IrrigationNZ news

WINTER 2021

Citrus and irrigation

IRRIGATION NEW ZEALAND

WETLANDS AT WORK

THE ADAPTABILITY OF WATER STORAGE

NATIONAL STADIUM'S IRRIGATION SAVING WATER

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IrrigationNZ news

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Design: Rosie Fenton

Printing: Caxton Press

Distribution: New Zealand Post

Cover Photo: Bruce Richter

IrrigationNZ News is published by Irrigation New Zealand Inc four times a year. The circulation includes all IrrigationNZ members. The opinions expressed in IrrigationNZ News do not necessarily reflect the views of Irrigation New Zealand Inc. The information contained in this publication is general in nature with every effort being made to ensure its complete accuracy. No responsibility can be accepted for any errors or copyright breach that may occur beyond the control of the editor or IrrigationNZ. Permission must be sought from the Editor prior to reproduction of any material contained in this publication.

ISSN 2230-5181

IRRIGATION NEW ZEALAND
WATER | FOOD | FIBRE | LIFE

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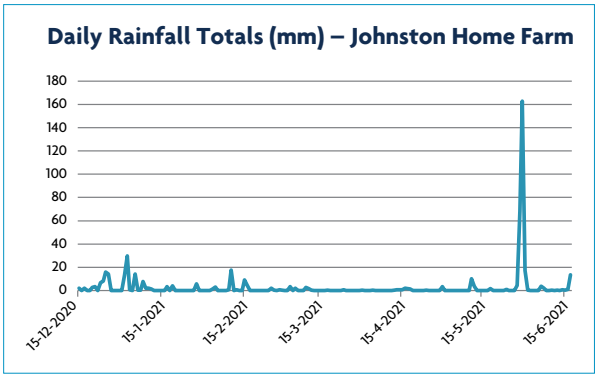
Drought to flood: how quickly our conditions can change

As I write this, the rain is slowly falling, the fire is roaring, and my trusty canine sidekick is curled up in the armchair. Normally, this would be a desirable scenario for a rainy, winters day, but this is rain on the back of the absolute deluge that we received here in Canterbury in late May, with even more in the forecast.



The irony of this situation is that we literally went from drought to flood overnight. The flooding came at a time where feed supplies were already low, and this has put immense pressure on many of us in what was already a tough winter.

Whether you are a climate change sceptic, or staunch believer, there is no denying that our weather patterns are changing. Water is the prime channel through which the impacts of climate change on the world's ecosystems and livelihoods will be felt. Climate change has the potential to affect every element in the water cycle (UN-Water, 2010). Food and fibre production will be affected by increased evaporative demand, changes in the amount of rainfall and rainfall patterns, and variations in river runoff and groundwater recharge, which are the two primary sources of water for irrigation. This will negatively affect food security, drinking water supplies, and increase the vulnerability of all of our communities.

While there is a large range of possible response options for adapting to climate change from policies, investments, institutions, water management, farming practices and capacity development, both within the water and primary sectors and beyond. This includes advancing technology in irrigation infrastructure, water storage, capture and flood management, development of climate change resilient crops, to national water and food security strategies. How we do this needs some serious thought, and the time for that is now. Electric cars is not the answer!

Kia kaha everyone.

Keri Johnston, Chair of IrrigationNZ

Flooding over farms and roads near Hawkins River, Canterbury, in May 2021. *(Photo: Adobe Stock)*

Ramping up as the end of the year looms

This year is proving to be as much of a seismic shift for democratic countries as 2020 was. Though now, as well as of health outcomes and protecting our people, the focus is also about the way we do business, how we organise government, and a significant change in policy settings.

As we recover from a pandemic, ongoing impacts are still being dealt with almost daily. Our government is getting bigger and more intervention is happening. Whether that is a good thing or not is probably not the question we need to be asking, as opposed to whether the intervention is having the desired impact; or more bluntly are the increased taxes and spending, having a more positive impact on the economy, environment, community, and our way of living than if we left it to the market. Spending more with little return in these areas would be the worst that could happen, so focusing on delivery now becomes increasingly important.

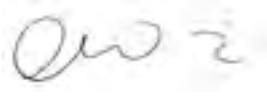
Even more liberal or right leaning governments across the world are intervening in areas of climate, health, and the environment at a greater rate than we have seen in the past, with more left leaning government policies. This spending stimulation to reset the world to be more sustainable and healthier as a planet is a noble goal, and one that most of us, especially those of us working on the land will agree with. The areas of disagreement when I meet with politicians, non-government organisations, (NGOs), industry, and farmers tend to be around the speed of the change, who needs to make the biggest changes, and how we go about it. The outcomes we mostly agree on.

So, when I meet with NGOs and discuss the waterways and how important they are to the ecology of the land and water, we agree improvement is needed and that people have had a negative impact – we agree that we all have a part to play in improvements for long term positive outcomes. It is when we start discussing how we can achieve those things, and whether it should be immediate or generational with the least impact on people that we start to disagree. Similarly, when I speak with politicians from the centre right versus the centre left – it is pretty close to the same conversations but, becomes about who controls the speed and what is needed – i.e., where legislation and regulation is required, and whether that should be a stick or a carrot.

> "New Zealand is on the cusp of some very big regulatory change, and water access, capture and storage are key to so many of the things we are trying to achieve as a country – from cheaper power, community drinking water, and improvements in productive use (and therefore economic prosperity)."

We have seen more extremes in weather this year and the past few years, drier, more storms, more natural impacts, and with winter here this is more noticeable as communities rally around natural disasters. The more we can mitigate against this change, the better off we will be too. This does require long-term strategic investment of the kind being announced, as well as a national plan on the investment priorities.

New Zealand is on the cusp of some very big regulatory change, and water access, capture and storage are key to so many of the things we are trying to achieve as a country – from cheaper power, community drinking water, and improvements in productive use (and therefore economic prosperity). It is too easy to throw stones and to hold up past investment as a predictor for the future – we have all moved forward and know more about impacts and outcomes. It is important that we sit at the table and have robust open conversations, and it is pleasing to see more doors opening as we ingrain ourselves more in Wellington and talk more broadly with people who are interested in outcomes and the long-term sustainability of our country. If increased intervention and centralised investment is the way forward as we are seeing now, then water needs to be centre to this. If we are going to improve the lives of our communities, we need to be working on solutions that use this precious resource and working together to decarbonise our country, and increase our productivity – they go together, rather than compete.



Vanessa Winning
Chief Executive, IrrigationNZ

Getting to know IrrigationNZ's new Principal Technical Advisor, Stephen McNally

In May 2021, Stephen McNally began his role as Principal Technical Advisor with IrrigationNZ. Mr McNally brings a wealth of knowledge to the organisation and will head the training programmes, provide technical support, and assist with advocacy work. Read below to find out more about his background.

My Great Great Grandfather, Robert McNally arrived with his wife Ann from Ireland into Auckland on HMS Ganges in 1865, within a few weeks of the HMS Bombay arriving with the Flay family, of my mother's side, who all settled near to each other in Franklin country, on the north facing slopes with their rich volcanic soils. Both families worked on the land in the market gardening and dairy industries with my Mum's brother still on the original Flay farm at Bombay, established 150 years ago.

I recall as a young boy sitting at my Grandfather McNally's feet learning how to split a potato between the eyes to get two seed plants from one tuber, a trick to stretch resources further for his market garden.

My father continued the traditions of involvement in food production through innovations in the poultry, then pork industries, eventually applying his engineering skills to the greenhouse industry. Helping set up irrigation systems for greenhouse crops as a schoolboy holiday job is where I caught the bug for precision growing systems. I headed off to Massey to get my Degree in Horticultural Science, focusing on agricultural engineering and crop production management.

I returned to South Auckland in 1987 working directly with growers to improve water and nutrient management decisions through adoption of the latest innovations of environment measurements and control technology, eventually setting up my own

production greenhouses. I gathered experiences of the business of growing and exporting crops into Hong Kong and Japan and gained an appreciation for how consumer tastes and trends heavily influence the production process through rapidly improving visibility back through the supply chain.

I moved with my wife to Marlborough in 2000 where I looked to apply my engineering skills to the viticulture industry, particularly irrigation and frost fighting systems working as a systems designer.

It was around the time of our family move to Wellington in 2003 that I heard of the Irrigation Association as it was then and took the opportunity to join the Board with a particular focus on contributing to the establishment of industry codes of practice on design and installing of irrigation systems.

We now live with our two teenage sons in the Hutt Valley which affords me close access to networks across many influential government agencies in Wellington.

My career path took me from on-farm system design to consultancy roles supporting irrigation water storage and distribution scheme developments. Through my time with Opus WSP a global infrastructure and environmental consultancy I was able to work within a team assisting good management practice and policy processes interacting directly with farmers, schemes, iwi and government agencies. Completing 14 years on the IrrigationNZ Board I was awarded Honorary membership in 2018.

Having now taken up an exciting opportunity in the newly established role of Principal Technical Advisor at IrrigationNZ, my function will be to support farmers, schemes, industry members and policy agencies. I see my role as bringing my knowledge of the plant/soil/water interrelationships to assist in the delivery of well thought out infrastructure solutions and appropriate freshwater policy. This will underwrite New Zealand's role in the global food supply chain. I value the relationships I have formed with people across the industries I have worked in and hope to bring a pragmatic approach to the many technical, policy, and education functions and working groups where IrrigationNZ has a critical role to play.

IrrigationNZ welcomes a new team member

Anna Matevosyan came on board as a policy advisor for IrrigationNZ in early August. Originally from Armenia, Anna has a Specialist Degree in English and Area Studies (University in Armenia), Master of Public Management (Germany), Cert. Rural Development (London), and most recently completed a Ph.D. in Development Studies from Auckland University. Anna has worked in New Zealand since 2019, for FCG ANZDEC a consultancy specialising in natural resource management, a period with Far North District Council as a strategic planner with responsibilities in policy formulation and stakeholder management, and most recently with Otago University as a Senior Analyst with project management responsibilities.

She is excited about this role as she is interested in how natural resource policy is formulated and implemented in the context of New Zealand and hopes her skills and expertise in natural resource governance issues may help improve this policy field and contribute to the irrigation sector. New Zealand freshwater management is important to Anna as she believes a sound policy base is a prerequisite for a healthy and sustainable future. Getting involved in such a critical policy field means planning for the future. With her experience in both research and project type work relating to natural resource governance, her key skills include understanding information management, planning, and stakeholder engagement; all skills that can help shape a productive policy environment.

IrrigationNZ: out & about

THE SEASON AHEAD

Warmer weather and longer days are on the way, and it's great to see some calves, lambs, and more young healthy animals around the countryside. Go to page 48 for the weather outlook for the coming months.

IRRIGATIONNZ TRAINING

The 2021 intake of students for the Level 5 NZQA Certificate in Irrigation Design started their first block course in late July in Christchurch. Our new Principal Technical Advisor, Stephen McNally, is facilitating the course – see the adjacent page to find out more about him.

SPECIAL WEBINAR FOR MEMBERS

Long term supporters of IrrigationNZ, Anderson Lloyd, hosted an event for irrigation scheme leaders as well as a webinar for our members, both to go over the Resource Management Act (RMA) Reforms. There were over 20 leaders at the event, representing about 70 percent of the irrigation in Canterbury and Otago, with another 20 people tuning into the webinar. The RMA reforms are a significant change in the way infrastructure and development can happen and we were lucky to have Sarah Eveleigh from Anderson Lloyd to give an overview. A recording of the webinar is available to members on our website. www.irrigationnz.co.nz/EventsAndTraining/Irrigators/Workshops

NATIONAL FIELDAYS 2021

IrrigationNZ Chief Executive Vanessa Winning (centre) at Fielddays KPMG Agri-business event in June, catching up with farmer and governance expert Mavis Mullens (front right), and Minister Stuart Nash (left).

VANESSA WINNING FEATURES IN USA'S IRRIGATION LEADER MAGAZINE

Great to see our Chief Executive Vanessa Winning on the cover of the June issue of Irrigation Leader magazine. Irrigation Leader is an American publication that highlights the people and issues associated with irrigation in the 17 western states and provides a forum for irrigators and engineers to share solutions and technology. You can access the New Zealand-focused issue online to read the feature. View: irrigationleadermagazine.com/volume-12-issue-6-june

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Clear thinking about the role of water storage

View from Here by Dennis Jamieson, Project Leader, Water Infrastructure for the Canterbury Water Management Strategy.

Water storage has an important role in time shifting water availability for out of river use but, international experience reminds us that it is not a simple silver bullet that enables past water use practices to continue.

Thinking about the future role of water storage needs to consider community expectations for adequate river flow regimes and that production systems do not have unacceptable downstream impacts. This future is about making effective and efficient use of more limited water supplies than have previously been available. This confirms the critical role of improvements on the demand side of water use rather than a focus on supply.

The good news is that irrigating farmers and growers are systematically trialling diverse approaches to improved use of water in producing food and fibre. One useful starting approach is that irrigation in New Zealand is about complementing rainfall rather than making the desert bloom, hence there is a focus on forecasting rainfall to minimise additional water needs as well as nitrate losses from drainage. Complementing this are initiatives that seek to improve the use of soil properties in water management. These are typically associated with farming systems and practices that seek to regenerate soil structures and properties which may also be significant future carbon sinks.

The reality is that international experience with large water infrastructure projects show they are unusual if they do not have large cost overruns. In addition, their reliability of supply can often be questionable given short, instrumented flow records and droughts occurring beyond previous expectations in the Southwest of the USA and elsewhere.

The lesson from this international experience is not doom and gloom. Rather it is a reminder of the high relative importance of supporting farmer, applied research and service industry efforts that are developing new approaches to maximise value (jobs/GDP, profitability) from the more limited water available to them in the future. This is essentially about (re)applying an "old" lesson as stated in Australia some time ago…

"It is not the quantity of water applied to a crop, it is the quantity of intelligence applied which determines the result – there is more due to intelligence than water in every case" – Alfred Deakin,1890

Almost all significant food and fibre industry messages emphasise the move underway from commodities to high value. An integral part of this are the farmers and growers getting on with the job of identifying and implementing improved growing systems that are financially sustainable and tackle the unintended consequences of historic practices. The overall approach reflects the personal values of leading farmers and growers plus the expectations of wider New Zealand society and future international consumers if a diversified, high value approach is to succeed.

Being able to produce high quality products reliably and with minimal impact involves supplying the right amount of water at the right time in the right place. This applies across New Zealand, whether for an urban garden tomato plant or a field scale orchard or farm. Across Canterbury leading farmers and growers increasingly have two reservoirs in mind to complement rainfall when considering their future.

The first is the "soil" reservoir where improvements to soil properties and better irrigation management minimise the need for (expensive and scarce) water to complement rainfall. An insight to the high level of activity and interest in soil improvement-based approaches is the white paper produced as part of Our Land and Water Challenge. Better irrigation management with a focus on minimising N loss and collaborative work with farmers on working farms has been the focus of a team from IrrigationNZ, AgResearch and NIWA described as part of the Irrigation Insight project.

The second reservoir in mind will typically be an off stream "pond" type storage that may service an individual property or number of properties. In either case the objective is to provide a reliable water supply that enables improved growing systems that are financially sustainable and avoid the unintended consequences of historic practices.

