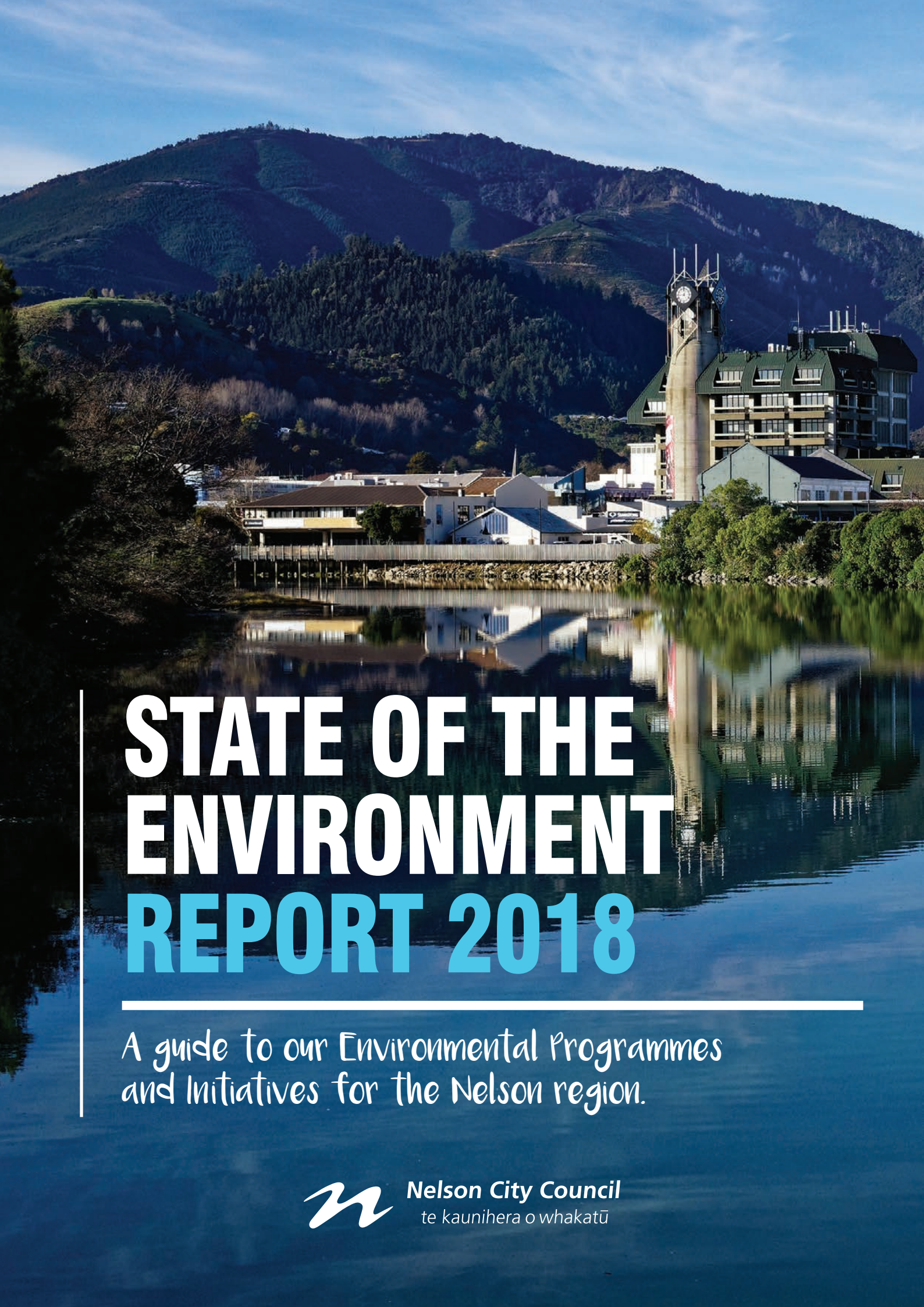

STATE OF THE ENVIRONMENT REPORT 2018

A guide to our Environmental Programmes and Initiatives for the Nelson region.

Nelson City Council
te kaunihera o whakatū

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VISION

Nelson is the Smart Little City: Whakatū Tōrire

Nelson is a vibrant place where we are deeply connected with, and committed to, our natural, social and cultural environment. Clever business and innovation help us thrive. We enjoy living fulfilled lives in smart, sustainable communities.

MISSION

We leverage our resources to shape an exceptional place to live, work and play.

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OUR REGION

Improving Nelson's environment is a primary focus for both me and the Council in partnership with our community. This focus encompasses freshwater and air quality, soil management, coastal and terrestrial habitats, waste minimisation and, increasingly, responding to the impacts of climate change.

A healthy, sustainable environment is one of the four key priorities of our Long Term Plan 2018-28, and this will continue to be a focus as our City grows and develops.

The purpose of this report is to identify the environmental issues Nelson is facing, describe the current state of our environmental assets based on what our monitoring tells us, and to highlight how we are responding.

