertigation system.

All urea arrives on the farm as a liquid, and is stored in a bulk tank that is bunded and can drain to the effluent pond in case of leaks. This tank is connected directly to one pivot while the other two pivots each have their own 5,000L bunded tanks. These smaller tanks are filled fortnightly using a 5,000L tank on wheels.

"Each pivot has a variable-speed pump and backflow preventers installed. The pivots and pumps have remote control functionality fitted, along with proof of placement recording. We looked at saving on cost by having one movable tank and pump, but wanted to be able to have more than one pivot fertigating at once. It also means less skill is required to operate the system. We can get very dry up here so wanted a fertigation system that would not interrupt our irrigation patterns. This meant fertigating on multiple pivots at once. The irrigation and fertigation are controlled through the same app, with the hope that we have proof of placement for irrigation water soon. We don't have a cleaning program as the fertigation rates are so low we regularly check pipes, fittings, and tanks for leaks."

Mr Henderson said at this stage they were just applying liquid urea through the fertigation system, at a maximum of 4.5kg of nitrogen per hectare per week which equated to 120kg of nitrogen per year. Alongside a first round of solid nitrogen fertiliser, total annual N application is budgeted to be 150kgN/ha, where previously 220kg was applied per year. He said fertigation will be a great tool in helping the farm comply with the new 190kg N/ha limit.

Due to pastoral fertigation not being common in New Zealand, Mr Henderson said there weren't a lot of protocols or guidelines, however, they chose to be forward thinking to make sure they were as resilient as possible.

"Backflow prevention was the only council regulation we had to comply with, to ensure that no fertiliser can get back into the groundwater. Bunding on the tanks is likely to become a future regulation, as if there is a spill or leak liquid urea can make its way into the soil and aquifers much faster than solid urea. We were also unsure about underground piping of liquid urea so avoided this design option too."

Although they hadn't done a full season with fertigation, Mr Henderson said they were already seeing some savings.

"We hope to save 70kg N/ha a year to what we were previously doing, as well as eliminating the cost of spreading, which works out at approximately $45,000 a year over 215 hectares with current urea prices. If we have a hot period, we stop fertigating, if we have a big rain event we stop, and when conditions look better we can apply fertiliser to the whole farm in a day rather than follow the cows. Doing this we saved approximately 30 percent of our autumn fertiliser costs this year with no apparent loss in pasture growth."

Mr Henderson said all up the cost of

Cam Henderson stands next to one of the pivots fitted with a fertigation system.

> "My background is in automation, so I love this kind of technology ... in my mind I wanted to press a button on an app once a week and have the fertigation system look after the fert spreading on its own and we are on our way to achieving that."

installing the fertigation system was $90,000 for all three pivots. "It will pay itself back in three years just with savings on fert spreading alone."

Mr Henderson said making sure the set up was right was important. The system was calibrated multiple times and they have created written guidelines on fertigation for each pivot while the remote-control system and app are still under development. "We are providing a lot of feedback about how the app could be improved. We keep a manual record of placement for backup."

Mr Henderson said he had really enjoyed developing the system and managing it.

"My background is in automation, so I love this kind of technology … in my mind I wanted to press a button on an app once a week and have the fertigation system look after the fert. spreading on its own, and we are on our way to achieving that."

"For us we needed to think of every scenario that could go wrong, such as if the pivot stopped and the fertigation didn't – developing the technology as we go, you've just got to be patient and think of things before they become a problem."

Mr Henderson was looking forward to reflecting on what impacts the system had after a full year, continuing to fine tune it, and make it easier.

"Now that we are under more environmental pressure than ever before, I see it as a real tool to reduce our nutrient use."

Cam checks on the system.

Fertigation: The application of liquid fertilisers through an irrigation system.

***Urea:** Urea fertiliser is a processed form of ammonia. Urea contains a percentage of nitrogen, making it an ideal nitrogen source.

Andrew Paterson next to the tank where the fertigation solution is mixed.

Fertigation here to stay

Farming on extensive Otago land and getting the best out of it for animals is important to Omakau sheep and beef farmer, Andrew Paterson. The introduction of fertigation has been a valuable asset for this purpose.

Andrew and Tracy Paterson own and operate Matakanui Station, which is home to 25,000 stock units. There are 19,000 sheep, made up of 10,000 breeding ewes, the rest being hoggets and wethers. 1,100 cattle reside at Matakanui, 500 of which are breeding cows, and the rest are heifers, steers, and calves.

The hot, dry summers and cold winters meant irrigation was especially important to them, and they have been developing it since they took over the running of the property in 2004.

"We have to grow enough decent quality feed to support them (the sheep and cattle) through the winter, and we couldn't do that as well as we do without irrigation."

Originally 150 hectares (ha) was under border dyke and flood irrigation. Although it served its purpose, Mr Paterson said to become more efficient they decided to shift to spray irrigation. Spray guns were introduced in 2008 and the first centre pivot was installed in 2015.

They now had 200ha under pivots, 240ha under spray and only 45ha remaining as border dyke.

When planning their pivot development, Mr Paterson talked with his cousin who had fertigation, and thought it would be a good option for them.

"My cousin had his system designed by Fertigation Systems. I contacted them and they came down and designed and installed the system. We then put it in and had a few teething problems at the start but have never looked back."

They now had two pivots with one injection system running the fertigation through them. A 30,000 litre tank was used to hold the fertiliser solution. Ten tonnes of urea was delivered, by blower truck, and added to 20,000 litres of water.* The solution is mixed in the tank. A high volume pump sucks from the bottom of the tank and then feeds back in halfway up the tank through three nozzles, to create a stirring action.