In Canterbury several private sector irrigation companies are working with shareholders to determine their next steps for some specific off-stream storage proposals. All concepts being considered are subject to stringent regulation (including dam safety, environmental effects of construction and operation). Farmer shareholders are facing uncertainty around future,

- access to water,
- support from markets for product change,
- desire for land use change – where future land use may be more "risky" that current if water supply reliability is low, and,
- need for realistic expectations of supply reliability to meet climate change effects – the particular risk of loss of storage supported water supply for high value crops/orchards.

These uncertainties combine to make progress using private sector investment alone extremely difficult – even though the full range of outcomes desired are addressed by the storage.

Let's learn from history. Economist Brian Easton celebrates the achievements of New Zealand farmers in responding to the collapse of prices for New Zealand wool exports of farmers in, "They went into beef and they went into forestry and they went into goats and they went into venison … they began to diversify from a market signal rather than from anything the government did."*

**Eyewitness: The Wool Shock of 1966, Radio New Zealand. www.rnz.co.nz/national/programmes/eyewitness/audio/2018688111/eyewitness-the-wool-shock-of-1966*

Why western water must be included in any US infrastructure plan

View from There with Christine Arbogast, President of the National Water Resources Association (USA).

The conversations that we're having here in the United States right now around water are about natural resources, and infrastructure—both brick-and-mortar infrastructure and natural infrastructure, like the forest—are a big focus for those of us who live in the West and those of us who try to influence public policy on western issues. Water in the western United States is scarce even in wet years, given the growing population that must be served. Water in the West is finite; it is not what one would call plentiful. In drought years, and there have been many drought years in a row with very little interruption, including this year, we can clearly see the looming need for additional infrastructure and for rehabilitations and upgrades in the areas where we have already developed water supply and delivery systems. In a multiyear drought, it is even more critical.

However, convincing the 435 members of the U.S. House of Representatives, the 100 members of the Senate, and a brand-new presidential administration of the need for infrastructure is an uphill climb, to put it bluntly. We in the National Water Resources Association (NWRA) and in the state water associations that make up its membership have our noses to the grindstone, trying to ensure that any infrastructure package that Congress passes in an effort to meet infrastructure needs across the board—needs for roads, bridges, broadband, and water infrastructure—does not leave western water behind.

Western water is different from water in other parts of the country. The fulcrum of western water is the Bureau of Reclamation, a federal agency that forms part of the U.S. Department of the Interior, and the projects that it has built over many years to provide water to agriculture, industry, and cities big and small across the West. Huge multi-purpose projects of the sort that Reclamation maintains in the West do not exist in the Midwest or on the East Coast. Caring for, maintaining, and making the best use of these multipurpose projects is our task. When an infrastructure proposal is on everyone's agenda in Washington, DC, we fight hard to make sure that western water infrastructure, with its different needs and enormous benefits, gets the attention it deserves.

Rafting on the Colorado River. *(Photo: Adobe Stock)*

> "Not only does the West's water infrastructure provide the indispensable resource for growing food for the country and beyond, it provides opportunities for outdoor recreation, which is an enormous economic driver in the American West."

The failure to invest in the West comes at a high price. The multi-year drought on the Colorado River has not only resulted in a shortage of water; it also threatens the clean power production that is achieved with those water resources. We need infrastructure tools to manage our deliveries, manage our conservation, and build up the ability to store water during wet years for use during dry years.

My message to decision makers in Washington, DC, is that the U.S. economy is made up of regional parts, and the American West contributes hugely to the economy in a distinct way. Not only does the West's water infrastructure provide the indispensable resource for growing food for the country and beyond, it provides opportunities for outdoor recreation, which is an enormous economic driver in the American West. If one of the short-term benefits of developing infrastructure is to create jobs, get money flowing, and spur our economy on after the pandemic, we need to do so in a way that enhances the best features of each part of the country. The outdoor recreation that the reservoirs and rivers in the West provide are an attraction for people from all over the United States and the world. The contributions the mountain West makes to the United States' economy and culture should not be ignored just because the region is less populated.

One of the more recent practices of the NWRA is to collaborate with other organizations with similar interests: the protection, development, management, and conservation of finite water resources in the creation of the "Western Water Coalition". Our steering committee includes the Family Farm Alliance, which is a strong advocate for irrigated agriculture in the West, where many farms, even large ones, are family owned and passed down through the generations; a growers' association; and the Farm Bureau. Through that steering committee, we are reaching out to organisations, water districts, and water providers throughout the West. We recently sent the second of two letters, with close to 250 signatories, arguing for the importance of water in the West to all Western Congressional offices. There's strength in numbers, and we have a critical mass with this coalition that we've built. Frankly, the approach is to create the image that we are too big to ignore. That will ensure that the Bureau of Reclamation and western water are included in any infrastructure package.

Our coalition and the western water community are also heavily focused on watershed management and watershed health. There is a vast amount of forest land in the West, the majority of which is in the U.S. national forest system. Keeping those forests healthy help reduce wildfire, but these drought conditions have made it difficult to reduce and control the potential for catastrophic wildfires. Those wildfires threaten to take lives and cause enormous losses to homes and businesses, but once the fires are out, the problem is only beginning for water providers and users. The floor of the burn area is scarred and is inches deep with ash. When the winter snowpack begins to melt in the spring and water flows down into the rivers and eventually into storage and delivery facilities, the ash and debris threaten to damage storage and treatment infrastructure and impede the treatment of that water. The natural infrastructure represented by those forests and watersheds is also a priority of the coalition. Keeping those forests healthy, helps.

A wildfire in Oregon. *(Photo: Adobe Stock)*

Christine Arbogast is a native Coloradan, born in Pueblo and a graduate of Southern Colorado State College, now Colorado State University at Pueblo. She earned a Bachelor of Arts degree with majors in both journalism and political science.

That educational focus has carried forward in Christine's professional life. Following graduation, she was a reporter and editor in Canon City, Colorado, and then a news and feature writer for the Durango Herald in the southwestern corner of the state. It was there that her interest in Native American issues and water resources began, and she was fortunate to be able to transfer that interest to a new career path in politics and government.

Christine began work with Congressman Ray Kogovsek in 1979, when he was elected to represent Colorado's sprawling Third District, which included nearly half of the state and reflected its diverse interests. She served as his press secretary and concentrated on legislative issues including Native American affairs, water, agriculture and local government.

She remained in Washington until July of 1984, and returned to Colorado to work as a special projects administrator for the Colorado Commissioner of Agriculture at the time the department was establishing its Always Buy Colorado programme, now known as Colorado Proud.

In 1985, Christine returned to work for Ray Kogovsek, who had chosen not to run for re-election to Congress. Since then, the small firm has worked primarily in the Western states on resource and tribal issues as well as local government concerns, capital construction projects and public land use.

"Beginning this new year as President of an organisation I have belonged to since 1985 is really an honour, and also a challenge. It will put to the test my more than 40 years of work on Western water policy, development, delivery and conservation. I am grateful for the NWRA family's trust in me, and hope I can make a tangible difference in how decision-makers approach our unique water resource needs in the semi-arid West."

Christine is President and Chair of the Federal Affairs Committee of the NWRA and has received the President's Award from three different leaders of the organisation. In 2016, the NWRA gave Christine the John F. Sullivan/G. Thomas Choules Award for one "whose service, promoting the regulatory/legislative/judicial agenda of the Association, was above and beyond that expected of a member of the leadership." This award has only been bestowed to five NWRA members. Christine serves on the board of directors of the Colorado Water Congress and serves on the policy/advocacy and federal affairs committees. In January, Christine was named the Aspinall Water Leader of the Year by the CWC, an award given to individuals who have demonstrated long-term commitment and contribution to the statewide water community. She is the third woman to receive the award in more than 40 years. Christine is also a member of the Colorado River Water Users' Association. She is the president of the Women in Water Scholarship Fund, a new 501C3 which awarded its first $5,000 scholarship in 2019.

Dam! Why should you care?

By Sherry Hunt, Research Leader and Acting Location Coordinator, USDA-ARS Hydraulic Engineering Research Unit, Stillwater, Oklahoma.

"Oklahoma, where the wind comes sweepin' down the plain, and the wavin' wheat can sure smell sweet when the wind comes right behind the rain."

Those lyrics from the Rodgers and Hammerstein musical Oklahoma still ring true in Oklahoma, just as they did when the show premiered in 1943. How poignant that song must have been, as Oklahoma was coming out of the Dust Bowl era! Did Rodgers and Hammerstein have a vision of what was in store for Oklahoma when they mentioned rain?

Growing up in Oklahoma, I heard stories about the great floods in the American Midwest from the 1930s to the 1960s. I didn't witness those floods, but my parents and grandparents could sure tell stories, like how my great-grandfather couldn't plant his crops due to water standing in the fields for months on end, and how my father had to ride a tractor down a flooded road to get to his own wedding. Torrential rains, and the ensuing floods, carved away thousands of acres of soil and disrupted transportation as roads and bridges were washed out. Worst of all was the lives lost when floodwaters swept people away.

While those stories were passed down to me, I rarely saw such disasters. My relative safety was due, in large part, to the United States Department of Agriculture (USDA) Small Watershed Program, which is administered by the USDA Natural Resources Conservation Service (NRCS). The USDA Small Watershed Program provides technical and financial assistance for the design and construction of dams on the upper tributaries of small watersheds across the U.S. The construction of these dams dates back to the 1940s. By the 1960s, the USDA was at the forefront of national dam construction.

Did you know that the USDA is the engineer of record for nearly one-third of the more than 95,000 dams on the National Inventory of Dams (NID)? Of that one-third, nearly 12,000 dams were constructed under the USDA Small Watershed Program. Of course, I'm not talking about famous projects like Hoover Dam or Grand Coulee Dam. I'm talking about small earthen dams, with a height generally between 8 and 25 metres, that are meant to provide flood protection for agricultural land. My home state of Oklahoma leads the nation in this effort. With over 2,100 USDA-assisted dams, 90 percent of Oklahoma's residents live within 20 miles of one of these dams.

These dams were built with the scientific research and engineering know-how provided by my predecessors at the USDA Agricultural Research Service (ARS) Hydraulic Engineering Research Unit (HERU) in Stillwater, Oklahoma. Their dedication and partnerships with the NRCS and local sponsors, including conservation districts, state and local governments, and private land owners, made the dam programme successful. These dams are all based on a fairly standard design, mostly developed by HERU scientists, with improvements made over the years as ARS and NRCS engineers learned more about dam performance. For the most part, a flood-control dam in Oklahoma looks very similar to a flood-control dam in New York or California.

> "Did you know these dams provide more than flood control? These dams are multi-purpose structures because they also provide rural and municipal water supplies that support economic growth, healthy ecosystems, water for crop and livestock production, recreation, and tourism."

Dam! Why should you care? You likely never thought about these dams or even knew of their existence. Why? Because they are silent sentinels, protecting you and your livelihood. Did you know that more than 50 percent of these dams have surpassed their planned 50-year service life? Many changes have occurred since their construction. Consider, for example, Dam Site 4 in the East Fork Above Lavon watershed, in Collin County, Texas. This dam was constructed in 1959 when the county population was less than 14,000. Today, the county population has surpassed one million. As a result, instead of protecting agricultural land, this dam, and others like it, are now protecting tens of thousands of downstream lives.

In addition to changes in land use, some of these aging dams are experiencing structural deterioration, and their reservoirs are beginning to fill with sediment. Climate change is also creating stresses on these dams like never before, with extreme cyclic conditions between droughts and floods.

Dam! Why should you care? Did you know these dams provide more than flood control? These dams are multi-purpose structures because they also provide rural and municipal water supplies that support economic growth, healthy ecosystems, water for crop and livestock production, recreation, and tourism. In 1957, Oklahoma built the first multi-purpose dam in the nation under the USDA Small Watershed Program.

Why is this dam, known as Wildhorse Creek Watershed Dam No. 22, of significance? At the time, a growing energy company in Duncan, Oklahoma, needed water for industrial use. This dam provided the water. Today, the company that needed water has grown to more than $20 billion in assets. Across the U.S., the USDA Small Watershed Program is estimated to provide an average of $2.4 billion in benefits each year. The actual benefits are likely much greater, as the estimated benefits are projected from the original, pre-development watersheds.

Now that you know that more than 50 percent of these dams have reached the end of their planned service life, and that they provide a plethora of benefits to you, your family, and your community, what do we do about them? How do we address the challenges they face, so that they can continue to provide the benefits that we've become accustomed to? In 2000, recognising the critical role these dams play in our national economy, Congress passed legislation for the rehabilitation of dams constructed under the USDA Small Watershed Program to upgrade them to current safety standards.

Fast forward 20 years, and the NRCS reported completion of 161 dam rehabilitation

projects last year, which is a far cry from the 6,000+ dams that have reached the end of their planned service life. The continuation of this rehabilitation programme depends on annual appropriations and funds authorised through the Farm Bill. Those funds are already stretched as far as they can be to ensure that the dams still provide flood management, water supplies, erosion control, agricultural productivity, recreation, and wildlife habitat.

We all know that there is ever-increasing competition for funding. We see it in the news every day. However, funding this programme does more than repair aging dams; it also creates jobs, and it protects homes, infrastructure, commercial property, interstate commerce, and lives.

Meanwhile, HERU scientists continue to build on nearly 80 years of research support for this programme by developing innovative, economical solutions for addressing the challenges that the dams are facing. For example, HERU scientists have developed standardised design criteria for roller compacted concrete (RCC) stepped spillways applied to embankment dams as a rehabilitation solution. In addition, in collaboration with the NRCS, Kansas State University, and ARS and NRCS engineers, HERU scientists have developed the Windows Dam Analysis Modules (WinDAM), a software program for predicting earthen dam failure due to overtopping or internal erosion.

New tools are still needed to sustain the benefits of the USDA Small Watershed Program. To meet the challenges we face, we need to be better stewards of the land and more efficient in our use of natural resources. This requires us to develop new technology and new uses for these dams, and their reservoirs, that have previously gone untapped.

For example, wouldn't it be great if we could monitor reservoir levels using modern technology to better meet the needs of farmers in times of drought or flood? Or if we could view the sediments stored in reservoirs as a valuable resource for maintaining a proper balance from uplands to river outlets, rather than as an environmental problem? These are the challenges that my colleagues and I are addressing. These are also the challenges that I ask you to help address.

Dam! Why do I care? I care because my family and friends depend on these dams for their agricultural livelihood. I care because my two daughters enjoy recreation with their grandfather at a dam close to where I grew up. I care because my family has enjoyed watching the diverse wildlife these dams support. I care because these dams supported the construction of a highway through my hometown, so commerce could continue and the town could survive and prosper. I care because these dams saved my community when it was threatened by wildfire. The Air National Guard used water from a reservoir to douse the flames. You bet I care!

The next time you fly over the American Midwest, look out the window at the landscape below. You will see the subtle colours of wheat and corn and freshly plowed ground, the paintbrush strokes of grass-lined waterways, and the stair steps of terraced fields that help keep sediment out of the reservoirs. You will also see water, water everywhere, in the tens of thousands of artificial lakes and reservoirs that speckle the land.

Now think about who is responsible for this masterpiece of sustainable engineering. You don't have to think very hard. You can thank your fellow agricultural and biological engineers, your federal, state, and local governments, and private landowners, because they all came together for the greater good. Just as the creation of the USDA Small Watershed Program was a collective effort among these entities, the future of the programme will depend on a collective effort.