Council's vision is for our Smart Little City to fully embrace both our natural and physical environments.

To be effective agents of change, we need to ensure that we are not only acting, but also monitoring and reporting on the outcomes of those actions. Over the last five years, Council has deliberately focused on our science and monitoring programme to deepen our understanding of our natural environment so we can better respond to issues.

We've also met the requirements of Government environmental management legislation and increased public access to State of the Environment information. How we interpret and present this information is vital to ensuring that we, other agencies, and the wider community, take the right actions.

We have continued to strengthen our investment in monitoring processes and programmes, including our award-winning air quality programme, with ongoing expansion of our work on freshwater and natural heritage. We're now beginning to put in place programmes around soil and erosion management, coastal and marine science, climate change and housing – all of which will impact our City in the future.

Identifying the implications of climate change for our community and developing our response through strategy, policy and operations is a priority. Monitoring and reporting will continue to play a key role in how we respond.

This report encapsulates the impact of the two severe weather events – Cyclones Fehi and Gita – in February 2018. The effects of these storms are reflected in our stormwater results and highlight the future challenge of maintaining healthy streams and coastal environments.

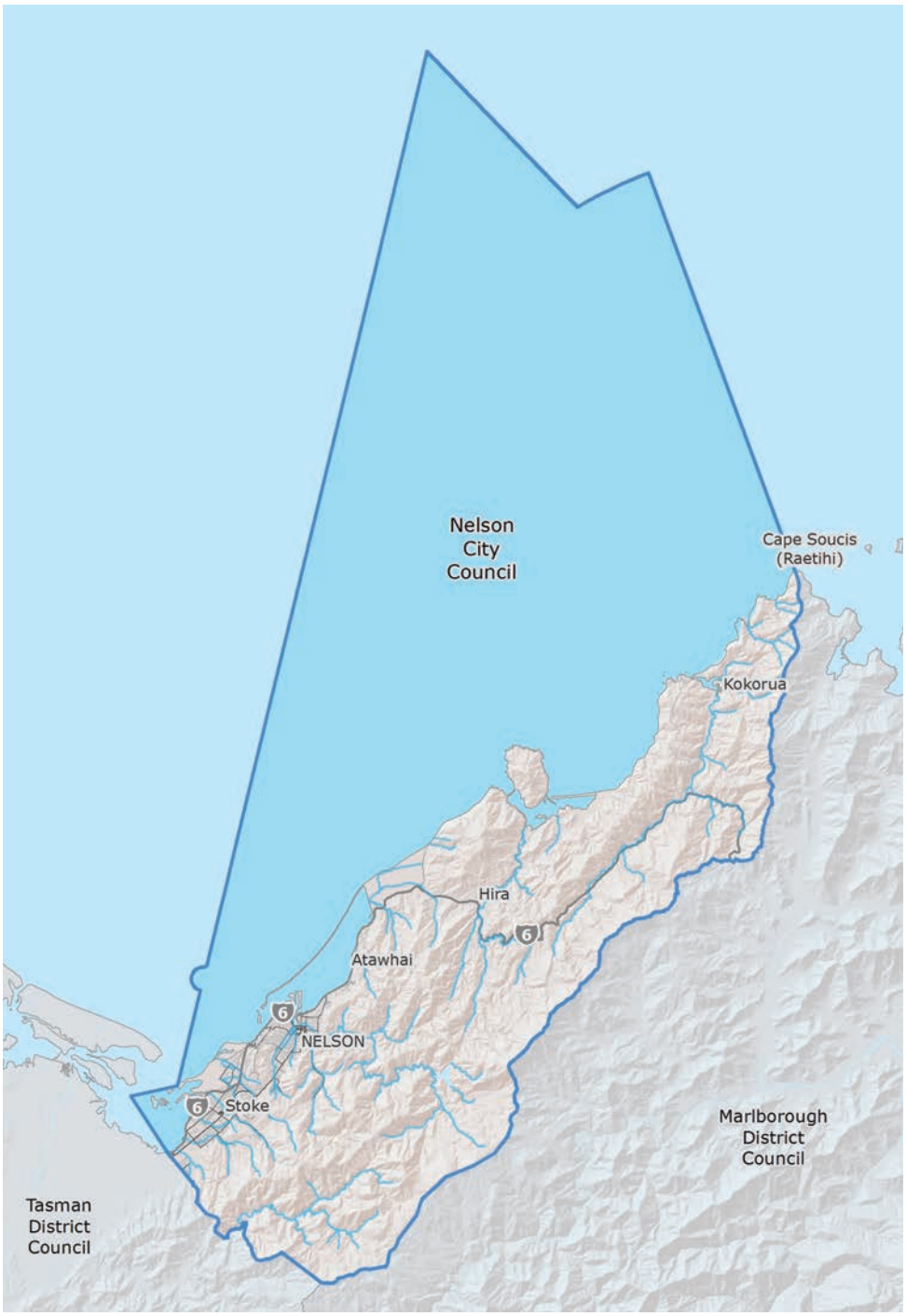
We're now starting to see the benefits of considerable investment in non-regulatory environmental programmes. Project Maitai/ Mahitahi, which was launched in 2014, focused on improving the environmental health of the Maitai River and all its tributaries. We've seen the results of this effort in environmental indicators and community engagement, and were delighted to receive the "Second Most Improved River" award at the National River Awards in 2016.