Mr Paterson said the mixture took two days to soften the urea before it was ready to mix, and then it is mixed for two 24-hour cycles. They could also put ten tonnes of ammonia sulphate through it. After that a Dosatron type pump (an electric dosing pump that injects the fertiliser into the mainline) injected the concentrated solution into the irrigation water as it flows through the centre tower on the pivot.

Their irrigation water came from their own private water rights, and two community irrigation schemes, and was gravity-fed, meaning there was plenty of pressure.

Mr Paterson said the mixing system had caused them to go through a few pumps while trying to find the correct pump size, as they needed a pump that could handle the flow and the fertiliser solution.

Under the pivot they grew a perennial ryegrass and clover mix. The expansive nature of their land meant the paddocks were all subdivided into three to four hectare blocks which "made for a real nightmare for the spreader truck driver," he said.

**It is important to understand the properties of dry urea when added to water. The reaction is endothermic. This is a negative heat reaction. When urea is added to water the liquid becomes cold; you can feel the side of the tank get cold. Once the liquid becomes very cold the dissolving could stop. To drive the dissolving to completion it is necessary to have vigorous agitation, more liquid to dissolve into or heat.*

"Getting ten tonne of urea under the pivot made for a lot of driving and opening gates, whereas the fertigation system has allowed us to put a little bit on whenever we want, without having to accommodate a truck driving around. We can flick it on and off with a button. Every time we irrigate, we do not fertigate. We just do it as we need it. Early spring with urea, then ammonia sulphate late spring, and back to urea in the autumn."

"We normally put 10kg urea/ha or 31L of mixed solution (4.6 units of nitrogen) per pass. For the first pass of the irrigation season, we usually double the rate. The ammonia sulphate is also at 10kg/ha or 28L of mixed solution (2 units of nitrogen and 2.2 units of sulphur) each pass. Total urea of 200kg/ha and up to 150kg/ha of ammonia sulphate per year."

To install the system cost around $20,000, and ongoing costs included electricity and minor maintenance. The system had now been in place for six years, and he said they had not seen any extra wear and tear due to the fertiliser.

"It's backflushed at the end of every season so there's no residual left behind, and because we aren't fertigating every time we irrigate there isn't fertiliser in the pivot all the time."

Mr Paterson said they used less nitrogen with the fertigation, and it had saved them both cost and time, even though other parts of the farm still received fertiliser via truck.

"I operate it, other staff members operate it and are happy to push the button, and away it goes. It's all recorded and up on the wall in the shed where the fertigation system is, so everyone knows what's happening."

Making good feed for healthy animals was made a lot easier at Matakanui Station due to fertigation.

"It guarantees us growth. You can see the grass growing behind the pivot. It's always there and has allowed us to fatten out steers at 18 months, mate all our heifers, and winter our ewes and hoggets. There is always good feed, which makes healthy animals."

It made proof of placement easy too, Mr Paterson said, as the pivot went to the exact same place every time.

"Although the pivot crosses over top of some troughs, we are fertigating at such a low rate of application, so it doesn't worry us."

He said the system had made a huge difference. "It guarantees us growth. You can see the grass growing behind the pivot. It's always there and has allowed us to fatten out steers at 18 months, mate all our heifers, and winter our ewes and hoggets. There is always good feed, which makes healthy animals."

Prior to farming Mr Paterson came from an accounting and science background, so he was not apprehensive about the idea of developing irrigation or adopting a new fertilising system.

"Going forward we will look to develop the system, improve the pumps, and continue to get the best out of our land for our animals, and look after the environment."

Fertigation meant fertilising was as easy as flicking a switch.

Reframing New Zealand's farming sustainability story

By Julia Jones, Head of Analytics at New Zealand's Exchange (NZX).

Regenerative, restorative, a journey of continual improvement; regardless of what you want to call it, its all about finding the intersection of profitability and wellness of community, people, animals and planet. This will secure which to create the sector's future relevance.

New Zealand is an export-led economy. Our food and fibre sector is one of the largest contributors to export revenue, with approximately $47 billion NZD expected to be earned in 2021. For all exports our top ten export destinations are China, United States, Australia, EU, Japan, South Korea, Taiwan, UK, Indonesia, and Hong Kong (in order of size of revenue earned).[1] The global food system is worth roughly $8 trillion USD annually.[2] New Zealand exports over 90% of what it produces but this is still less than 2% of the global food system. We need the world to buy our food more than they need to buy it. To maintain market relevance we need to work strategically in order to stay connected with the fast-changing preferences of our markets, from consumers through to investors.

> "New Zealand exports over 90 percent of what it produces but this is still less than 2 percent of the global food system."

Are consumers asking for regenerative agricultural products?

When thinking about consumer preferences it's important to remember there are billions of consumers around the world. They live in hugely diverse environments and seek different attributes in the products they consume. Averaging out globally or lumping consumer preference together is fraught with inaccuracy; the most effective way to seek signals for change of consumer preference is to look at individual markets independently and to scan for themes. One theme globally which seems to cross borders is the desire for individual wellness and immunity strength. This is particularly important in China.

Other themes, which are prevalent across the UK, USA, and the EU are the desire for a healthier planet, healthier humans, good working conditions, climate change resilience, and food equality. All desire delicious, high-quality food. It must be recognised that these principles apply to the privileged who have choice.

Most consumers are not yet explicitly asking for regenerative products. The regenerative focus started with growers driving the conversation, and big food businesses such as Danone and General Mills adopting a holistic production philosophy that would help them meet several consumer expectations. Taking into account the themes mentioned above, the holistic context of regenerative agriculture deeply connects with a variety of different consumer desires, therefore the mainstream consumer market.