As Rodgers and Hammerstein put it, *"We know we belong to the land, and the land we belong to is grand."* Dam! I will continue to tell this story, because it has a strong past and a great future. Do you care to be part of that future?

Big bucks for Rangitata River restoration

A $16 million project has been announced to protect and enhance unique habitats in a Canterbury River.

The Rangitata River is in the east-central South Island. It is formed by the confluence of the Clyde and Havelock rivers, which rise in the Southern Alps. The river is part of two initiatives; an $8.7 million project focusing on the Lower Rangitata, led by Te Rūnanga o Arowhenua, and a $7.3 million project focusing on the Upper Rangitata, spearheaded by the Upper Rangitata Gorge Landcare Group.

Part of the Department of Conservation's (DOC) Ngā Awa, river restoration programme, the Rangitata is one of fourteen rivers of significance.

Minister of Conservation Kiritapu Allan said work on the Rangitata River would restore the health of awa.

"The Upper Rangitata project will see farmers and landowners partnering with DOC and other agencies to fence off stock, restore wetlands, trap pests, and propagate and plant eco-sourced and culturally significant natives in a joint move to improve water quality and enhance biodiversity values along the riverbank."

"It recognises the intrinsic values of this special area, which runs through some of the South Island's best-known high-country stations including Mt Peel, Erewhon and Mesopotamia."

"The project on the Lower Rangitata, the section of the river from the Gorge to sea comprising a 65km river run, focuses on the braided fairway, berms next to the main river channels, wetlands, and intensively farmed riparian margins within the lower catchment."

IrrigationNZ Chief Executive Vanessa Winning said the Rangitata river was an important artery in the landscape of Canterbury – a lifeblood for our fish, lands, and community. It provided recreational, ecological, and economic outcomes for the whole community.

She said, the restoration and support were important to farmers and growers, and will help climate change resilience, and improve the quality of the water we use to irrigate our crops and pastures.

"We are lucky to have plentiful natural resources in New Zealand that provide for us. It is important we don't take them for granted, and we continue to look after them with ongoing investment. Seeing projects such as the Rangitata restoration, and many more across the country ensures generational improvements and makes you proud of how far we have come in our understanding of the importance of the life-giving properties of the land, water and sea."

BACKGROUND INFORMATION: This project is part of a cross-agency approach to the restoration and protection of the river. Department of Conservation, Land Information New Zealand, Environment Canterbury, Timaru District Council, Ashburton District Council and Te Rūnanga O Arowhenua having formed a steering group and are working together to support the restoration of the awa. The Lower Rangitata project will be managed by Te Rūnanga o Arowhenua, while the Upper Rangitata project will be managed by the Upper Rangitata Gorge Landcare Group.

The winds will come; take time to plan now

Advice from FMG, IrrigationNZ's Risk Partner.

Although your irrigators are probably parked up, those winds will eventually come so now's the time to plan how'll you protect your irrigators from damage.

The windstorm in Culverden last September was a reminder of this and resulted in rural insurer FMG settling $1.5 million in claims.

Wind damage is consistently the top cause of irrigator claims, FMG Manager of Advice Services Stephen Cantwell said.

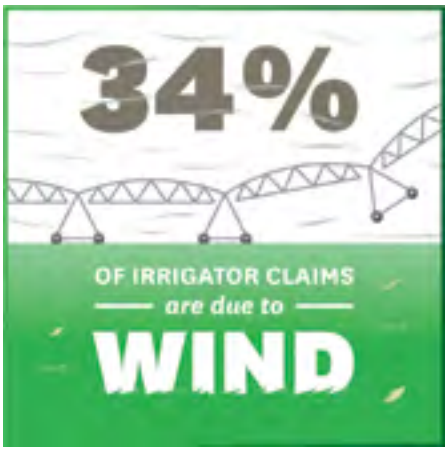
"In spring the frequency and severity of foehn winds rise, which increases the risk of irrigators blowing over. Around 34 percent of irrigator claims are related to wind damage."

FMG wants to support farmers and growers to limit the disruption irrigator damage can have on their business.

"We've worked with the team at IrrigationNZ and based on our claims' insights, together we've developed an irrigator advice guide. We know how important irrigation is for farmers and growers, and New Zealand's economy. The guide provides practical advice on how you can limit the risk of irrigator damage," said Mr Cantwell.

A key piece of advice in the guide is to take time to plan before spring.

"Although the impact of wind on irrigators may not be the first thing on your mind right now taking the time to put together a wind plan can really ease the pressure come spring. This is particularly important if you have new employees on board," said Mr Cantwell.



PUT AN IRRIGATOR PLAN ON YOUR WINTER TO-DO LIST

"Prior to spring is a great time to review and/or document your irrigator plan," said Mr Cantwell.

Here are some suggestions on what to consider:

1. Prediction

New Zealand weather patterns are known for being variable and unpredictable. Farmers and growers are increasingly more connected online. Some of FMG's clients have had great success in using platforms such as MetService and Yr as well as applications such as PredictWind and Windy which allow you to set parameters for wind speed alerts.

2. Authority

There needs to be a clear understanding of who is responsible for monitoring winds and making the final decision to proceed with the action plan.

3. Action

It's important that all employees understand what the agreed farm plan is if strong winds are on the way. This could include the method of "Point, Park, and Anchor".

4. Practice

Winter is a good time to practice your plan, especially for new employees who may not be familiar with it. Just like fires, wind events are spasmodic, so 'on the job' practice is limited. Practicing the plan will help to keep you across what to do when high winds come.

For more detailed advice download the Irrigator Guide available free from: www.fmg.co.nz/advice/irrigators.

The result of strong winds can be detrimental to your irrigators. Make sure you are prepared.

The adaptability of water storage: the vital role of Lake Opuha in Canterbury's May 2021 floods

During the May 2021 Canterbury floods – what has been termed a one-in-a-two-hundred-year flood – manmade Lake Opuha saw water levels change more than they had in the previous six months, rising from 15 percent capacity to more than 80 percent in just 48 hours.

Lake Opuha, formed by the construction of the Opuha Dam, is situated at the confluence of the North and South Opuha Rivers, 17km north-east of Fairlie, South Canterbury. The infrastructure project, undertaken by the local community, was officially opened in 1998 and comprises a 50-metre-high earth dam, with a single hydro turbine and a lake covering up to 710 hectares. The lake holds an operational volume of 65,470,395 cubic metres of water. Although not the full volume of the lake, but what's allocated to maintain river flows and provide for abstraction. Once that operational volume was used, the lake reverts to an out-flow equals in-flow situation.

Water from the lake enters the Opuha River, which merges with the Opihi River. The Opihi flows past the town of Pleasant Point and, further downstream, it is joined by the Temuka River before reaching the sea on the South Island's east coast near the Milford Huts settlement. Renewable hydroelectricity is generated by the water released from the dam. The irrigation scheme services 16,000 hectares, (16,000 shares, 1 per hectare). Each share is allocated 25 millimetres of water per hectare per week for 22.5 weeks, within a nine-month irrigation season.

Opuha Water Limited (OWL) Chief Executive Andrew Mockford said between

> "... during the dry periods the lake was able to provide enough water for irrigation and environmental flows, then in a matter of days, it was able to provide flood buffering to reduce the level of flood damage downstream."

Lake Opuha before and during the May 2021 flooding. *(Photos: Penny Williams)*

Andrew Mockford, Opuha Water Limited.

> "The adaptability of Lake Opuha has showcased how integral water storage is during periods of drought, and high rainfall. The focus was intergenerational assets that assist in our community managing and adapting to changing climate patterns."

29 and 31 May more than 250 millimetres of rain fell in the catchment, with the lake retaining more than 45 million cubic metres of water.

From January to just before the floods (late May 2021), the lake had not received any meaningful rain meaning it was running very low (15 percent operational capacity). Through this time the lake had ensured the downstream river was kept above its consented minimum flows to ensure river health and provided irrigators the water they needed in a long season. Mr Mockford said, "during the flood event the lake also held back a major amount of water that otherwise would have ended up downstream with even more detrimental impacts to what the flooding had caused by an already swollen river system".

"The power of water is absolutely incredible, but for us at Opuha Water the real story that comes from this is the role the dam plays for the environment and community … during the dry periods the lake was able to provide enough water for irrigation and environmental flows, then in a matter of days, it was able to provide flood buffering to reduce the level of flood damage downstream."

"It's a very resilient piece of infrastructure."

The lake was now at 95 percent capacity due to subsequent rain. Mr Mockford said it was important to monitor the levels, inflow, and outflow, to be prepared for another rainfall event, as well as the coming irrigation season.

He said telemetry of the system was crucial for daily monitoring and, especially during flood events like this one.

"It really showed the importance of having telemetry and control across a range of data points, which is an absolute necessity. We couldn't access some of these points during the floods, however, we knew exactly what was happening even though we couldn't see it."

He said that as we continue to adapt to climate change, the so-called 200-year events will occur more frequently, if the experience of this year's various flooding events alone, is anything to go by.

"The adaptability of Lake Opuha has showcased how integral water storage is during periods of drought, and high rainfall. The focus was intergenerational assets that assist in our community managing and adapting to changing climate patterns."

Mr Mockford has been Chief Executive of OWL since January 2018 and said the time since then has flown by. He had some prior involvement with Opuha when he was the Southern Regional Hydro Manager for Trustpower, as Trustpower has the operations and maintenance contract for the Opuha Power Station. His main working background had been physical asset management and optimisation, across military aviation, hydro-power generation, air traffic control, and now at Opuha Water Ltd.

"I really enjoy the role at Opuha Water as there is certainly an asset management and optimisation aspect to the role, but more so the fact that through the assets we manage we play such an important enabling role for our community to thrive."

The Opuha Dam and Lake – which showed its adaptability during dry conditions in early 2021 and also incredibly high rainfall come May.

THE HISTORY OF LAKE OPUHA

Initially, the concept came out of discussions between the Electricity Corporation of New Zealand (ECNZ) and the Opihi Augmentation Society. This resulted in the Opuha Dam Partnership being formed in 1992 to commercialise the project. The proposal enjoyed the support of local lines company, Alpine Energy Ltd, Timaru and Mackenzie District Councils, the Opihi River Development Company and two irrigation companies – Levels Plain Irrigation Company Ltd (which existed prior to the dam) and South Canterbury Farmers Irrigation Society (SCFIS), which was established to represent the farmers who would, in future, be able to access water from the dam.

Israel Water Education

Please save the dates, October 4–12, 2021, for the following scheduled tour, sponsored by *Irrigation Leader* magazine and operated by Imagine Tours and Travel, LLC.

Projected Itinerary

1. Arrival at Ben Gurion Airport and dinner in Netanya, Israel.
2. The group will visit the Caesarea National Park and see the Roman aqueduct and water cistern, proceed to Kibbutz Maga and visit the Netafim irrigation factory, and then go to the Megiddo National Park to see the ancient water system there.
3. The group will drive north to see two of the main sources of the Jordan River, the Dan and Banias Rivers; go to the Golan Heights to see the Syrian border and Mt. Hermon; and proceed to the famous Golan Winery for a tour and wine tasting. The day will end at the Sapir site near the Sea of Galilee, where water is pumped for the National Water Carrier, the water supply system that spans the length and breadth of Israel.
4. The group will depart Tiberias and drive to Mt. Arbel for an amazing panoramic view of the Sea of Galilee, drive to Mt. Gilboa and Kibbutz Maale Gilboa, and then proceed to Kibbutz Sde Eliyahu for an agriculture bio tour.
5. During two full days in Jerusalem, the group will have the opportunity to see a wide range of historical, spiritual, and water-resources-related sites. On the first full day, the group will visit the Mount of Olives for a beautiful panoramic view over the Old City of Jerusalem, then visit the City of David, including Hezekiah's Tunnel—brave participants can walk through the wet tunnel to the Pool of Siloam, while others can walk along the dry tunnel. The group will then drive to Armon Hanatziv to see the ancient tunnels that convey water from Solomon's Pool to the temple. The group will then enter the Old City to see the Western Wall tunnels, the Pool of Bethesda, and the Roman Cardo with its old wells. There will be an opportunity to visit the Church of the Holy Sepulcher and to shop in the Old City. On the

and Trade Tour, October 4–12, 2021

second day, the group will visit the Israel Museum, home of the Shrine of the Book and the Dead Sea Scrolls as well as a miniature model of Jerusalem during the First Temple period. Then the group will drive to the Sataf spring in the Judean Hills to see how the citizens of Jerusalem get a few acres to grow their own vegetables and fruits while using an ancient irrigation system that leads water between terraces and will finish by visiting the Beit Zait Reservoir and Dam.

6 The group will depart Jerusalem and drive to the Einot Zukim Nature Reserve, where there are freshwater springs and typical oasis vegetation and animal life. Next, in the desert next to the Dead Sea, which has salty water and no life at all, the group will proceed to the Ein Gedi Nature Reserve, where kibbutz members pump water for their mineral water factory. The group will then visit the world heritage site of Masada, where participants can walk the snake trail by foot or ascend via cable car to see King Herod's fortress, an ancient synagogue, a Byzantine church, and the water cistern.

7 The group will depart the Dead Sea and drive via the Arava Desert Valley to the Yair Research and Development Agriculture Center and tour the Center for Modern Desert Farming, one of the world's most advanced. There will be a guided visit to the experimental greenhouses and a presentation of agricultural inventions to deal with the challenges of desert soil and climate. The group will then continue to the ecological Kibbutz Lotan near Eilat and learn how it transformed sandy desert soil into a green and flowering organic garden. Participants will learn basic organic and permaculture tips and practical solutions that the Center for Creative Ecology has developed over the years to treat waste, raise healthy food, save energy, and build naturally. Proceeding to Eilat, the tour group will visit a desalination facility that draws water from the Red Sea.

8 The group will depart Eilat and drive via the Ramon Crater to the Negev Desert Research and Development Center near Ashalim, which specializes in using salty water for agriculture. The group will proceed to Kibbutz Hatzerim near Beersheba, the southern branch of the Netafim irrigation factory, and continue to the desalination facility in the Ashkelon/Ashdad region on the Mediterranean Sea.

9 We will hold a farewell dinner in Jaffa and then drive to Ben Gurion Airport for a night flight back home.

Services Included

- meeting and assistance at Ben Gurion Airport on arrival
- transfer to/from Ben Gurion airport
- licensed English-speaking guide for all transfers and sightseeing days
- luxury air-conditioned coach
- entrance fees for all visits and tours
- eight nights of hotel accommodation
- breakfasts and dinners at hotels and farewell dinner at local restaurant

$4,707.00 per attendee (with airfare from Dulles airport, VA, USA)
$4,319.00 per attendee (without airfare and meeting in Tel Aviv)
All posted prices, services, and destinations are subject to the terms and conditions of a participant agreement. Irrigation Leader *Magazine is published by Water Strategies, LLC, an American company founded in 2009.*

For more information visit www.irrigationleadermagazine.com.

Comprehensive travelers insurance is strongly recommended.

(Note: All monetary amounts are in US dollars.)

WATER STRATEGIES LLC

Keep an eye out in the Summer edition of IrrigationNZ News for a report on this tour.