Success rarely comes from the fringes

The context of regenerative agriculture for New Zealand farming is yet to be defined. Success is not likely to come from the fringes or extremes., Success will more likely come from shared desired outcomes, where individual farmers have the freedom to apply methods that suit their personal and business goals, and their biological environment. These factors will be vastly diverse across New Zealand. It's great to have different perspectives, and important to keep discussion constructive. Assigning 'good' or 'bad' labels to how we farm, or attempting to discredit regenerative or non-regenerative farmers is not productive. Respect the differences and look toward mutually beneficial outcomes.

Adaptation and improvement have always been integral parts of farming. Due to global climate change we don't have the luxury

Sources. 1. SOPI June 2021; 2. worldbank.org

of time. The need for adaptation has been accelerated. Regenerative perspectives can be an effective tool in the battle against climate change, as well as being part of New Zealand's sustainability story.

Sell the process as much as the product

New Zealand has always been geographically distant from most of the world's population, and the global Covid pandemic has further isolated us from our global consumer. It is more important than ever that we recognise that some things we may consider obvious, ordinary, or typical within New Zealand may be considered new or extraordinary within the markets we sell to. Defining the attributes of our production processes is as important, if not more so, than the products that we produce. We need to connect to the global market and take the time to really understand what consumers are asking for. Using resources such as the Beef and Lamb report, we can look at opportunities and ensure that we match our production attributes with the consumer wants.

Success for regenerative agriculture is a choice. We can spend time splitting hairs over what we call it, or we can use that time and energy to continue to investigate opportunities and look at how we can position ourselves to benefit the sector.

Is regenerative agriculture a silver bullet?

There is no silver bullet or simple solution regarding building climate resilience or guaranteed continued global market relevance.

Regenerative agriculture can be a valuable part of the solution to climate resilience and it can give us a competitive advantage in specific markets, such as the UK, USA and the EU. New Zealand earns 37% percent of its red meat export revenue from these three markets combined, and a total of 17% for all exported products. For comparison, the revenue from red meat exports to China is 38%, with a similar total exports value. So, although these three combined markets are not as big as China for all exports, they still hold huge economic relevance to our export revenue, especially for products such as red meat.

We need to do our best to decrease risk to our export revenues and build diversity across markets. Learning from our past is important. In markets that valued grass-fed, New Zealand was slow to the party; we didn't have it written on our labels because we just assumed people knew. We didn't start to capture the value of this until there were over 75 brands already in the grass-fed market space.

Regenerative agriculture intersecting with needs across the supply chain

Most of New Zealand's processors engage in ESG (environment, social, governance) reporting. This reporting is often sought by investors. Although many of our processors are cooperatives, the food/fibres they process sit inside the supply chains of global companies where investors are requiring full ESG transparency. Processors will need to report on their environmental, social and governance practices, including how the food/fibres they process are grown. Offshore customers may require attributes of production that align with regenerative agriculture in order to meet investor requirements.

There are more questions to be asked and answered. We need to better understand how to measure outcomes, and we need more science-backed validation. We need to keep progressing, looking for opportunities, and making sure that we keep an open mind to the future. Our future generations, communities, economy and planet deserve it.

Growing fruit with the help of irrigation

Being able to produce a healthy fruit is crucial to a Hawke's Bay orchardists, who says you can do all the tests you want but the taste test is the most important.

Roger Brownlie and his wife Anna are the owners of The Orchard, in Bay View, just north of Napier. They grow over 18 hectares of fruit, which is mainly stone fruit including apricots, peaches, plums, and cherries, as well as apples.

The pair own and run the orchard along with a right-hand man, and many seasonal workers during the picking and packing season.

Horticulture has always been the grassroots for Mr Brownlie, having been brought up on the family orchard. After school, he went on to study a Diploma of Horticulture at Massey. He then came home and worked on the family orchard which at the time grew kiwifruit and grapes. Mr Brownlie said the ground wasn't really any good for growing kiwifruit and "next door grew summer fruit so we thought we would give it a go". That was in the late '80s, and they have been growing summer fruit ever since. They bought into part of the original family orchard in the early '90s and have added other smaller blocks over the years.

Mr Brownlie said over time their growing seasons had changed slightly. This is due to moving to a two-dimensional (2D) system over the last ten years, where the fruit grew more like grapes, doubling the production off the same land area. "Now we have more inputs at different times of the year we manage to have mostly down time in the winter. Now where we used to be pruning all winter, now we prune the apples in winter and the other fruits we summer prune, thin in the spring, pick and pack before Christmas and then we pick apples and plums in March–April, late autumn".

"We believe it's easier to manage this way."

The orchard has always been home to irrigation. It has been developed over time and has seen them learn from a range of methods. Although always using

Anna and Roger Brownlie at The Orchard in Bayview.

Apples with hail net and micro sprinklers.

The difference between 2D and vase shaped trees.

"Irrigation is becoming more and more important to use, as the rain is not consistent."

bore water, the original bores were close to the sea. "This meant we got a lot of salt in the water which caused us a few problems." They shifted the bores closer to the hills to avoid the problems.

They used to use overhead irrigation until in the '90s they moved to automated under-tree sprinklers. In the 2000s they developed micro-irrigation in the apples, but struggled with it due to having to unblock it often. In 2013 they installed their first lot of drip irrigation and have been developing it since, while the orchard has shifted to the 2D system.

"Irrigation is becoming more and more important to use, as the rain is not consistent," Mr Brownlie said. They also installed soil moisture monitors in 2018 which had been an eye-opener.

"You think you know what the soil is doing but you actually don't. Having the moisture monitors means we know exactly what to put on and confidence that we are doing it right … water is becoming more and more important. We need to look after this precious resource … everybody does."

He said irrigation became crucial closer to harvest, particularly for the stone fruit which had a high-water uptake at that time.

They first installed fertigation on their one hectare cherry block which was planted in 2017. Last Christmas they harvested one tonne from it and this year were hoping for five to ten.

"It's not an instant thing, horticulture. It's a long time after you get plants in the ground before they become productive."

He said they were looking at expanding their fertigation system in the future.

Mr Brownlie said they had encountered many challenges over the years, and one that springs to mind was the hailstorms in 1994 and 1995.

"The hail caused so many issues for us two years in a row, I had to get work elsewhere and got a job at a local sawmill. Following that we installed hail cloth on some of the orchard and although it was a big investment it was definitely worth it. You're always trying to work out different ways to be more sustainable and efficient in ourselves."

Another challenge they had experienced, like many other

"You think you know what the soil is doing but you actually don't. Having the moisture monitors means we know exactly what to put on and confidence that we are doing it right … water is becoming more and more important. We need to look after this precious resource … everybody does."

businesses, was Covid, which in 2019 forced them to close their roadside store which they had had for 15 years. The uncertainty of not having somewhere to sell their fruit was too risky.

"We sell all our fruit domestically, and Covid presented uncertainty, so we had to look at other markets."

An ongoing challenge was disease risk for the fruit – the major one being brown rot which is a fungal disease that gets into the plant while flowering. "We have to spray for it and cover before bad weather. It's something we are always keeping an eye on."

Away from the orchard Mr Brownlie has been involved with SummerfruitNZ since 2009. He has been deputy chair for the past five years, and became chair earlier this year.

"I like the opportunity you get to learn from other growers and get insight you wouldn't otherwise have the opportunity to."

After many years of growing, Mr Brownlie said he still loved the fruit and was lucky he could pick and eat the best pieces.

"Even after all these years I still love it and I'm a bit superstitious in that I always give away the first box of fruit each harvest."

2D cherries with drip irrigation.

A career driven by the importance of freshwater management

Thomas Tebb has over 36 years of environmental and engineering experience in both the private and public sectors. Currently, Thomas is the Director for the Office of Columbia River (OCR) within the Department of Ecology, Washington, USA, and maintains an office in Ecology's Central Regional Office located in Union Gap.

Thomas has over 29 years of experience with the Department of Ecology and has served as Central Regional Director and manager in four different programs during his tenure with the agency. Those programs include Nuclear Waste, Shorelands and Environmental Assistance, Water Quality and Water Resources.

He received his Bachelor of Science degree in Environmental Geology from Western Washington University. Thomas is a licensed geologist, hydrogeologist, and engineering geologist in the State of Washington.

We caught up with Thomas to hear his story.

What is your role and how did you become interested in water management? Was it something as a child? Was it when you were studying?

SSince 2015 I have served as the Director of the Office of Columbia River for the Washington State Department of Ecology. I am nearing my 30-year anniversary with Ecology, which is in January of 2022. When I started working for Ecology at the Hanford Nuclear Site in 1992, I really only thought I would be with the state for a couple of years. During my career with ecology, I have had a variety of senior technical, managerial, and executive positions covering a span of environmental interests mostly centred on water. I am also a licensed geologist, hydro-geologist, and engineering geologist with the State of Washington. I am currently serving my second term on the State's licensing Geology Board.

Water was always important and a fascination with me from an early age. I grew up on my uncle's fruit ranch in Zillah, Washington, and learned at an early age how important water is to agriculture and our way of life in eastern Washington State. Our family farm received water from the Bureau of Reclamation's Yakima Irrigation Project, which brought water to the desert. Our farm received both senior and junior water supply so we always were worried about whether we would have enough water for the irrigation season. As junior water users (water rights with a priority date after May 10, 1905), we often received less than a full supply.

There was not really a place for me on the family farm, and I was ready for change when in 1980 I went off to college to Western Washington University in Bellingham, Washington. I decided to study geology because I like working outdoors and with natural systems. The landscape in eastern Washington, with mostly sage-brush, allowed for the curious mind to reflect and wonder at what formed the landscape in which we live. In 1984, I graduated from Western with a Bachelor of Science degree in environmental geology. At the time it was a bit new. I was the only graduate to earn that specific degree out of the entire geology class that year.

The remainder of my career at Ecology centred on water, whether that was in shoreline protection and riparian habitat, water quality, or water resources. Prior to my job at OCR, I served as the Regional Director for the Central Region Office, which meant that many of the issues and problems that could not be resolved at the section manager (mid-management) level were transferred up to my office for resolution.

What has been the journey to the role you have today? What has your work involved, and what are some of the challenges/ successes you have experienced along the way?

After graduation I looked for work in the Pacific Northwest, but could not find anything where I could use my education, so I looked south to California. I moved to the San Francisco Bay Area and found a job there as an entry-level geologist, working for a small geotechnical and environmental firm. I worked there for seven years, slowly working my way up the seniority level, and ultimately achieved senior project geologist. The jobs were diverse in nature and covered everything from environmental remediation to geotechnical and geological investigations of dam sites, slope

stability, and soil and rock mechanics.

My high school sweetheart and I were married at Lake Tahoe in 1985, and we started a family in 1988 with the arrival of my first daughter. We eventually had another daughter in 1990, and it was then that we realised that we wanted to return to the rural environment in which we were raised.

I was successful when I applied for a job with the Department of Ecology's Nuclear Waste Program, which had just been established for the purposes of environmental clean-up at the Hanford Nuclear site in south-east Washington state. As a boy, our family would often travel along the margins of the secret nuclear site, but no one ever talked about what was going on out there. I was naturally curious and I wanted to help improve the environment in my own backyard, so to speak, which was damaged due to the production of plutonium 'buttons' used in nuclear weapons. After about seven years of working on the complex issues at the Hanford site, I was ready for a career change. That change took me to Spokane and Yakima where I worked with local government in all eastern and central Washington Counties, working to improve or create shoreline protection plans. That job evolved into an opportunity to manage a team of Water Quality specialists, which in turn took me to managing the Water Resources Team, and ultimately the entire Ecology office in the Central Region. In 2015, I was asked to lead the Office of Columbia River, and have found immense joy and satisfaction in making a difference to developing water supply for people, farms, and fish.