National stadium saving water through a new irrigation system

Auckland's Eden Park has switched from using treated drinking water to bore water to irrigate their turf, thanks to a new custom-made water treatment plant and reinstated bore provided by Watercare, with projected water savings of 16 million litres of water per year.

Eden Park Turf Manager Blair Christiansen has been in the turf industry for 30 years – 18 at Eden Park. He heads the turf team of six (plus a summer casual) and has driven the water bore project all the way from coming up with the idea – exploring how the historic bore could future-proof systems and get Eden Park off town water – through to delivering the project six months later.

Mr Christiansen said the vision for Eden Park's reinstated water bore came from a proactive desire to future-proof water supply at the onset of restrictions in the Auckland region.

"Because we have sensors in place to monitor the moisture level of our two sports fields, we were able to continue watering the surfaces during level one restrictions (drought/water restriction). At level two however, watering sports fields is not feasible under any conditions, so we knew early on that we needed to find a viable solution should restrictions be ongoing."

Eden Park had a redundant water bore on-site, installed more than 20 years ago, and retired due to sandy sediment and minerals making the water supply unusable on the fields. Mr Christiansen said late last year, they decided to investigate the bore's ongoing viability, test the water quality, and make an assessment whether reinstating the system would be possible.

This meant teaming up with Watercare to begin investigations into the current water quality and suitability and identify if technology that has been developed since the bore was retired in 2008 might enable the use of the resource.

The bore sits unobtrusively alongside a wall next to the Number One field. A new mechanical filter removes large sand particles, before the water is piped underground to the water treatment plant, which sits 50 metres away directly below the main concourse.

The mini plant consists of three tanks which remove any further small particles. Chlorine

The bore that sits behind the Number One field.

What appears as a massive green lawn is in fact a patchwork of grass requiring complex management.

Keeping it green under water restrictions and saving water.

is added to remove manganese and iron. At this stage, the water is clear and has been treated to a high standard but is non-potable. It travels another 15 metres to six 30,000 litre holding tanks. A booster pump sends it to 300 sprinklers dotted around playing and practice fields as required.

Mr Christiansen said "together, we designed a system that could remove water from the ground using the existing bore, treat it on-site in a bespoke treatment plant, store the water and pump it out for use on both fields … in total, the project took six months from start to finish, with the official reinstating of the water bore just before Eden Park's first concert in April."

The irrigation system is computer controlled but Mr Christiansen and staff must decide how much and where the water will go. What appears as a massive green lawn is in fact a patchwork of grass requiring complex management. Different parts of the field have their own microclimate, and the shade footprint from the stadium's roof alters as seasons progress.

"Having the ability to draw water throughout the year from our own bore provides an assurance of quality for years to come when one of our greatest resources is at risk. Eden Park could only achieve this thanks to Watercare's expert knowledge and generosity to bring this initiative to life."

The reinstated water bore system is designed to moved and store water in the same way as we have done previously when we were on town supply, said Mr Christiansen.

"As such, the operator does not notice a difference; however, because we now have a chlorine-injected treatment plant on site, there are new processes around checking chemical levels within treatment plants, managing equipment and ensuring we are compliant with all resource consent conditions."

The project has been a joint investment between Eden Park and Watercare.

In return for installing the plant, Eden Park is promoting Watercare's proactive water saving messaging around the stadium as part of an integrated partnership.

"Eden Park is thrilled to be working with Watercare to develop sustainable initiatives to support the community and future-proof our ability to host domestic and international content for the city. This is one of several sustainable initiatives in place at the Park which showcases our commitment to reducing the impact of our events on the environment, while aligning with several United Nations' Sustainable Development Goals," said Eden Park Chief Executive Officer Nick Sautner.

Auckland is still experiencing the effects of the drought, with dam levels currently close to 50 percent, as compared to usual levels of 76.9 percent. Aucklanders have saved close to 15 billion litres of water since restrictions began almost a year ago, and at the same time Watercare is bringing new water sources online.

"The initiative has been a real win-win for

both Eden Park and the wider community as we navigate water-saving conditions and what's likely to become the new normal for Auckland for the foreseeable future. While there is of course capital investment at the start, these savings are realised in the water savings and reduction in our reliance on town supply," Mr Christiansen said.

Watercare is looking to extend the bore water irrigation project and likely candidates include Lloyd Elsmore Park in Pakuranga – one of the largest sports parks in Auckland. Bores tend to be found in volcanic areas such as Maungakiekie where underground aquifers naturally occur.

> "The initiative has been a real win-win for both Eden Park and the wider community as we navigate water-saving conditions and what's likely to become the new normal for Auckland for the foreseeable future."

Opening the new water system (from left) Blair Christiansen, Jon Lamonte (Watercare Chief Executive), Nick Sautner, and Mayor Phil Goff.

Horticulture New Zealand appoints new Chief Executive

Nadine Tunley, Horticulture New Zealand.

The desire to work for an organisation that does critical work for growers is what made Nadine Tunley want to take on the role as chief executive for Horticulture New Zealand (HortNZ).

"I chose to join HortNZ because I wanted to continue the really critical work of the organisation to improve things for growers," Ms Tunley said.

"Growers across the country are under immense pressure. There are widespread labour shortages, central government proposals around climate change and freshwater are many and often confusing, local government plan change proposals are constant, and then you have the weather. Growers have had several severe weather events already this year."

She said her role as the leader of HortNZ is to work with product groups and organisations such as IrrigationNZ to ensure growers can focus on what they do best: grow fresh, healthy food for New Zealanders and the rest of the world.

"The irony here is that is what the government says it needs growers to do, to ensure New Zealand's economic recovery post-Covid and to make sure the country meets its climate change goals and commitments."

"However, if there's no land or water to grow the fruit and vegetables, and no labour to plant, pick and pack this wonderful produce, there's no way that our growers will be able to contribute to the Government's goals for New Zealand as a society and country."

Ms Tunley is known to many in the horticulture sector having been primarily in the apple and pear industry since 2000. Nadine was Chair of NZ Apples & Pears Inc from August 2012 until April 2018, and was a director from 2010. Her involvement in this industry began just prior to deregulation in 2001, when Nadine was tasked with exporting some of the first shipments made outside of the single desk model.

She started out in horticulture with the Heartland Group, which she credits for the solid foundation of knowledge, skills and tenacity often required to achieve change and progress.

After she then went on to found, with her business partner, marketing company, Energie Produce Ltd, which exported mixed produce to more than 34 countries globally. That company was sold to Freshmax NZ Ltd in 2013, and became its Global Exports Manager. She is also a Director of Scales Corporation Ltd, Plant & Food Research, the Strong Wool Action Group, and was a member of the Primary Sector Council.

Citrus growing in New Zealand and the importance of irrigation

New Zealand has been growing citrus for well over 100 years. It is likely it was first introduced to New Zealand from New South Wales, Australia, as initially the British Crown Colony of New Zealand was governed from New South Wales. The Poorman orange, now known as the New Zealand grapefruit, was bearing fruit on Kawau Island in 1856, so it was probably introduced at least five years earlier. The Washington Navel orange was introduced and planted at Hairini, Tauranga, in the early 1880's.

Commercial citrus growing developed in Northland, around Auckland city, and in the western Bay of Plenty in the early years of New Zealand's European settlement. Later, Gisborne became a citrus area of significance.* Growers produce around 30,000 tonnes of citrus each year with almost 2,000 hectares planted of which 556 accounts for mandarins, 783 for oranges, 22 for tangelos, 260 for lemons, 27 for limes and 15 for grapefruit. With around 320 growers there are more than one million citrus trees in New Zealand. Most New Zealand citrus is sold domestically with around $58.5 million in domestic sales in 2019 and $12 million in exports.

Citrus in New Zealand is fairly tolerant to dry conditions. Many orchards do well without irrigation, but supplementary irrigation can enhance profitability by improving yield, fruit size and yield consistency. Irrigation is required when evapotranspiration exceeds rainfall. These periods usually coincide with the important phenological fruit growth stages from October through to the end of February. The benefits of irrigation will vary depending on soil type, season, and individual orchard circumstances. Citrus feeder roots are shallow in most soils as they have a high oxygen demand and are in the top 15 to 50cm of soil. It is these roots that are responsible for nutrient absorption – when it is dry water may be absorbed further down the soil profile but not in the nutrient rich topsoil which can result in fruit growth deficits.

Ripe Satsuma Miho Mandarins.

*Citrus New Zealand: *Growing Citrus in New Zealand.* Further Statistics: Citrus New Zealand: *How big is NZ's citrus industry?* www.citrus.co.nz/faq/how-big-is-the-citrus-industry-in-new-zealand

Mature Satsuma Miho Mandarins with a single drip line per row on heavier soils.

From Zimbabwe to New Zealand – a career in citrus and irrigation

Growing up in Rhodesia, Zimbabwe, Bruce Richter never thought he would be involved with citrus growing in New Zealand, however it is now his passion. Based in Tapora north of Auckland, Mr Richter is General Manager of Avocado Heaven in Tapora and Aeneid Orchards in Matakana. Aeneid Orchard is 40 hectares Mandarins Satsuma and Avocado Heaven, 15 hectares Mandarins Satsuma – not producing yet.

Him and wife Sharon moved to New Zealand in 2006 with their three daughters. Mr Richter hadn't experienced growing citrus until coming to New Zealand however orchard and plantation crops weren't new to him. After completing a degree in Agricultural Economics, he joined an irrigation company designing and selling irrigation systems. He then joined his father on a coffee farm and developed coffee, macadamias, and tea for 20 years. Following immigration to New Zealand he had a couple of jobs designing and consulting irrigation schemes then joined Netafim as the Country Sales Manager for the last ten years.

Bruce Richter.

Fertigation system.

"I worked closely with Tony Gibbs on developing both his citrus and avocado irrigation schemes from scratch. Sadly Tony passed away last year and I was approached by his family to take on my current role which was a fantastic opportunity for me."

The first plantings at Aeneid Orchard were around 25 years old with several more recent plantings.

Mr Richter said "the mature orchard has been the family farm and is very efficiently run and well developed."

CITRUS IRRIGATION

Mr Richter has had citrus irrigation experience both on farm and within the industry, so he has plenty of knowledge about it. He said in New Zealand irrigation for citrus was essential to produce quality fruit.

"It may be possible to grow (citrus fruit) without irrigation but the benefits from it and fertigation are worth it, the fruit is healthier, less susceptible to disease and changing conditions… it is important to growing but possibly more important to setting the crop and developing it to full maturity and quality."

Young Mandarins on sandy soil with two driplines per row.

Young Mandarins with Barna Grass as temporary shelter.

Mandarins off to the packhouse.

"The amount of water and timing depends on the tree age (size), crop load and most importantly the soil type which is the source of available water. Young trees may only require five litres per day but five-year-old cropping trees will require up to 40 litres per day. Soil type determines how quickly this can be applied and how long the cycle before another irrigation."

Drip or Micro sprinkler were the ideal irrigation systems for citrus and Mr Richter said like any plant or crop there were a lot of factors which determined how much water was required.

"The tree age, canopy area, season and crop factor define how much the tree requires."

"The amount of water and timing depends on the tree age (size), crop load and most importantly the soil type which is the source of available water. Young trees may only require five litres per day but five-year-old cropping trees will require up to 40 litres per day. Soil type determines how quickly this can be applied and how long the cycle before another irrigation."

Mr Richter said one of the biggest challenges was the timing. Both timing of when the crop ripens as it must be picked whether there is labour, or if the market is ready or not.

"Mandarins are mainly for local market and as such the market is limited and affected by over supply so extremely price sensitive."

Conversely he said one of his greatest achievements had been when he helped introduce fertigation to Aeneid Orchard in 2014 through the drip system the crop size and quality responded immediately.

He said his favourite thing about growing citrus was the trees respond well to being looked after and a big part of that was precision irrigation; "and they reward you accordingly".

In future Mr Richter believed the advantage would be having the ability to produce during market shortages.

"I think people need to plan carefully where and which varieties to plant based on supply from existing orchards – this will be the real difference as the citrus industry evolves."

Wetlands that work: a freshwater future for New Zealand

By Courtenay Bremner, Primary Industries Consultant, WSP NZ.

The quality of freshwater in New Zealand rivers and lakes is a key issue for many Kiwis. This stance is not dependent on where in New Zealand you live, your education, or your what you irrigate. We Kiwis are passionate environmentalists who want the best for our country. Water is a passion of mine, to be honest, science in general is a passion of mine and hopefully that is something I can share with you through my writing. Science doesn't have to be incomprehensible and overwhelming; it can be a tool we use for the greater good of our country!

I grew up in Selwyn (in a time before there was even a supermarket in the district), on the outskirts of Christchurch. I studied science at the University of Canterbury, majoring in biology, and then went back and completed my Masters in Water Resource Management, through the Waterways Centre at the University of Canterbury and Lincoln University. I now have an amazing job as a Primary Industries (PI) Consultant which allows me to use my science background, specifically water resources science, to help the PI sector with anything and everything water related.

Water. It's incredibly topical now. Whether it is too much or not enough or it's in the wrong place at the wrong time. Maybe it's contaminated, overallocated, and full of pests (animal and/or plant), then there are the extremes of climate change! Looking at the science would suggest it will only get more extreme with time without intervention. It can be exhausting just trying to keep up to date season to season with on farm challenges and life changes, let alone thinking too far into the future. But it is now that we must start thinking about these issues and acting, nothing is going to change if we don't start making the right changes in our own backyard and our farmers are in a unique position to take pragmatic action now.

Scientific knowledge is always improving, and as we understand more, we can adapt our thinking and technology to meet many of the challenges we face now and in the future. Wetlands, nature's bioretention systems, have been perfected by nature over millions of years and yet we are constantly learning new and exciting information about them that could be harnessed to face the challenges, mentioned above, head on.

Wetlands, be they a small swamp or seep, an intermittent wet and dry environment, a larger wetland area at the bottom of a gully, or even a man-made wetland, can be incredible assets and invaluable to the environment. However, there is a lot of uncertainty surrounding the current freshwater management reforms and in particular "… what is considered a wetland?" followed by "… what should I be doing to protect and manage mine?". This uncertainty in the future of legislation leads to conflicting thoughts around the loss of productive land, the cost of protecting and maintaining these systems, and wanting to do the right thing for the environment. Time and time again, uncertainty and a lack of clear communication can lead to disconnect and animosity between parties who are probably more aligned than they think.

Fortunately, regardless of the outcomes of the policy reforms, the benefits of wetlands cannot be disputed, and these benefits can extend beyond the environment (i.e., biodiversity, water quality etc.) to include flood protection, native species habitat, recreation, and cultural benefits.

The effectiveness of wetlands is twofold; firstly, through the function of plants, without which you essentially have a boggy pond in the middle of your paddock, and secondly, the role of microbes that live throughout the wetland (which in turn depend on the plants and soil in the wetland). In truth, the number of connections between different aspects of a wetland is immense and the systems operating within a wetland are intertwined. Therefore, the success of a wetland will depend entirely on preserving and/or creating a system that works harmoniously and autonomously.

The role of vegetation in wetland systems should not be underestimated: their benefits are vast and varied and not necessarily visible to the human eye, but they are certainly not restricted to the immediate area of the wetland. A functioning wetland will be enhanced by the establishment and maintenance of wetland plants, the diversity of which are vast.