What has been your biggest achievement?

I think my biggest achievement is getting federal legislation passed in 2019 to support the federal acknowledgement of the Yakima Basin Integrated Plan. I made many trips to Washington, DC with our Yakima team of irrigation district managers, members of the Yakama Nation, and environmental groups, all lobbying in support of this important legislation.

How is irrigation different from New Zealand? What are the processes predominantly for? What is the water mostly used for?

The water in eastern Washington is mostly used for growing over 300 types of food crops, including a lot of fruit, particularly grapes, and the farms and irrigation districts are very large in size. While, in my experience in the Canterbury region of the South Island of New Zealand, irrigation seemed to mostly support pastures for dairies. There are, of course, many similarities too. The wine growing region of the northern portion of New Zealand's South Island looked and seemed very similar to many areas in eastern Washington that grow wine grapes. I must admit that I fell in love with New Zealand and its people, and hope to return soon.

What are you working on now?

I have many large-scale water supply development projects that I am working on, and I would encourage your readers to look at the 2020 CRB Water Supply Inventory Report for more specific information. *https://apps.ecology.wa.gov/publications/documents/2012001.pdf*

Where do you see the future of irrigation and freshwater management for yourself/your area?

The future of irrigation and freshwater management is critical for our human societies and nations; to feed our people, protect our natural environment, and plan for future water supply needs. I see more emphasis on and need for water professionals to work with agricultural interests, municipalities, and environmental concerns and organisations, in order to balance the competing needs that a changing climate is likely to create.

Awards finalists highlight breadth of farming sectors that rely on irrigation

The three finalists of the 2021 Zimmatic™ Trailblazer Sustainable Irrigation Awards highlight the breadth of farming sectors that rely on irrigation. These outstanding farmers share a willingness to embrace the challenges of irrigation, and the commitment to finding solutions for the benefit of their farm business and their communities.

Award nominations were double last year's, with the following farmers being selected to go through to the on-farm judging finals, which will be held in November.

IrrigationNZ chair and Irricon Resource Solutions principal, Keri Johnston, was the head judge for the awards. She said the three finalists stood out for their willingness to embrace the challenges that irrigation is often associated with.

"They demonstrated their commitment to working through the issues, seeking out opportunities to do things better, and highlighting the positive synergies of working with our natural resources for the benefit of all. They really are leading by example. Our sincere congratulations to them all."

The awards aim to celebrate excellence in sustainable irrigation and encourage farmers to share ideas for achieving sustainable freshwater management.

The competition is run by agricultural irrigation systems leader, Zimmatic, with support from New Zealand Awards partners Farmers Weekly, Irricon and Vantage NZ and IrrigationNZ.

Together, Zimmatic and its awards partners are offering a total prize package for 2021 of more than $22,000.

FINALIST

Simon & Lou White – Hawke's Bay

Hawke's Bay farmers Simon and Lou White farm Ludlow Farms, which is an 835 hectare mixed arable cropping, sheep, and beef finishing operation in Otane, near Waipawa.

For the Whites, sustainable irrigation management is about future-proofing their business for another generational transition by investing time, energy, and capital into making sure they have the most efficient irrigation systems – environmentally, economically and socially. They have invested in technology and advanced machinery to irrigate in the most sustainable way, and use technology as a tool for making the best decisions.

Mr White has shared his story at several conferences and for educational purposes has opened his farm to other farmers, schools, councils, and iwi. The Whites themselves are committed to learning and continuous improvement.

Photo: Kate Taylor

FINALIST

Angus & Elise Aitken – Canterbury

Canterbury farmers Angus and Elise Aitken farm a 550 hectare mixed cropping property in Waiau, where they grow a variety of produce, from sweet corn to red clover for lamb finishing. For the pair, sustainable irrigation management is about the efficient use of a water resource in balance with the needs of plants or crops, and the surrounding environment and soil.

Technology plays a huge part in understanding and measuring the constantly changing conditions and variability they have on the land. The application of technology with the required training allows everyone involved in the farm to be a part of managing the water resource.

FINALIST

Richard & Annabelle Subtil – North Otago

North Otago farmers Richard and Annabelle Subtil farm fine wool sheep and run a beef breeding and fattening operation on Omarama Station – a 12,000 hectare High Country property in the Mackenzie Country.

For the Subtils, sustainable irrigation management is about implementing a development that increases productivity and profit, without having detrimental downstream effects on local water quality. Environmental stewardship and community involvement have always been a priority.

They are involved in a variety of water-related projects both on the station and in the community: including working with local iwi on native eel protection on the Omarama Stream; partnering with the local school to plant natives; working with Department of Conservation and Environment Canterbury to protect native fish in a freshwater spring downstream from the farm; and establishing a catchment group that has held information events to promote excellence in irrigation and preserve the wider social licence of irrigators in the community.

For more information about the 2021 Zimmatic™ Trailblazer Sustainable Irrigation Awards visit

www.irrigationtrailblazer.com

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What should you think about when it comes to house prices?

By Cameron Bagrie, Managing Director at Bagrie Economics.

Are house prices sustainable? Does it really matter? Could we need to start looking elsewhere for wealth creation?

The Reserve Bank of New Zealand (RBNZ) is on record as saying house prices are unsustainable.

Here are a few aspects to think about.

Housing has a huge impact on the economy, both economically and socially.

The value of the housing stock in New Zealand is around $1.5 trillion, which is four times the size of the economy and almost eight times the market capitalisation of the New Zealand stock exchange. Movement in the value of houses, which are a major part of a household's wealth, is a major driver of spending.

Residential construction is a sizable and very cyclical part of the economy. It is typically hot at the top and suffers badly in downturns as booms turn to busts. Property is estimated to be responsible for 20 percent of gross domestic product.

The Ipsos® Issues Monitor shows high concerns about housing, including affordability, with 53 percent of respondents citing it as an important issue facing New Zealand, twice more than any other issue. Housing has consistently been the top-rated issue for the past four years. Housing affordability is a key variable shaping employee's decisions on where to reside and work. Severely unaffordable house prices also risk seeing people depart overseas when borders reopen.

The sky-rocketing house prices have worsened wealth inequality. I suspect insecure housing tenure is one of many factors behind declining school attendance. Poor school achievement is a poor deposit on the economy in 30 years. We have chronic housing shortages in many regions, with the social housing waiting list sometimes more than one percent of a region's population.

> "New Zealand is becoming more and more divided. Housing is one facet and contributor. A highly unequal and divided society is not an economically healthy society, that risk driving polarising policy initiatives, and rising inflation will accentuate this further."

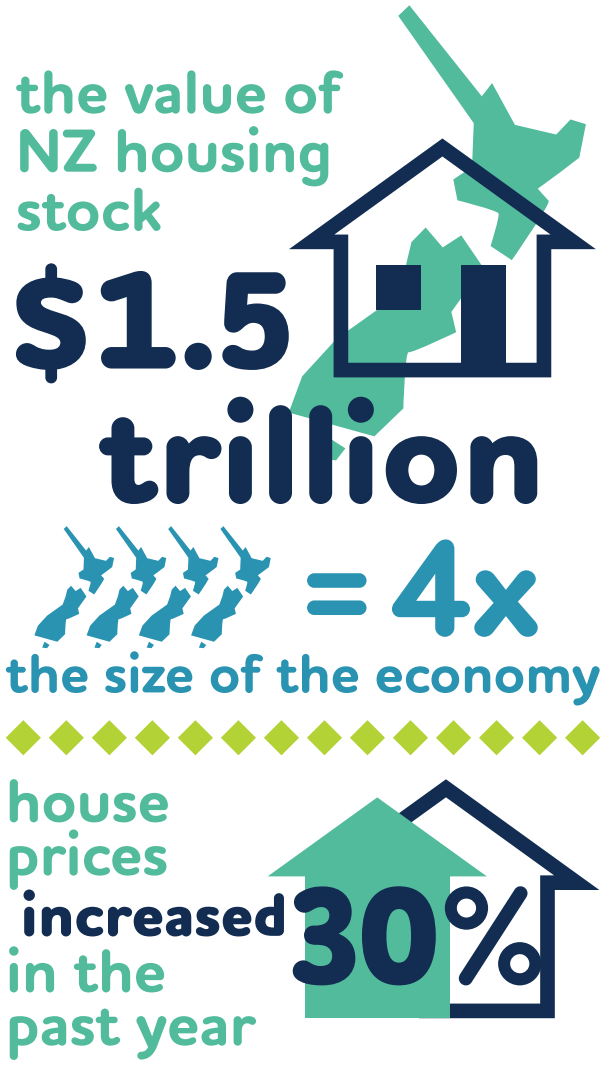
New Zealand is becoming more and more divided. Housing is one facet and contributor. A highly unequal and divided society is not an economically healthy society. Inequality risks driving polarising policy initiatives, and rising inflation will accentuate this further.

Are house prices sustainable?

It depends which indicator you look at.

House prices increased nearly 30 percent in the past year. The median house price is now almost 11 times the median income and 8.5 times the household income. Dermographia considers that a house price-to-household income ratio of 5.1 or more is "severely unaffordable".

A 20 percent deposit on the median house price is about 220 percent of median annual disposable income, up from 132 percent in 2004. Home lending has risen at a double-digit rate in the past year, considerably faster than



incomes. The share of new lending at a debt-to-income (DTI) ratio above five, or riskier lending, has been rising. First home buyers typically take on a lot of debt to enter the market. That can work if interest rates are low.

Other indicators, including yields and debt serviceability measures such as the ratio of interest payments to income, are more mixed on the sustainability of house prices. The cost of servicing a mortgage compared to renting remains relatively low.

A strong labour market and low unemployment rate is boosting incomes.

The interest rate used by banks in assessing debt serviceability test levels for new borrowers has declined but remains above six percent, which is well above mortgage rates on offer, implying a considerable buffer to prospective rises in interest rates.

Will higher interest rates hurt?

Households have benefited from lower interest rates. Household interest payments have fallen to 5.9 percent of income though this is masked by many people having little or no debt.

A 200-basis point rise in interest rates from their lows sees household debt servicing as a share of income rise from 5.9 percent to just over 8 percent. A 300-percentage point rise in interest rates implies a debt servicing ratio of more than 10 percent and into the hurt zone. The average since 1999 is 9.4% percent.

Some highly leveraged households are likely to be vulnerable. Estimates from the Reserve Bank's August 2021 Monetary Policy Statement highlighted the potential impact on new home buyers, assuming five-year borrowing rates returned to levels consistent with a neutral official cash rate (OCR) near 2 percent. Estimated debt servicing cost for new buyers as a share of income would rise above 50 percent.

What does the future path for house prices look like?

People have different views, but it is probably easier to look at it through a common-sense lens. House prices have increased at an average annual rate of more than 7 percent for the past 30 years, far exceeding income growth, so the ratio of house price to income now sits at 11.

A continuation of the house price trend of the last 30 years would see the ratio of house price to median income exceed 14 by 2030. Returning the ratio of house price to income to below 10, which it was pre-Covid, can be achieved by house prices rising at 3-4 percent, which is roughly half the historical experience.

The number 10 is still high, but gives some idea how contained house price growth needs to be to restore a basic metric affordability into the reasonableness zone. Odds of a correction in house prices are non-trivial.