Plants provide excellent wildlife habitat. In fact, most New Zealand's wetland species are not found anywhere else in the world making them unique. Also, they can provide opportunities for recreational activities and improve the aesthetic appeal of an area. Kuta (*Eleocharis sphacelate*), for example, is a versatile wetland species that is deep rooted and used traditionally by Māori for weaving.

Wetland plants dissipate wind and wave action to reduce resuspension of sediment and erosion, thus promoting the settling and retention of sediment within the wetland. While, shading of the water surface by vegetation reduces algal and weed growth. For example, the purei (*Carex secta*) which forms large tussocks with weeping leaves, provides excellent shade.

One of the big benefits wetlands bring to the table is their treatment of farm runoff; which involves the transportation of oxygen by the plants to their roots to enhance nitrification and aerobic microbial processes (which, ironically, are processes that occur in low oxygen conditions, but which rely on oxygen from the plants to establish). Plants also provide surfaces for the development of microbial biofilms (essentially the green slimy layer growing around your pond margins, but which are microbial powerhouses! Biofilms provide hugely diverse populations of microbes that work cooperatively to treat pollutants). Finally, they produce leaf litter which is a valuable source of organic carbon for denitrification and other microbial processes. The process of microbes 'transforming' nitrates into nitrogen is known as bioremediation; a term which can be used for the process whereby a harmful pollutant is removed from the environment using microorganisms.Interestingly, nitrification and denitrification are two separate transformations within the nitrogen cycle and not a spelling mistake. Without going into too much detail, nitrification converts the nitrogen compounds into oxidised forms, a process which requires plenty of oxygen; denitrification converts the oxidised compounds into reduced forms which are eventually (in most cases) released as nitrogen gas, a process which requires low oxygen conditions.

Sometimes there can be a disconnect between plant and soil processes which can upset the flow (excuse the pun) of nutrients (and the ability to transform nutrients) between the two, essentially causing a bottleneck. Successful planting comes down to the species you chose to plant. Plants with appropriate characteristics for the wetland can improve the permeability of the soil over time and ensure optimal nutrient removal.

Significant environmental gains are being made around the country through improved management practices on farm, but wetlands both naturally occurring and constructed offer an exciting opportunity to help reduce contaminant loads within a catchment while providing invaluable benefits to the wider environment and contributing to New Zealand's biodiversity goals.

If you are considering establishing a wetland on your farm, I'd recommend accessing good advice on its design. It's important to get the hydraulic flow paths, the mix of shallow and deep sections and the species right, otherwise you may just build a glorified "duck pond" that doesn't necessarily achieve the environmental improvements you hoped for.

"Significant environmental gains are being made around the country through improved management practices on farm, but wetlands both naturally occurring and constructed offer an exciting opportunity to help reduce contaminant loads within a catchment while providing invaluable benefits to the wider environment and contributing to New Zealand's biodiversity goals."

Wetlands can be incredible assets and invaluable to the environment.

A perspective of freshwater – from New Zealand and abroad

John Wright has been involved with freshwater management for many years now both on farm and at a governance level; his knowledge has seen him involved in many roles. Recently, he took on the role of the Minister of Water Resources in the Republic of Uzbekistan. We caught up with John to find out more about his journey to where he is today and how his new role compares to freshwater management in New Zealand.

My parents, two brothers and I moved from Hinds to Methven (Canterbury) in 1985, when I was at Lincoln University studying for a Bachelor of Commerce (Agriculture). The family decided to move to get away from irrigation, moving to a high reliability rainfall area with good soils, and away from sheep.

John Wright.

I came back from Lincoln University and we focused on intensive arable farming and processing to add value to what we were producing. The family business managed to grow and separate through a series of planned transitions including machinery syndicates and contracting arrangements. Increasingly we found that the reliable rainfall in Methven was not sufficient to support the intensive arable system we had developed, and our business was not as resilient as we had hoped.

I started to consider irrigation options for our land east of the RDR at the time that Barrhill Chertsey Irrigation Limited (BCI) was considering development options. Groundwater in the area was likely to only be found approaching sea level which was some 300 metres down from where we farmed.

I joined the BCI Board in 2004 out of self-interest. A capital raise to develop the scheme had just failed to gain farmer support and I wanted to see what I could do to get water to local farms, including ours. I travelled on a Nuffield Scholarship in 2005 and on return was elected Chairman of BCI.

The original BCI proposal was for a large-scale development on the South side of the Rakaia River and would utilise 17 cumecs of water on 40,000 hectares of some of the best soils in New Zealand. The proposal was consented in 2001 with minimal fuss thanks to the collaborative approach taken by local leaders in the area at the time. The issue that BCI faced however was threefold. The proposal was expensive due to the pumping requirement from the river, the consented water wasn't as reliable as desirable, and consents to drill for water in the mid and lower

Harvesting wheat that has been irrigated using furrow irrigation in Uzbekistan.

John Wright (middle) at the intake of the Great Fergana Canal on the Naryn River, with his Assistant Farkhod to his left and Foziljon, from the Andijan Basin Irrigation Service.

plains were freely available. As a result, many of those prospective users of BCI water made their own arrangements and developed at their own pace.

What followed was a mixture of stubbornness and perseverance to "cut the BCI cloth" to suit the demand in the area, and ultimately the district. In 2010 we developed the first stage of the BCI Scheme as a joint venture (JV) with local electricity lines company EA Networks, a grand total of 6,700 hectares and spread across the district using the RDR under a water swap and conveyance arrangement, and Trustpower to pump water 100 metres up from the Rakaia River at their Highbank Power Station site. We also licensed water to facilitate the 6,000 hectare Acton scheme which was a key factor in "giving effect" to the BCI consent.

When I stepped out of my BCI General Manager role in late 2020 the scheme had grown to 24,000 hectares, had achieved high reliability through commercial arrangements with Trustpower for water storage in Lake Coleridge, and amicably separated from its joint venture (JV) partner. I had transitioned from BCI Chairman to Project Manager for the JV, to JV and BCI General Manager.

Along the way I enjoyed involvement with other schemes including seven years on the North Otago Irrigation Company Board, and three years managing the acquisition and subsequent operation of the Rangitata South Irrigation Scheme on behalf of irrigator users of the water. At some point on this journey

Cotton being established with drip irrigation in Uzbekistan.

my involvement in water management became much less about self interest and more about providing for the needs of future generations within our communities.

The development of Irrigo, a joint administration and environmental service with other Mid Canterbury schemes, was a positive step forward on collaboration amongst the industry. However, a personal desire to consolidate local irrigation schemes has remained elusive.

The freshwater management landscape has changed massively over the relatively short time I have been involved in it. The challenges BCI faced pre-development were all about water quantity. The water resource was seen as limited and those wanting to further develop were doing all they could to stake a claim on whatever they could.

But, at the same time irrigators were making significant steps in improving the efficiency of use of water on-farm through changes in application technology and scheduling. At least in Mid Canterbury this resulted in a level of relative comfort in the water resource availability.

What we did not see coming around 2015 was the negative environmental impact of intensive farming. I think we were too focused on developing new infrastructure and meeting demand for water that we chose to ignore the increasing nitrate burden on groundwater and lowland streams. We should have seen it coming and reacted more quickly.

> "... the 270 kilometre long Great Fergana Canal here was built in 45 days in 1939 by 160,000 people. Two major river systems, the Syr Darya and the Amu Darya, had huge water resources that were exploited. Both rivers lead to the Aral Sea and because of the development the Aral Sea has gradually drained and is seen as one of the most significant man-made environmental disasters of all time."

From that point on the freshwater management landscape changed to a focus of managing the environmental impact of intensive farming, or water quality. BCI took this responsibility seriously and were the first in Canterbury to operate under a Scheme Nutrient Discharge consent, employing specialist staff to ensure real change occurred on-farm.

I am now advising the Minister of Water Resources in the Republic of Uzbekistan. I started a twelve-month contract in April, based in the capital city Tashkent.

The role is quite varied and focuses on the upgrade of infrastructure to improve efficiency of water delivery and use. I lead two new departments at the Ministry, one is driving the implementation of digital technology and the other is the use of Public Private Partnerships to manage and fund infrastructure. I also support the Centre for Foreign Investment which seeks funding from International Funding Institutions.

The task here is massive. Although the country has 2,500 years of irrigation history, the Soviets built most of the infrastructure around the same time as New Zealand developed early irrigation schemes approaching the middle of the 20th century. The Soviets decided to

An aerial shot over Tashkent in Uzbekistan. *(Photo: Adobe Stock)*

use Uzbekistan for production of cotton and increased the irrigated area from its 1.2 million hectares in the early 20th century to around 4.3 million hectares.

The development over this period was incredible. As an example, the 270 kilometre long Great Fergana Canal here was built in 45 days in 1939 by 160,000 people. Two major river systems, the Syr Darya and the Amu Darya, had huge water resources that were exploited. Both rivers lead to the Aral Sea and because of the development the Aral Sea has gradually drained and is seen as one of the most significant man-made environmental disasters of all time.

When the Soviet Union collapsed in the early 1990's many of the water management experts returned to Russia and Uzbekistan was left without the financial resources to continue to invest in the irrigation infrastructure. Over the subsequent period much of the infrastructure deteriorated.

In addition, the carve-up for the former Soviet Union meant that the rivers flowed in and out of the various new states causing subsequent transboundary water management issues that have caused many conflicts.

Over this period the Government required a shift from primarily cotton production to include other crops to ensure self sufficiency in food production. Now wheat is a major crop to help feed the near 35 million population.

The confluence of the Naryn River and Kara Darya where the major Syr Darya starts, with Foziljon, Farkhod.

"The New Zealand irrigation industry is very advanced internationally and Kiwi farmers have always been (needed to be) early adopters of new research and technology, where it is practical, to improve efficiency in our businesses. We have also always had a strategic approach to our businesses that allows us to see beyond the day-to-day operations. These are the things we have to offer the developing world."

Only in recent years has a programme to reconstruct the ageing infrastructure been implemented, relying on funding of Multilateral Development Banks such as World Bank and Asian Development Bank. Much of the focus has been on concrete lining of canals to reduce water losses and upgrading of inefficient pump stations to reduce the energy burden. The energy bill for the irrigation network is second only to the military budget in Uzbekistan.

In 2020 a Presidential Decree approved a Water Development Concept for 2020–2030 which was followed by a Strategy for 2021–2023. These were prepared with the assistance of international consultants and set out quite specific targets for improvement of the water management system in Uzbekistan. Targets range from increasing the area irrigated by water saving technologies such as drip irrigation, through to implementation of digital monitoring of the many thousands of sites in the distribution network.

Facing dire consequences of reducing water supply due to climate change, Uzbekistan is seeking to position itself to meet the needs of its growing population into the future. My role here is to assist with meeting the Concept and Strategy targets and bring my experience to help develop a highly efficient water management system.

I had put some feelers out for potential international roles over the last couple of years. I got an introduction to the Ministry of Agriculture and Ministry of Water Resources in Uzbekistan through one of the key suppliers to the New Zealand irrigation schemes who were preparing a pilot project here.

Uzbekistan is a developing country, predominately Muslim, and they speak Uzbek and Russian. There are not too many similarities to New Zealand. That said, the locals are very welcoming, and the country feels very safe.

The Covid-19 statistics here show relatively low numbers which have risen from 50 per day to around 400 per day since I have been here. Many are not convinced that the numbers are capturing what is going on in reality, plus the people are taking a reasonably relaxed approach to things like social distancing and mask wearing.

My wife Jane hasn't travelled with me on my initial trip and I do feel isolated when I am not busy. On the positive side I have found reasonable coffee shops near work and my apartment and have done a lot of exploring around Tashkent.

The New Zealand irrigation industry is very advanced internationally and Kiwi farmers have always been (needed to be) early adopters of new research and technology, where it is practical, to improve efficiency in our businesses. We have also always had a strategic approach to our businesses that allows us to see beyond the day-to-day operations. These are the things we have to offer the developing world.

In return, the developing world can give us a reality check on what is really important. Growing our New Zealand businesses and export-based economy is important, but relies on a stable global economy. This in turn relies on people in developing economies enjoying some basic needs to avoid future disruption.

Also, without advocating for government control of irrigation infrastructure in New Zealand, it is highly satisfying to be involved in a water industry that is attempting to implement a national strategy to ensure it meets the future needs of it people.

Technical matters

By Stephen McNally, Principal Technical Advisor, IrrigationNZ.

Whoever said, variety is the spice of life, certainly must have had an inkling of what the role of Principal Technical Advisor with IrrigationNZ would be like. This is my first column in this magazine and you'll see from the activities below there are many and varied topics that I want to brief you all on; this column will be a regular feature going forward where you can read how IrrigationNZ is working on your behalf to assist the irrigation sector navigate the complexities of technology developments, upskilling opportunities and the interplay with legislators that frame up some of your irrigation infrastructure decisions.

I must point out that many of the working groups IrrigationNZ participates in, where we are accepted and valued for providing our depth of industry knowledge to balance and augment others around the various tables, comes with obligations of objectivity, discretion, and trustworthiness. So, whilst I can reference in this column some initiatives in detail, others have commercial sensitivities or are at a delicate point of collaboration.

So, I will kick off with some feedback for you on the working groups we are involved with … moving from my role in a busy infrastructure consultancy to this organisation has been a whirlwind of activity of a different kind, and I must say exciting and rewarding already.

DAM SAFETY REGULATIONS IN NEW ZEALAND

The best available data shows that New Zealand has around 3,300 known dams. Since 1960 there have been 25 known dam incidents in New Zealand, with at least 14 being considered serious. The Building Act contains provisions for regulating post-construction dam safety. However, regulations are needed to give effect to those provisions.

The public discussion paper from the Ministry of Business, Innovation and Employment (MBIE) on the proposed dam safety regulations proceeded to a consultation period that ended on August 6, 2019 with 106 submissions received, including from IrrigationNZ. Stakeholders were largely supportive of the proposals made in the public discussion document. However, they raised several specific concerns. Key issues raised particularly for small farm dams included the threshold for a dam's inclusion in the regulatory system and the ability of a limited pool of appropriately skilled engineers to conduct assessment of risk. The policy proposals have been revised to reflect stakeholder feedback and IrrigationNZ is pleased with the direction that has set more acceptable limits. We agree that the community and environment need to be protected from the impact of dam failure but a pragmatic approach to excluding dams that pose low risk is needed. We are working with MBIE to further develop guidance and information to help farmers and their advisors in understanding the height, volume, and risk category for their dams.

WATER SERVICES REGULATOR BILL 2019

The Water Services Regulator Bill 2019, is aimed at providing safe drinking water throughout the country and improving on the performance of our wastewater and stormwater networks that manage, treat and discharge water back into the environment. The Department of Internal Affairs (DIA) established the Water Services Regulator – Taumata Arowai – in part to work alongside the Ministry for the Environment (MfE) National Environment Standards for Drinking Water.

Significantly for irrigation schemes or farming operations, the DIA is now looking to implement Approved Treatment Solutions for Small Rural Supplies. Where a water supplier allows the use of water for human consumption, there are proposed thresholds for the number of people supplied that will trigger requirements for safety management such as filtration of sediments and treatment of bacteria to a safe standard. This may therefore apply to an irrigation scheme where households also draw water from it or individual farming operations that make water available to multiple homes or staff facilities from one supply. The proposed acceptable solution defines what is required for point of entry treatment systems installed at buildings supplied by agricultural drinking water supplies. It describes the design, configuration, installation, operation, maintenance, testing, monitoring, emergency management and auditing that is required.