Is enough being done?

Housing fundamentals in terms of supply relative to demand, look better, or should I say not so bad. Estimates of the housing shortage sit at around 70,000 units. Demand is being constrained by borders being shut, while at the same time the granting of building consents continues to rise rapidly.

The government has announced numerous initiatives to boost supply and manage demand including removing the ability of investors to tax deduct interest payments. The playing field is skewed towards new builds and supporting first home buyers. Higher interest rates will curb demand.

This combination is reducing housing shortages, rapidly. Freeing up land is critical to addressing housing affordability. Despite the rhetoric, section sales remain 8 percent of total property sales, while land availability remains tight and is expected to remain so.

The bigger picture

Economically or socially, historical house price performance looks unlikely. Rather, there could be some real pressure over the coming years as a combination of tax changes, higher interest rates and shifting supply-demand fundamentals come into play. Housing is unlikely to be the golden goose creator of wealth. The rubber band is stretched on too many levels.

We are not going to raise living standards in New Zealand by selling more expensive houses to each other, anyway. Home lending has risen from nearly 50 percent bank total lending in 1998 to 62 percent now. It has risen 4.5 percentage points in the past four years.

New Zealand in general is "long" with housing as an asset class and investment, and "short" (under-weight) the real productive stuff.

The challenges going forward are not just to make housing a less attractive investment and deliver affordable houses, but also to unlock the attractiveness of alternative investments and investment in the real productive part of the economy. This is a profound shift for a nation fixated with houses.

Water is one of New Zealand's unique strategic advantages and will play a big role in unlocking opportunities associated with that shift.

** The Ipsos New Zealand Issues Monitor tracks what New Zealanders are concerned about, who is worried about what, and which political parties are seen to be best able to improve these matters.*

Seasonal climate outlook November 2021 to January 2022

OUTLOOK SUMMARY

A progression toward La Niña conditions occurred in the equatorial Pacific during October and NIWA has moved to La Niña Alert. Temperatures are very likely to be above average across Aotearoa New Zealand with a period of particularly warm conditions from around the second week of November.

New Zealand's coastal sea surface temperatures (SSTs) ranged from 0.5°C to 1.0°C above average during October. SSTs are predicted to become more unusually warm over the coming month or two which could culminate in marine heatwave conditions in some regions.

Higher than normal air pressure is favoured over the South Island and to the south and east of the country, causing more easterly quarter winds and increasing the chance for dry spells in the South Island and western North Island in particular.

For the tropical cyclone season (November 2021–April 2022), NIWA's SW Pacific Tropical Cyclone Outlook indicates the risk for New Zealand is elevated. Those with marine interests north of the country should closely monitor the situation. On average, one tropical cyclone passes near the country each year, bringing heavy rain, strong winds, and rough seas.

Rainfall is most likely to be below normal in the west of the South Island, near normal in the north and east of the North Island and about equally likely to be near normal or below normal in all other regions. Occasional sub-tropical low-pressure systems can bring heavy rainfall and possible flooding to New Zealand, particularly in the northern and eastern North Island.

Soil moisture levels are most likely to be near normal in the east and west of the North Island and about equally likely to be near normal or below normal in all other regions. River flows are most likely to be near normal in the east of the North Island and about equally likely to be near normal or below normal in all other regions.

REGIONAL PREDICTIONS FOR NOVEMBER 2021 TO JANUARY 2022

Northland, Auckland, Waikato, Bay of Plenty

- Temperatures are very likely to be above average (65 percent chance).
- Rainfall totals are most likely to be near normal (45 percent chance).
- The potential for sub-tropical low pressure systems is elevated, particularly in the northern part of the region such as Northland. These systems can bring heavy rainfall and cause flooding. The risk is lower for southern and western parts of the region, like Waikato.
- Soil moisture and river flows are about equally likely to be near normal (45 percent chance) or below normal (40-45 percent chance).

Central North Island, Taranaki, Whanganui, Manawatu, Wellington

- Temperatures are very likely to be above average (65 percent chance).
- Rainfall totals are about equally likely to be near normal (40 percent chance) or below normal (35 percent chance).
- Soil moisture levels are most likely to be near normal (50 percent chance) while river flows are equally likely to be near normal (45 percent chance) or below normal (45 percent chance).

A north west wind creates an arch shaped cloud bank over a Canterbury coastal landscape. *(Photo: Adobe Stock)*

Gisborne, Hawke's Bay, Wairarapa

- Temperatures are very likely to be above average (60 percent chance).
- Rainfall totals are most likely to be near normal (40 percent chance). Moist, humid easterly winds will increase the chance for periodic heavy rainfall across Gisborne and northern Hawke's Bay, although chances are lower in southern areas like the Wairarapa. This may result in a south-to-north rainfall gradient across the region.
- Soil moisture and river flows are most likely to be near normal (50 percent chance).

Tasman, Nelson, Marlborough, Buller

- Temperatures are very likely to be above average (65 percent chance).
- Rainfall totals are about equally likely to be below normal (40 percent chance) or near normal (35 percent chance).
- Soil moisture and river flows are about equally likely to be below normal (45 percent chance) or near normal (40–45 percent chance).

West Coast, Alps and foothills, inland Otago, Southland

- Temperatures are very likely to be above average (70 percent chance).
- Rainfall totals are about most likely to be below normal (50 percent chance).
- The development of La Niña-like patterns may contribute to drier conditions in the coming months around the hydro lake areas.
- Soil moisture and river flows are about equally likely to be near normal (50 percent chance) or below normal (45 percent chance).