IrrigationNZ is part of a working group examining the initial working drafts and the practicality of requirements under this legislation.

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

Introduced in 2010, the Resource Management (Measuring and Reporting of Water Takes) Regulations have driven considerable activity around the installation and verification of accuracy of water measurement devices. Whist we have become familiar with the need for accuracy of measurement and data recording, in late 2020 the regulations were amended to introduce a staged timeline requiring anyone with a consent taking over five litres of water a second to: a) measure their water use every 15 minutes, b) store their records, and c) electronically submit their records to their council every day.

Compliance dates for existing water permit holders

Water Permit	Date for Compliance with the Regulations
20 L/s or more	3 September 2022
10 L/s or more, but less than 20 L/s	3 September 2024
5 L/s or more, but less than 10 L/s	3 September 2026
Less than 5 L/s	Not required to comply with the Regulations

For water permits granted after the 3 September 2020, there is no transitional period, and hence compliance with the Regulations are required immediately, as soon as water is taken.

Arising from the 2010 regulations, whole new businesses were established, and accredited by IrrigationNZ, to meet the demand for these important pieces of equipment and data management. Water meters are needed not only to meet water take consent regulatory reequipments but also to add a valuable

tool to the farm environment management toolbox to ensure efficient management of water and energy resources used for irrigation. IrrigationNZ is working closely with MfE and our industry members to refresh our guidance material and accreditation processes to reflect the amended regulations.

FISH SCREENS ON IRRIGATION WATER INTAKES

Fish screens on irrigation water intakes are subject to varying regulation and approaches across New Zealand. IrrigationNZ has been working closely with Regional Councils, schemes, individual irrigators, and the industry in finding a pathway through consent requirements and the guidance for best practice design. A Ministry for Primary Industries (MPI) funded project is nearing a stage milestone completion and further interaction with the irrigation sector is being undertaken.

The valuable research and investigations to date have revealed some critical information and highlighted where consistency is required. Unfortunately, the journey is not yet over, and additional New Zealand specific research is needed to fully understand the effectiveness of fish exclusion for our unique native species. The implications of the fish screen project are significant for regulators and the industry alike, as large structures are complex to design, build and monitor.

The IrrigationNZ project team is working to fill the knowledge gaps and drive best practice while considering the practical implications of large infrastructure capital costs.

FERTIGATION

Fertigation, or the addition of soluble nutrients to irrigation water, is a growing feature of large-scale pasture irrigation systems in New Zealand. While a fundamental part of many horticultural operations, where the technology and management practices are mostly well understood, the use of fertigation on large pastural operations is more recent. The Government's freshwater regulations were released in August 2020 and place restrictions on synthetic nitrogen use in what is known as the 190kg N cap. The IrrigationNZ project is working closely with a student research programme at Lincoln University. A possible method of maintaining production under the 190kg N/ha restriction could be the application of dissolved/ liquid nitrogen (urea) fertiliser with irrigation water, as it allows for nitrogen to be applied frequently at small doses preventing nitrogen losses through ammonia volatilisation or nitrate leaching. This was tested in the 2019/2020 irrigation season. The first year of the fertigation project was to develop an understanding of any potential yield or feed value differences between the use of solid vs liquid nitrogen applied at different frequencies but maintaining an equal monthly allocation N/ha/year. The first year showed there was no consistent significant difference in dry matter production, pasture moisture percentage, clover percentage, nitrogen percentage and pasture quality (crude protein dry matter digestibility, neutral detergent fibre and metabolisable energy) between the nitrogen treatments.

As the year 1 trial showed no significant difference in pasture quality and production a second trial was carried out. The treatments for the second-year trial included a repeat of the treatments of the first experiment plus both solid urea and fertigation as shoulder treatments. The shoulder treatments and the reduction nitrogen treatments are therefore two methods of decreased nitrogen application. IrrigationNZ and industry partners are now analysing the two years of results and looking at communication of recommendation during 2021.

Fertigation trial site at Lincoln University.

THE WATER AVAILABILITY AND SECURITY ADVISORY GROUP

The Water Availability and Security Advisory Group (WASAG) is an initiative driven by MPI. The purpose of the WASAG is to provide insights that guide the future shape of government policy and investment in water availability and security. It is considering how lessons from past and current policies and infrastructure development case studies can guide future strategies, while also considering the developing regulatory settings and key challenges such as a changing climate.

Current investment is largely focused on community-led initiatives that align with specific policy objectives. This approach is partly reflective of a swing in New Zealand's public interest in our freshwater resource. The mantra of a plentiful, underutilised resource has swung to that of a life-supporting taonga in need of protection and nurturing. The NPS for Freshwater Management refers specifically to Te Mana o Te Wai which refers to the vital importance of water. When managing freshwater, it requires firstly the health and well-being of the water is protected, secondly human health needs are provided for, before thirdly enabling other uses of water. It expresses the special connection all

New Zealanders have with freshwater.

In a quote from MfE information, Dr Mahina-a-rangi Baker, a member of the government's advisory group Kahui Wai Māori who specialises in environmental planning and science says, "In practice, upholding Te Mana o Te Wai means taking steps like protecting wetlands, ensuring fish passage up and down catchments, ensuring that practice on-farm is improving to reduce contamination and being more conscious in our decision making with regards to freshwater" … across both rural and urban environments.

This means that a different holistic approach is needed that represents the evolution of past approaches and provides for the taonga, while also enabling equitable benefits across cultural, social, and economic interests. IrrigationNZ is one of the industry bodies providing valuable information to the officials in WASAG.

CERTIFICATE IN IRRIGATION DESIGN

Great news, the Certificate in Irrigation Design (NZCID) is up and running again in 2021.

This industry and regional council supported qualification and training course will help you acquire the specialist skills required to design efficient and sustainable irrigation systems. This Level 5 certificate runs for 18 months and is suitable for people with prior knowledge and experience in irrigation. You will be required to attend three face to face training modules and complete four assignments. Two of those assignments require you to design two different irrigation systems. To do this you will need access to two properties which are in the process of developing irrigation.

At the end of this programme, you will be able to:

- Work with the customer to best determine the irrigation needs on their property.
- Assess soil moisture parameters, water consent conditions and local climate data.
- Design the system most suitable to meet these needs.
- Prepare design reports and understand the commercial proposal and contract.
- Plan the installation, testing and commissioning of the new system.
- Prepare as-built drawings and an operation and maintenance manual.

The course is supported by NZQA approved Unit Standards and as such the assessment process is rigorous. Your requirements will be:

- A completed irrigation system design brief for two properties.
- An example contract to deliver the project, as-built drawings, and installation and commissioning plans for an irrigation system.
- An operation and maintenance manual for an operator.
- Worked examples and questions relating to hydraulic design.

As part of the course, you will receive training resources, IrrigationNZ templates, and guidelines, meet industry experts and carry out real world engineering tasks based on a field trip to an operational irrigation system.

To view the latest course intake dates, go to www.irrigationnz.co.nz and download the registration form, or contact admin@irrigationnz.co.nz

IRRIGATION ENGINEER

Irrigation Engineer is a new career pathways and competency framework being developed by IrrigationNZ and industry.

We have been working with our industry services members grappling with the problem that there is currently no viable career pathway available for those entering the industry. Whilst there are some similar learning and competency programmes in the milk pumping and urban water industries, the lack of specific irrigation engineering qualifications is making it hard to attract talent into the sector and to retain staff when other industries can offer a trade qualification. We have engaged extensively with several industry training organisations (ITOs) in the hope that an NZQA recognised irrigation engineer apprenticeship could be developed. The ITOs are facing their own challenges with restructuring of tertiary education roles and responsibilities and while talks have progressed, we have reluctantly reached the point where it will not be possible at this time to form a bespoke apprenticeship. The

skills required to be learnt cross over many ITOs and there is not currently an effective system in place to develop a qualification across ITOs. This has been extremely disappointing for us and our industry to conclude.

However, coming out of the talks with the ITO's, and after further discussion with industry, it has become apparent that the best way forward to support the continued growth and development of those in the irrigation sector is to develop the competency credentials and training content (where not already available) ourselves. We envision the training pathway to involve options to train in entry level role/s such as an irrigation technician and then a pathway to follow to progress to an irrigation engineer. Some of the content will also provide a linkage to the irrigation designer qualification that already exists. The training will be a mix of smaller block courses, possibly micro credentials, as well as online learning and on the ground training. Where there is existing training already available, the framework will guide people to the appropriate course. As well as covering the fundamentals of the practical aspects of the job so that an employee can 'work the tools' safely and knowledgeably, we would also like to have modules developed around Te Mana o Te Wai, the drinking waters reform and the social responsibility we have as an industry to look after our environment.

By upskilling those in the industry and teaching them best practice irrigation this knowledge in turn will be passed on to those irrigation operators in the field that they work with, having the desired outcome of producing better irrigation solutions for our communities.

TECHNICAL ADVISORY GROUP RE-ESTABLISHMENT

With the move of IrrigationNZ head office to Wellington in 2020, to allow key staff to be closer to the cut and thrust of advocacy around legislative development and work shoulder to shoulder with other industry bodies already in the capital, the ability of IrrigationNZ to support activities in the technical advisory space has also improved. However, the breadth and depth of technical issues already facing the industry, plus the rate of technological change being driven by responses to global factors of population food demand, consumer food preferences, freshwater availability and climate change is dramatic. To build on the internationally acclaimed knowledge base held within the New Zealand primary sectors and irrigation industry, IrrigationNZ is in the process of re-establishing a Technical Advisory Group.

In the past this group provided support to the Board and staff of IrrigationNZ, providing pragmatic and independent information helping to identify future opportunity for continued sector improvements. This group will be re-established in 2021 on primarily a voluntary basis and along with the support of IrrigationNZ honorary life members and will aim to obtain additional contributions to add specialist knowledge areas. One of the initial tasks will be to conduct a broadly focused gap analysis, considering the various roles and information IrrigationNZ currently has in the technical fields, and contemplate leadership opportunities for future issues impacting the irrigation and freshwater sectors. Outputs from this Technical Advisory Group will be reported to the membership through this magazine and other forums.

Alert: First battery water meters reaching end of life

The service industry has reported to IrrigationNZ an increase in the number of battery-operated water meters going flat. Most battery meters have a life span of 10 to 15 years. The water meter regulations have now been in place for 11 years, so we expect to see more batteries failing in the coming years.

It is important that you check your meters are still operational on a frequent basis. This should be completed as part of your pre-season checks and throughout the irrigation season. If they are showing signs of going flat or are no longer operational, engage a Blue Tick installer to undertake maintenance or replacement of the meter.

Find a full list of 'Blue Tick' accredited companies at www.irrigationaccreditation.co.nz

Looking after natural assets – the key to New Zealand's resource management

Fish screen design and installation involves significant investment. Given the large capital outlay ahead for irrigators, clear expectations need to be set around how to achieve effective fish screens, alongside the provision of greater certainty that the designers and installers of fish screens can achieve long-term, affordable, and compliant screens for irrigators.

Studies have shown that most fish screens are not effective at screening fish and returning them uninjured to their source. The Regional Committee of the Canterbury Water Management Strategy formed the Fish Screen Technical Working Group to investigate this and make any findings applicable in a national context.

In late 2019 IrrigationNZ (on behalf of the New Zealand Fish Screen Technical Working Group), received a grant from the Sustainable Farming Fund to further research fish screen design criteria. The aim of the research is to provide clear and simple guidance on fish screen requirements and provide solutions and guidance on existing fish screen deficiencies.

This work is helping to develop more effective fish screen designs by getting a better understanding of fish behaviour at intakes, improving design guidance and informing the development of appropriate future consent conditions.

Bridget Zoe Pringle is the Technical Project Manager of the Fish Screen Project, we caught up with her to learn more about fish screens and her involvement with the project.

Bridget Zoe Pringle is the Technical Project Manager of the Fish Screen Project.

Where are you based and what is your role?
I am based in Temuka, but generally work between Christchurch, the Upper Waitaki Catchment and South Canterbury. I am the Project Manager (Technical) for the IrrigationNZ *Adoption of Good Practice Fish Screening* project. I also work with Irricon Resource Solutions as a Senior Environmental Consultant and am a Director and Project Manager for UAV Services – an aerial data gathering company.

How did you get involved with water management/resource management, what is your background?
I grew up on a farm in North Otago where I spent countless hours mucking around in the local river. I think this is where my interest in water and rivers originated – I find everything about water interesting and especially so in New Zealand! I am married to a mixed arable, vegetable and fruit producing farmer and water plays a massive role in our family life, both on farm and recreationally.

I hold a bachelor's degree in Resource Studies and have worked in the field of resource management in New Zealand and the UK for over 15 years. I have experience in freshwater quantity and quality management, fisheries management, and planning/legislation processes, including preparation and presentation of submissions in hearings and presenting expert evidence in the Environment Court.

Why is resource management important to you – specifically freshwater?
Natural resources – land, water and air, are the only reason we can exist.

Management of natural resources, now and for future generations is the core of New Zealand resource management legislation but is fraught with competing demands between human uses – economic, cultural, recreational, inherent values, and again between humans and other species – taonga species, unique fisheries, invertebrates, plants and other habitat/ecological values. There are

Intake screen with submersible pontoon.

linkages between all these values and there is always a 'knock on' effect of any resource use. Recognising and managing these effects, whilst it can be a very challenging and adversarial space to be in at times, suits my management style and inherent interest in natural sciences.

How did you get into the fish screen project and why?

I was probably approached to manage the Fish Screen Project because of my fisheries and planning background and the relationships I have with the various stakeholders. I was a member of the original Fish Screen Working Party around 2007 and managed to gain some good technical and planning knowledge via that process and in other consulting roles I have held. IrrigationNZ's Commercial Manager Julie Melhopt handles all the financial aspects of the project and we have become a good team over the last year, this support has helped me immensely in the role.

What are the hopeful outcomes of the project?

This project is a two-year national research project predominantly funded by Ministry of Primary Industries and facilitated by Environment Canterbury. The project has various stakeholders that include skills in understanding of irrigation systems, technical fish screen design and installation, biological fisheries and habitat criteria, cultural values, field and laboratory testing methodology and implementation, policy/planning/compliance and recreational values in a national context.

The goal of the project is for the Fish Screen Technical Working Group to provide clear guidance and recommendations around how to achieve effective and compliant fish screens in New Zealand.

> "The goal of the project is for the Fish Screen Technical Working Group to provide clear guidance and recommendations around how to achieve effective and compliant fish screens in New Zealand."

What has been done so far? What is still to do?

There are several milestones and deliverables associated with the Project and as expected the group has learned a lot and adjustments have been necessary to the project schedule as new matters have arisen. The sheer number of stakeholders and respective skill sets has meant we were able to split the main Fish Screen Technical Working Group into three sub-groups – a Technical Advisory Group, a Communications Group and a Planning/Legislation Group. Note: the Fish Screen Working Group (and its sub-groups) provide recommendations and guidance and do not make regulatory decisions.

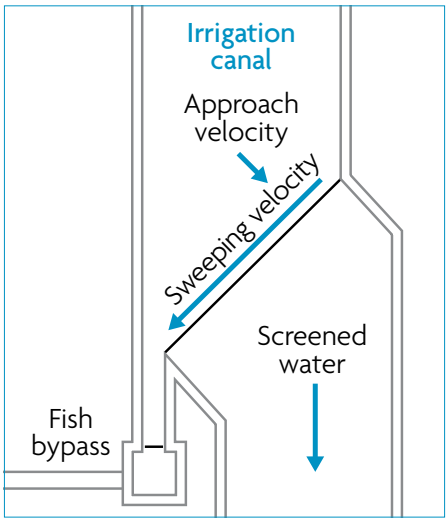
To date the following has been achieved:

1. A Summary Status Report has been produced that identified gaps to address, compared fish screening regulations/implementation throughout New Zealand and provided updates to existing information.
2. Secured site agreements with irrigators to participate in the physical installation of Best Practice Screens for field trials.
3. Technical Options Reports for these irrigators.
4. Survey and design work for preferred options.
5. Concurrently, various laboratory (indoor and outdoor) trials looking at fish behaviour have been conducted with different fish species and reported on.
6. Held an Industry Engagement Workshop with industry (engineering and manufacturing) to discuss common issues and present findings to date.
7. Developed an online Guidance Tool (working draft) to help irrigators, designers, engineers, fishery managers and regional councils to identify appropriate locations and types of screens suitable for their scenario.
8. Ongoing updates and discussions between stakeholders, both online and written.

Why are fish screens so important? What do they aim to do?

Over the last two decades, issues relating to the management of water and the effects of water use have been a focus of central government. Statutory agencies and regional councils have particular legislative responsibilities and functions relating to fish and fish passage and irrigators must avoid, remedy or mitigate adverse effects caused by their activity.

Freshwater fisheries have suffered serious decline over this time, in particular, there has



Basic fish screen concept.

been a significant increase in the number of threatened native fish species. Many of our species are diadromous (migrate between freshwater and marine environments) which makes them particularly susceptible to becoming entrained in irrigation intakes of all sizes. As above – there is always an environmental 'knock-on' effect of resource use that needs to be effectively managed.

Whilst we have existing guidance with key criteria relating to effective fish screening, there remains uncertainty about the 'what to achieve' and 'how to achieve it'. In an engineering and design sense the business of fish screening is much trickier than it sounds – differing species act and move in different ways, within different parts of the water column, at different stages of their life cycle – this has become very apparent in our recent lab trials, and coupled with hydraulic issues in and around structures, consenting/compliance and the costs involved of screening (generally between a $10,000 for a small intake right up to over $15 million for large schemes) there is a lot at stake for both fisheries and irrigators.

An effective fish screen is an essential part of any surface water irrigation infrastructure.

Fish screens come in big and small sizes.

Cylinder screen on dual pipe.

What are the three main things considered when installing a fish screen?

The Guidance Tool, developed as part of this project, has been designed to help you determine the appropriate location and type of screen for your scenario. There are seven key technical criteria to consider when designing and installing a fish screen and you need to work your way through a number of considerations for each of the following criteria:

1. Location
2. Approach velocity
3. Sweep velocity
4. Fish bypass at screen
5. Connectivity of the bypass to the natural ecosystem.
6. Screening material
7. Operation and maintenance.

The Guidance Tool is available at www.irrigationnz.co.nz/KnowledgeResources/FishScreens

What has working on this project taught you?

This is one of the most technical projects that I have managed, with significant implications for irrigators and fisheries alike. It is not often that you get the opportunity to collate such a diverse and large number of stakeholders, some with statutory roles, some with representative roles and some with industry roles (irrigators as well as designers and manufacturers).

The stakeholders have all come from vastly different 'starting' points, but I have noticed a real shift in general approach, and everyone involved has been able to openly 'dare to disagree' and then constructively work through the issues towards the common goal. We still have a way to go, but I am looking forward to the next steps and getting some real outcomes from the project.

For further information on the fish screen project including project updates and reports produced to date please visit www.irrigationnz.co.nz/KnowledgeResources/FishScreens

Certificate in Irrigation Design

TTAF Funding Approved

New Zealand Certificate in Irrigation System Design – Due to over subscription of the 2021 intake, we are adding a second intake starting February 2022.

Acquire the specialist skills essential to design technically efficient and environmentally sustainable irrigation systems. This Certificate is suitable for people with prior knowledge and experience in irrigation. You will be required to design two different irrigation systems so will need access to properties developing irrigation.

At the end of this programme, you'll be able to:

- Work with the customer to best determine the irrigation needs on a property.
- Design the system most suitable to meet these needs.
- Plan the installation and commissioning of the new system.
- Prepare design reports, as-built drawings and an operation and maintenance manual.

Irrigation New Zealand is now taking expressions of interest from those people wishing to attend our next course starting in February 2022. The full course is run over 18 months and includes three classroom modules which will be scheduled over Summer/Autumn 2022.

The Certificate in Irrigation Design has recently been approved by the Tertiary Education Commission for the Targeted Training and Apprenticeship Fund (free trades training). This funding is currently available to cover course fees for those students working in New Zealand until December 2022.*

*Conditions may apply and funding criteria is subject to change.

To register your interest and to receive notification when registrations open please email admin@irrigationnz.co.nz with your contact details.

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GIS mapping and irrigation

Dianne Zuchetto is a Geospatial Consulant, running her own geospatial consultancy. She provides data, mapping, and analysis to clients to help them formulate policies and make informed decisions, some of those decisions being involved with irrigation.

What is GIS mapping?

GIS (Geographic Information Systems) mapping is a smart computer-based map. You are familiar with paper maps such as a road map, or even Google Maps. A GIS map takes this to the next level, by including information about the point, line and polygon features contained within. For example, a road on a GIS map may contain information about its length, the type of surface, its installation date, and maintenance programme. The road on a GIS map can then be used to get directions, model real world traffic flow and congestion, and calculate route diversions. Outputs from a GIS may include analysis results presented as tables, charts or maps. GIS is not limited to a flat surface (two-dimensional). GIS can be used to model three-dimensional (3D) space and across time such as tracking migratory animals.

How did you become involved with it?

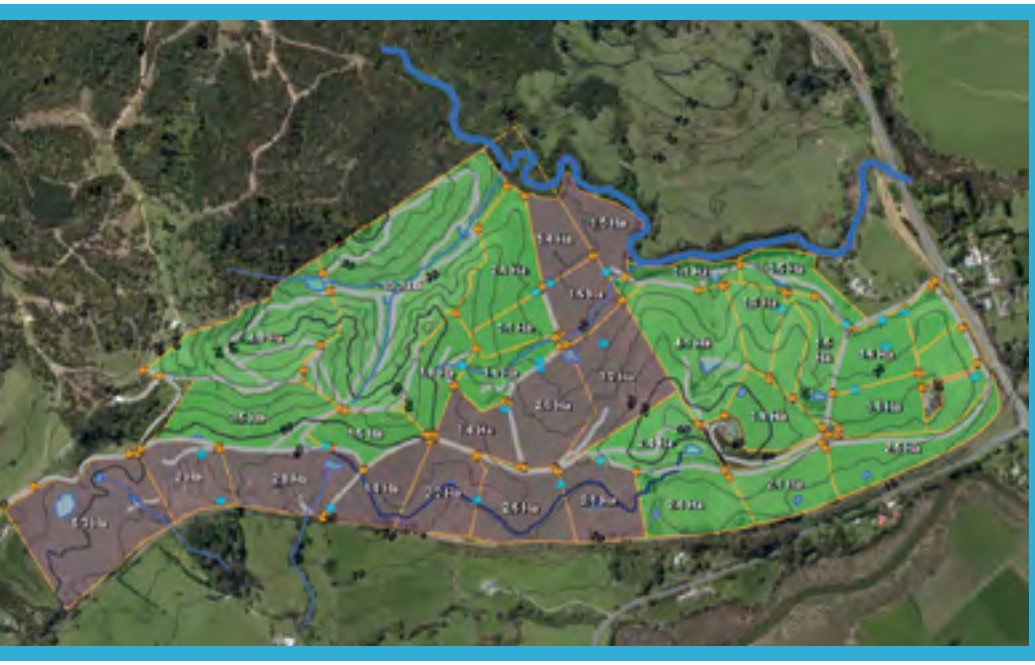
Having been brought up on a farm, I would often sit with my father while he studied a large aerial photo of the farm. My father would take out his ruler and measure off new fencelines and work out the area of paddocks for fertiliser application. I was interested in physical geography and went on to complete a science degree with double-major in geography and geology, which are both map and location focused disciplines. Armed with a good foundation in geosciences, I built on that with a Masters of Applied Science degree in GIS. Back then, GIS was a new discipline as technology was just starting to take off. I loved the combination of computer science, data and my geoscience background to build models and analyse the real world. I have now accumulated over 25 years' experience in the geospatial industry in Australia and New Zealand for various private and government agencies. When I started in GIS, data wasn't readily available. I spent the first few years of my career creating data, such as roads, property boundaries, vegetation cover, satellite images, and 3D terrain models like those used in Google.

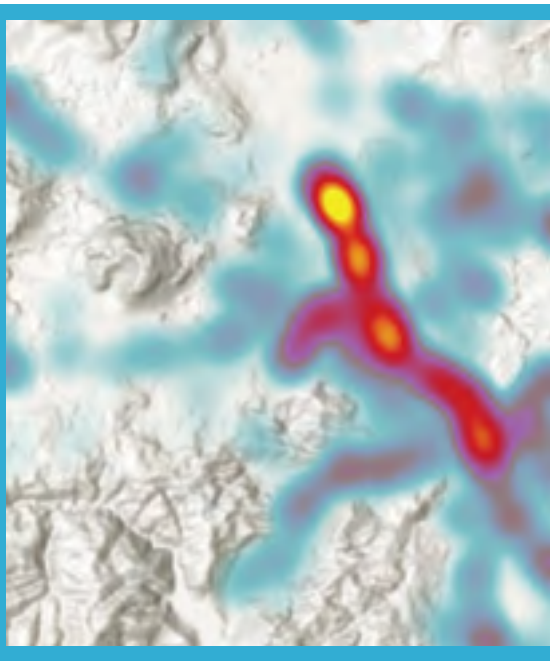
> "With the combination of different pieces of information and mapping layers such as soil type, soil moisture, vegetation cover, climate, topography, groundwater quantity and more. GIS can be used to calculate the volume of irrigation required and best installation location to achieve optimum growing conditions."

Dianne Zuchetto.

How is it done?

GIS is a combination of computer software and data storage. The features you see on a map are stored as point, line or polygon





data in a database with attributes containing information about them. The data is then displayed either as a map, table or chart. Data can be combined to model the real world or answer questions. For example, soil moisture, soil type, vegetation cover, topography, and climate can be used to calculate the quantity of irrigation required to achieve optimum growing conditions.

What do you enjoy about it?

I enjoy discovering patterns, looking at spatial relationships, undertaking data analysis, combining multiple layers of information, and helping people answer questions that will enable them to make informed decisions. Often in the analysis you discover additional information that wasn't considered and adds a new angle to the discussion. I enjoy integrating science into evidence-based planning.

How is GIS mapping important for irrigation?

GIS will be very beneficial in the planning and implementation phases of irrigation. With the combination of different pieces of information and mapping layers such as soil type, soil moisture, vegetation cover, climate, topography, groundwater quantity and more. GIS can be used to calculate the volume of irrigation required and best installation location to achieve optimum growing conditions. Any of the variables can be updated and changed to give a property or catchment-wide assessment, and the assessment can be repeated when new information becomes available. Taking it to the next level, using smart technology above and below the ground the field information can be feed live into a GIS system to produce the most efficient use of a resources for any given area.

Where do you see the future of GIS mapping going – could it be used to help farmers in different ways in the future?

GIS has come a long way, and Google has helped a lot with that. While people may not know what GIS is, they are familiar with Google maps. They may have used Google Maps or Google Earth to map their holidays, find a business, get directions, which is all GIS in action. In the future, GIS will become even more mainstream and user friendly with the use of AI (artificial intelligence), VR (virtual reality) and machine-learning. This is where it will help landowners, by being more user friendly with processes becoming more automated. For example, we can currently use Google to get directions from A to B. For landowners, GIS may automate and simplify the calculation of the best place for an irrigation line given the source and destination points. With driverless vehicles, it may also mean automation of fertiliser and irrigation applications.

In addition to the advances in technology and capabilities of GIS, land-practices are being scrutinised more often with farming often being in the headlines. Government legislation and national policy statements around freshwater quality, and biodiversity, mean GIS will be invaluable for landowners to plan, manage and monitor their activities and mitigate environmental impacts, as well as providing empirical evidence for the good work they already do.

What are you working on at the moment?

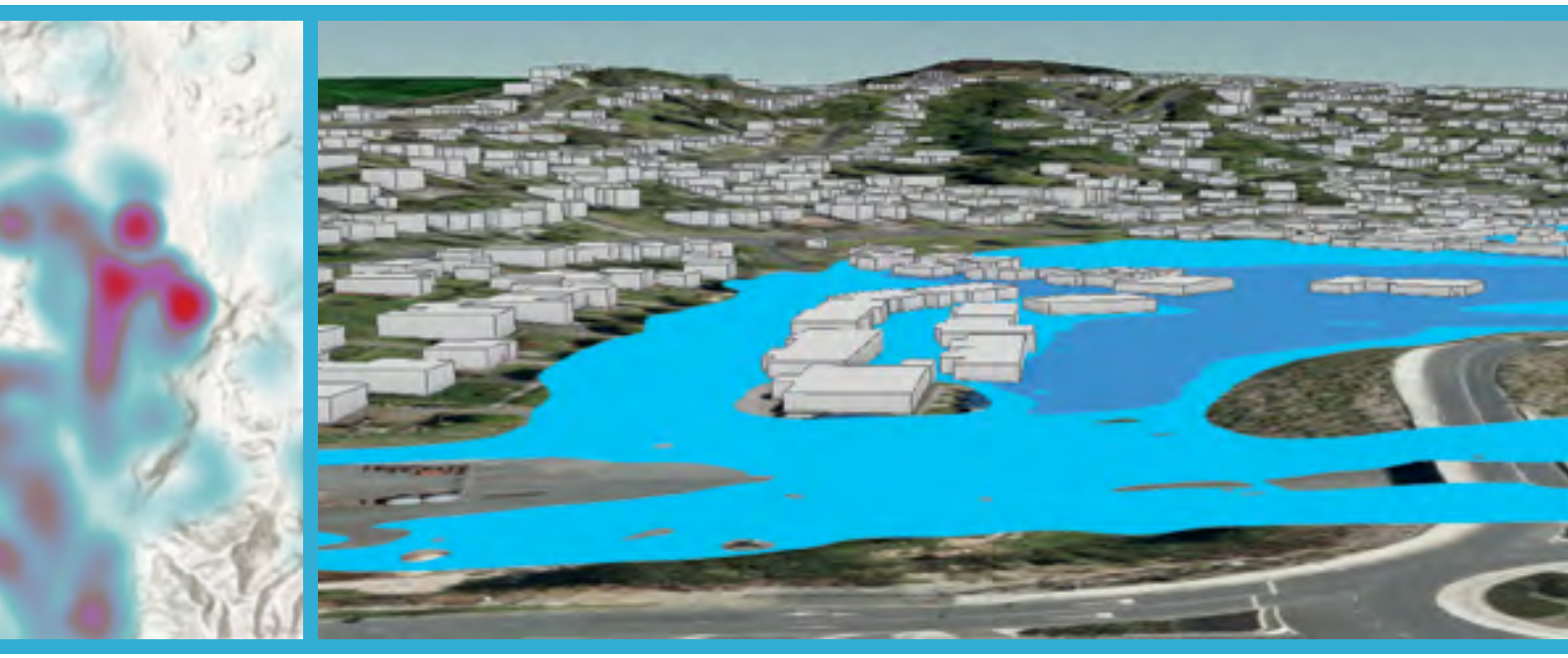
I have recently hosted a series of webinars with the NZ Landcare Trust, helping landowners and catchment groups map their properties, waterways, vegetation cover, infrastructure, and critical source areas. The webinars showed landowners how they can use a simple mapping tool to create maps, how they can use it for fencing estimates, fertiliser application, irrigation, water reticulation, crop rotation, revegetation, winter grazing, and feed budgets. The aim of the webinars was also to enable landowners to undertake their own mapping and give them autonomy over their content and data.