Coastal Canterbury, east Otago

- Probabilities are assigned in three categories: above average, near average, and below average.
- Temperatures are very likely to be above average (65 percent chance).
- Rainfall totals are about equally likely to be below normal (40 percent chance) or near normal (35 percent chance).
- Soil moisture and river flows are about equally likely to be near normal (45 percent chance) or below normal (40-45 percent chance).

Probabilities are assigned in three categories: above average, near average, and below average.

In the absence of any forecast guidance there would be an equal likelihood (33 percent chance) of the outcome being in any one of the three categories. Forecast information from local and global guidance models is used to indicate the deviation from equal chance expected for the coming three-month period.

This is an extract of the Seasonal Climate Outlook published by NIWA.

Irrigated land use by regions

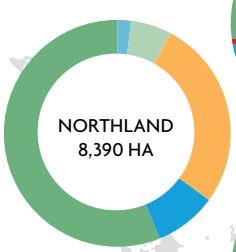
- Amenity
- Vegetable
- Grapes
- Fruit
- Sheep & Beef
- Arable
- Dairy
- Other

New Zealand irrigates 721,323 hectares:

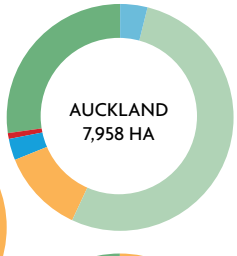
47.5% Dairy
23.4% Sheep & Beef
15.6% Arable
5.0% Vegetable
4.2% Grapes
3.8% Fruit
0.4% Amenity

Less than 0.1% Other

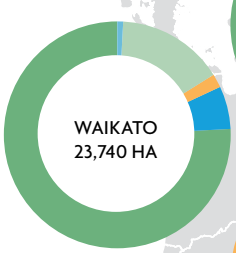
Northland's major irrigated areas:
57% Dairy
27% Fruit
9% Sheep & Beef



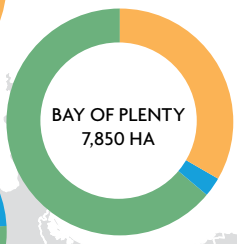
Auckland's major irrigated areas:
53% Vegetable
27% Dairy
12% Fruit



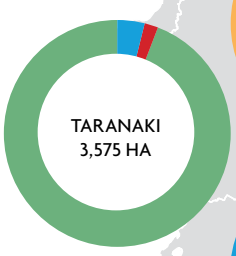
Waikato's major irrigated areas:
75% Dairy
15% Vegetable
6% Sheep & Beef



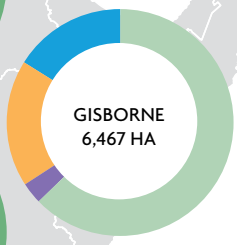
Bay of Plenty's major irrigated areas:
63% Dairy
33% Fruit
3% Sheep & Beef



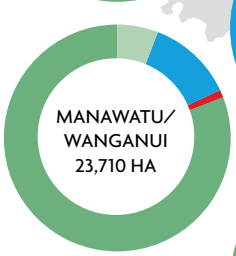
Taranaki's major irrigated areas:
94% Dairy
4% Sheep & Beef
2% Arable



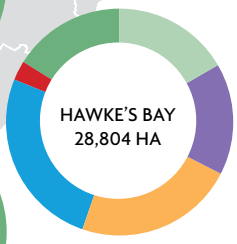
Gisborne's major irrigated areas:
63% Vegetable
18% Fruit
16% Sheep & Beef



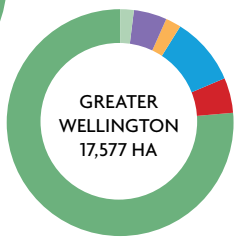
Manawatu-Wanganui's major irrigated areas:
80% Dairy
12% Sheep & Beef
6% Vegetable



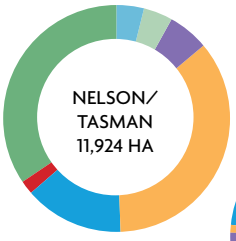
Hawke's Bay's major irrigated areas:
26% Sheep & Beef
23% Fruit
17% Vegetable



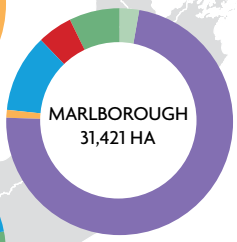
Greater Wellington's major irrigated areas:
77% Dairy
10% Sheep & Beef
5% Grapes



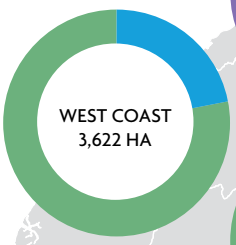
Nelson/Tasman's major irrigated areas:
35% Fruit
35% Dairy
14% Sheep & Beef



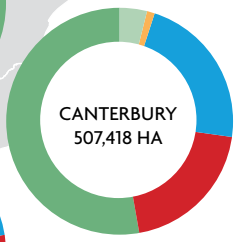
Malborough's major irrigated areas:
72% Grapes
11% Sheep & Beef
7% Dairy



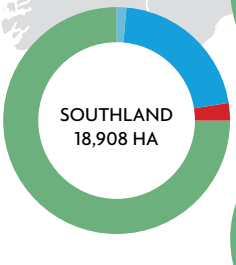
West Coast's major irrigated areas:
78% Dairy
22% Sheep & Beef



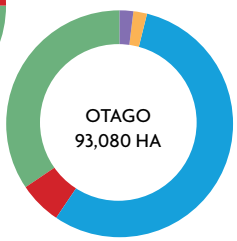
Canterbury's major irrigated areas:
52% Dairy
22% Sheep & Beef
20% Arable



Southland's major irrigated areas:
75% Dairy
21% Sheep & Beef
3% Arable



Otago's major irrigated areas:
55% Sheep & Beef
34% Dairy
6% Arable



Source: Statistics New Zealand, Ministry for Primary Industries 2018.

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