"... GIS will be invaluable for landowners to plan, manage and monitor their activities and mitigate environmental impacts, as well as providing empirical evidence for the good work they already do."

The next piece of work for NZ Landcare Trust is creating an interactive web map that enables landowners and members of the public to contact their local Landcare/catchment coordinators and to find local catchment and Landcare groups to work with.

I am also working on various town planning, spatial plans and strategy projects for local councils. These involve combining different pieces of information, mapping layers and analysis to provide the detail required for policy formulation and decision making.

The images below show examples of GIS in action. From left: a farm map; a population density graphic, and a flood assesment visual.



Urban Kiwis keen to buy food direct from farms to support sustainability

In late March 2021, New Zealand's second annual Open Farms Day welcomed more than 2,700 Kiwis onto 37 farms across the country. Designed to reconnect Kiwis with New Zealand's land, food and farmers, the event enabled the Our Land and Water National Science Challenge (an event sponsor) to conduct a survey into attitudes towards food and fibre production.

A recent study shows that many urban New Zealanders see buying food directly from farmers as the most effective action they can take to support sustainable farming.

The insight, from research by the Our Land and Water National Science Challenge and Open Farms (a nationwide Open Farm day event), suggested direct relationships between farmers and citizens could be a pathway towards more sustainable farming practices.

The research explored shared urban and rural visions for sustainable farming, said Our Land and Water science leader Dr James Turner, also a senior AgResearch scientist.

"High food prices and the influence of large market players are perceived to be preventing sustainable outcomes," he said. "We also found a standout potential solution from urban respondents – buy food direct from a farmer."

KEY RESEARCH INSIGHTS INCLUDED:

- **A shared vision of sustainable farming**

Urban and farmer respondents generally shared a vision of more diverse landscapes, fewer chemical inputs, and farming practices that improve soil and water health.

When asked to rank sustainable farming practices, urban respondents cited 'regenerative practices', 'reducing inputs and 'diversity' as their top three. Farmer respondents rated 'diversity' and 'farm environment plans' as their top two sustainability practices, followed by a third tier including 'regenerative practices', 'reducing inputs' and 'higher-value end products'.

- **Barriers to the vision**

Urban and farmer respondents agreed that the biggest barrier to sustainable farming was the purchasing and pricing power of large market players, like supermarkets.

"Respondents generally understood the nuance of food systems issues – like how demand for cheaper food can drive unsustainable practices, or how supermarkets can act as a gatekeeper to market, excluding more sustainable producers through price setting. These findings echo concerns raised by the Australian Commerce Commission and Consumer NZ around the vulnerability of farmers in this kind of competitive price market," said Dr Turner.

- **Food: too expensive as it is**

Only one percent of urban respondents believed food was too cheap in New Zealand. 40 percent suggested it was priced about right and 59 percent that food was too expensive. Despite clear concern that farmers should receive a fair price for their produce, price increases for food in New Zealand were not recognised as a likely pathway towards sustainable farming.

Source: Our Land and Water – ourlandandwater.nz

THE WAY FORWARD: FOOD DIRECT FROM THE FARMER

Urban respondents clearly viewed buying food direct as the "best way to support farmers".

At 29 percent, purchasing food direct from the farm was ranked as the most effective sustainable food action customers could take, followed by buying New Zealand grown food at 21 percent.

Whether through farmers' markets, online direct sales, roadside stalls or small shops, respondents associated direct-from-the-farm food with quality, community benefits and supporting farmer's environmental practices on the land. Logistics and convenience were cited as their main barrier to more direct-from-the-farm food, but not price – reflecting a recent study from Farmer's Markets New Zealand showing 80 percent of like-for-like shopping baskets were cheaper at a farmer's market than the local supermarket.

Dr Turner said the research "signals an opportunity for farmers to find support and funding for sustainable farming, through direct-to-citizen food systems".

"But we need to recognise that selling direct is currently challenging because our food system is set up for mass production and big retailers. While it is encouraging to see such alignment between farmers and wider society on what sustainable farming looks like, we need relatively significant structural changes to our system to help farmers realise the benefits of this closer connection."

ABOUT THE OUR LAND AND WATER NATIONAL SCIENCE CHALLENGE

Our Land and Water is one of 11 MBIE-funded National Science Challenges taking a more strategic approach to science investment by targeting a series of goals that, if achieved, would have major and enduring benefits for New Zealand.

For Our Land and Water this means tackling the biggest science-based issues and opportunities facing New Zealand's primary sector. Our Land and Water's vision is a future in which catchments contain mosaics of land uses that are more resilient, healthy, and prosperous than they are today; a future where all New Zealanders can be proud of the state of our land and water and share value from them.

ABOUT OPEN FARMS

Open Farms is a platform to reconnect Kiwis with the people and places that grow our food. It's a grassroots, nationwide initiative encouraging farmers from all sectors to host Open Farm day experiences. The platform provides farmers with event guidance, visitor marketing, registration support, and connects visitors to Open Farm days via a booking system. The platform is independently run, with 2021 sponsor support from Beef + Lamb New Zealand, the Our Land and Water National Science Challenge and the Ministry for Primary Industries' Sustainable Food & Fibre Futures fund.

For more information on Our Land and Water visit: ourlandandwater.nz
For more information on Open Farms visit: www.openfarms.co.nz

One of the largest fish screens in New Zealand taking shape

March this year saw the construction phase of the Rangitata Diversion Race (RDR) $17 million fish screen project begin, and it is now over halfway through. The RDR is a 67 kilometre long channel that diverts water from the South Island's Rangitata River for irrigation, stock water, and hydropower generation.

The RDR has been in operation since 1945, over time technologies have continuously been improved and environmental aspects investigated, and the new fish screen was no easy feat.

Rangitata Diversion Race Management Limited (RDRML) Chief Executive Tony McCormick said "there have been years of work and research put into this and it is great to see it taking shape".

The main fish screen structure is 105 metres long and 5 metres high, but the amount of actual screen area is over 370 square metres which was enough to wrap a one-metre-high barrier right around a rugby field.

The fish screen will divert up to 34 cumecs into the RDR whilst excluding sporting and native fish and returning them safely back to the river via a fish bypass channel.

Mr McCormick said they were now about 60 percent through the construction phase. All major excavation work had been completed and the main concrete structure supporting the screens was 90 percent complete.

"All the seven T-screens (the large cylindrical screens) are now on-site and the main outstanding components due from Australia in the next month are the flat-screen panels and the lay-flat gate that regulates the flow in the by-pass."

"We expect to have all the screens mounted by mid-September and have completed the main construction phase by year-end."

"We are planning public open days for early in the New Year (likely February) where visitors will have the opportunity to walk through the facility before the cut-over into the RDR and wet commissioning in May (2022)."

The Rangitata River (top right hand corner) flows adjacent to the fish screen.

Seasonal climate outlook August–October 2021

OUTLOOK SUMMARY

Rainfall is about equally likely to be near normal or above normal in the west of the South Island, most likely to be near normal in the west of the North Island, and about equally likely to be near normal or below normal in all remaining regions. Higher than normal air pressure is in the New Zealand region, especially to the north and east, is expected to bring spells of drier than normal conditions to many regions through the three-month period along with more northwesterly quarter winds (westerly to northerly). Temperatures are most likely to be above average in all regions of the country. More northwesterly air flows will likely cause spells of unseasonably warm temperatures in the north and east of both islands in particular. NIWA will move to La Niña Watch, acknowledging ocean and atmosphere conditions in the Pacific Ocean that are trending toward La Niña. The climate system is showing similarities to this time last year, which featured La Niña development during spring – these similarities are reflected in the rainfall and temperature outlook. This information may be useful for planning purposes over the coming season. New Zealand's coastal sea surface temperatures (SSTs) ranged from 0.7°C to 1.0°C above average during July and are predicted to remain warmer than average. Soil moisture levels are about equally likely to be near normal or below normal in the east of the North Island and most likely to be near normal in all other regions. River flows are about equally likely to be near normal or below normal in the north and east of the North Island and north of the South Island and most likely to be near normal in all other regions.

It is the season... warmer temperatures are on the way.

REGIONAL PREDICTIONS FOR AUGUST TO OCTOBER 2021

Northland, Auckland, Waikato, Bay of Plenty

- Temperatures are very likely to be above average (60 percent chance).
- Rainfall totals are about equally likely to be near normal (40 percent chance) or below normal (40 percent chance).
- Extended dry spells, unusual for the time of year, are possible.
- Soil moisture levels are most likely to be near normal (45 percent chance) while river flows are about equally likely to be near normal (40 percent chance) or below normal (35 percent chance).

Central North Island, Taranaki, Whanganui, Manawatu, Wellington

- Temperatures are most likely to be above average (55 percent chance).
- Rainfall totals are most likely to be near normal (45 percent chance).
- Soil moisture and river flow levels are most likely to be near normal (45 percent chance).

Gisborne, Hawke's Bay, Wairarapa

- Temperatures are very likely to be above average (60 percent chance).
- Rainfall totals are about equally likely to be below normal (45 percent chance) or near normal (40 percent chance).
- Extended dry spells, unusual for the time of year, are possible.
- Periods of unseasonable warmth are possible due to more northwesterly winds.
- Soil moisture and river flow levels are about equally likely to be near normal or below normal (40-45 percent chance).

Tasman, Nelson, Marlborough, Buller

- Temperatures are most likely to be above average (55 percent chance).
- Rainfall totals are equally likely to be near normal (40 percent chance) or below normal (40 percent chance).
- Extended dry spells, unusual for the time of year, are possible.
- Soil moisture levels are most likely to be near normal (45 percent chance) while river flows are about equally likely to be near normal (40 percent chance) or below normal (35 percent chance).

West Coast, Alps and foothills, inland Otago, Southland

- Temperatures are very likely to be above average (60 percent chance).
- Rainfall totals are equally likely to be near normal (40 percent chance) or above normal (40 percent chance).
- More westerly wind flows can bring frequent fronts to the region, elevating the potential for heavy rainfall events.
- Soil moisture levels and river flows are most likely to be near normal (45 percent chance).

Coastal Canterbury, east Otago

- Temperatures are very likely to be above average (60 percent chance).
- Rainfall totals are about equally likely to be below normal (45 percent chance) or near normal (40 percent chance).
- Extended dry spells, unusual for the time of year, are possible.
- Periods of unseasonable warmth are possible due to more northwesterly winds.
- Soil moisture levels and river flows are most likely to be near normal (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.

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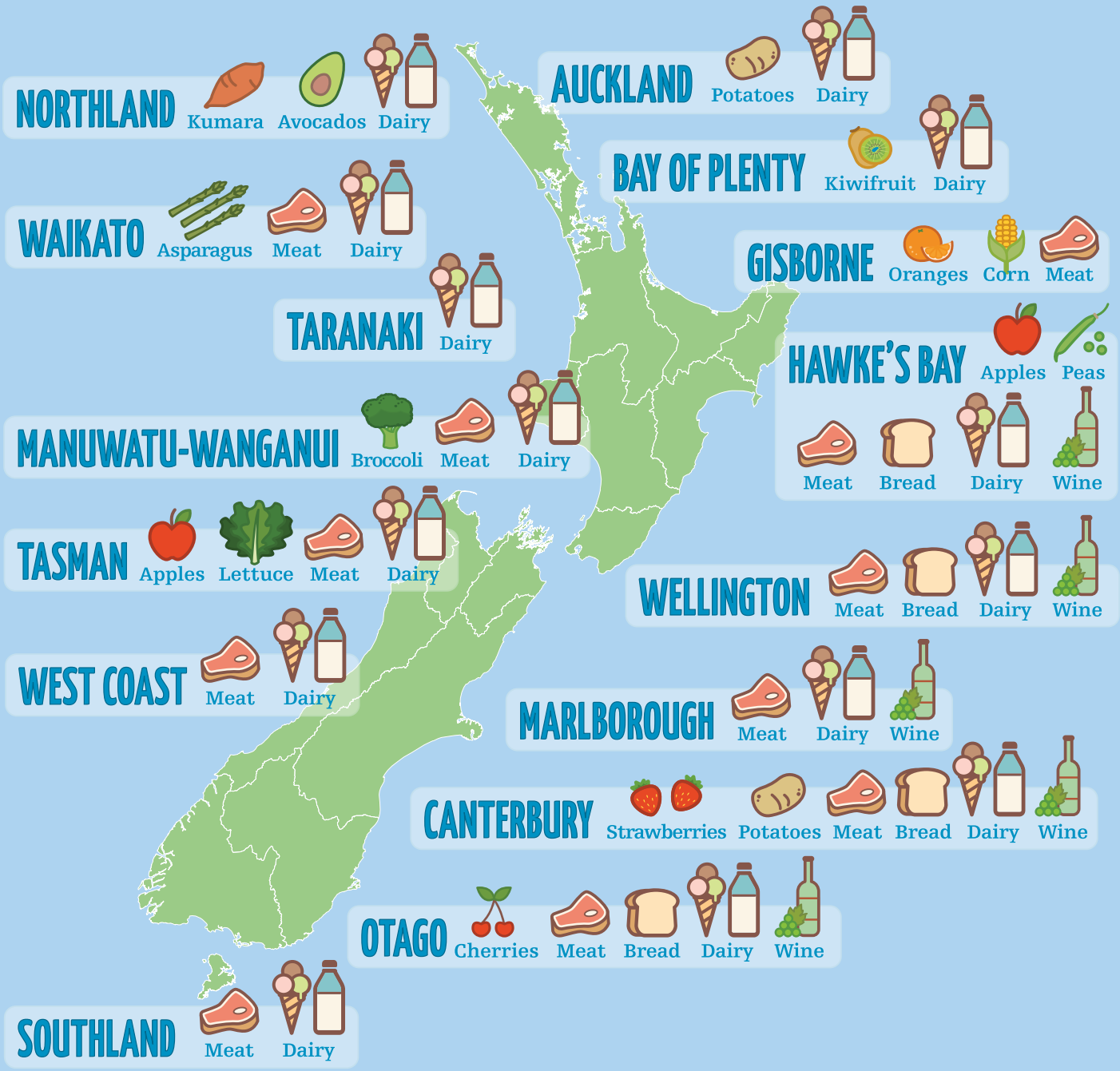

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