This work will continue under the Healthy Streams programme, alongside other community engagement stream care projects like York Stream/Te Wairepo and Wakapuaka Bursting with Life.

Nelson Nature is our flagship terrestrial biodiversity programme, alongside our freshwater and marine biosecurity programme. The health, resilience and sustainability of our native plant and animal populations is directly related to the health and well-being of our human community, so improving habitats through programmes like wilding conifer control, significant natural areas, riparian planting and pest control all make Nelson a more sustainable and economically resilient community.

We know that land use can directly impact stream and river health, with flow on effects on our estuaries and coastal habitats. Having secured funding through the Ministry for Primary Industries Hill Country Erosion Fund we're working on new community initiatives in our rural sector to reduce erosion, which will complement our existing regulatory processes.

With the addition of soil monitoring to our surveillance programmes, we're increasing our knowledge to contribute to the national and regional picture of soil quality, which will help us make informed decisions about how to manage our soil resources.



The introduction of the National Environmental Standards for Plantation Forestry will support our regulatory functions and encourage best practice across the forestry sector.

Air quality has long been a point of focus for us, and we continue to monitor, respond educate and support good practices around wood burner use, transport, and industrial emissions to improve air quality and its impact on the health of our community. Our monitoring shows a continued improvement in air quality and it's our intention to support the continuation of this trend.

Council is now reviewing its resource management plan through the draft Whakamahere Whakatū Nelson Plan process. Consultation and engagement will continue over the year ahead and I encourage you to follow this process, put forward your thoughts and ideas and be part of the future of Nelson's Smart Little City. The outcome of this review, underpinned by our State of the Environment monitoring, will set the environmental framework for a sustainable and resilient region.

This report is a snapshot in time, and a valuable resource for benchmarking and understanding trends, so it is important to view the results in context. Where robust long term data is available it has been used to describe trends. In some cases only short term data is available and has been used to describe the current state. Specific case studies have been included to provide context and detail.

We want above all to offer an engaging approach to our environmental reporting, because it is together, Council, iwi, environmental and community groups, schools, research providers, businesses and neighbourhoods, that we secure a rich, diverse and resilient environment.

Rachel Reese
MAYOR OF NELSON

Wakapuaka River at Paremata Flats.

NATURAL HERITAGE

NGĀ TAONGA TUKU IHO

BIODIVERSITY

AT A GLANCE

50% OF NELSON IS COVERED IN NATIVE VEGETATION
22,000 ha of Nelson land area is covered in native vegetation

33% OF NELSON LAND IS PROTECTED
14,000 ha of Nelson land area is protected as public land by Council or DOC

Photo: Jane Gosden

TERRESTRIAL BIODIVERSITY

Prior to the arrival of humans, Whakatū/Nelson was dominated by extensive forest cover. Lowland forests were a mix of beech and broadleaf with emergent podocarps like kahikatea and totara. Mixed beech forests with emergent rimu covered the higher altitudes. Unique ecosystems of tussock grasslands and low stature vegetation occupied the infertile soils of the Dun Mountain mineral belt and Boulder Banks. The map on page 10 depicts the predicted potential extent of different native ecosystems based on current climate, soil and geology.

Today, approximately half of the land in Nelson remains in native vegetation. The remaining 22,000 hectares has been replaced by farms, exotic forestry and urban development. Lowland and coastal areas have experienced the most extensive loss since pre-human times and only small fragments of native ecosystems remain in these areas.

The map on page 11 shows the current extent of native ecosystems in Nelson. There is a clear pattern between the suitability of land for human use and the extent of loss of native vegetation.

Most of the loss of Nelson's native ecosystems occurred many decades ago and current areas of protected land and planning regulations prevent further widespread loss. Approximately 33% or 14,000 hectares of Nelson is protected land managed by the Department of Conservation or the Council. In addition, almost 4,000 hectares of the most valuable native ecosystems or habitat for native species occur on private land. These have been identified by Council as Significant Natural Areas (SNAs).

WHAT ARE WE DOING ABOUT IT?

Council is working with public and private landowners to protect, restore and enhance Nelson/ Whakatū's native ecosystems and species through the Nelson Nature programme.

Nelson Nature is Council's long term programme (2015-2025) to care for Nelson/Whakatū's natural environment, working closely with other agencies, community groups, businesses and private landowners to coordinate restoration efforts and enhance ecological outcomes across the region.

NELSON NATURE

There are five key focus areas in the Nelson Nature programme:

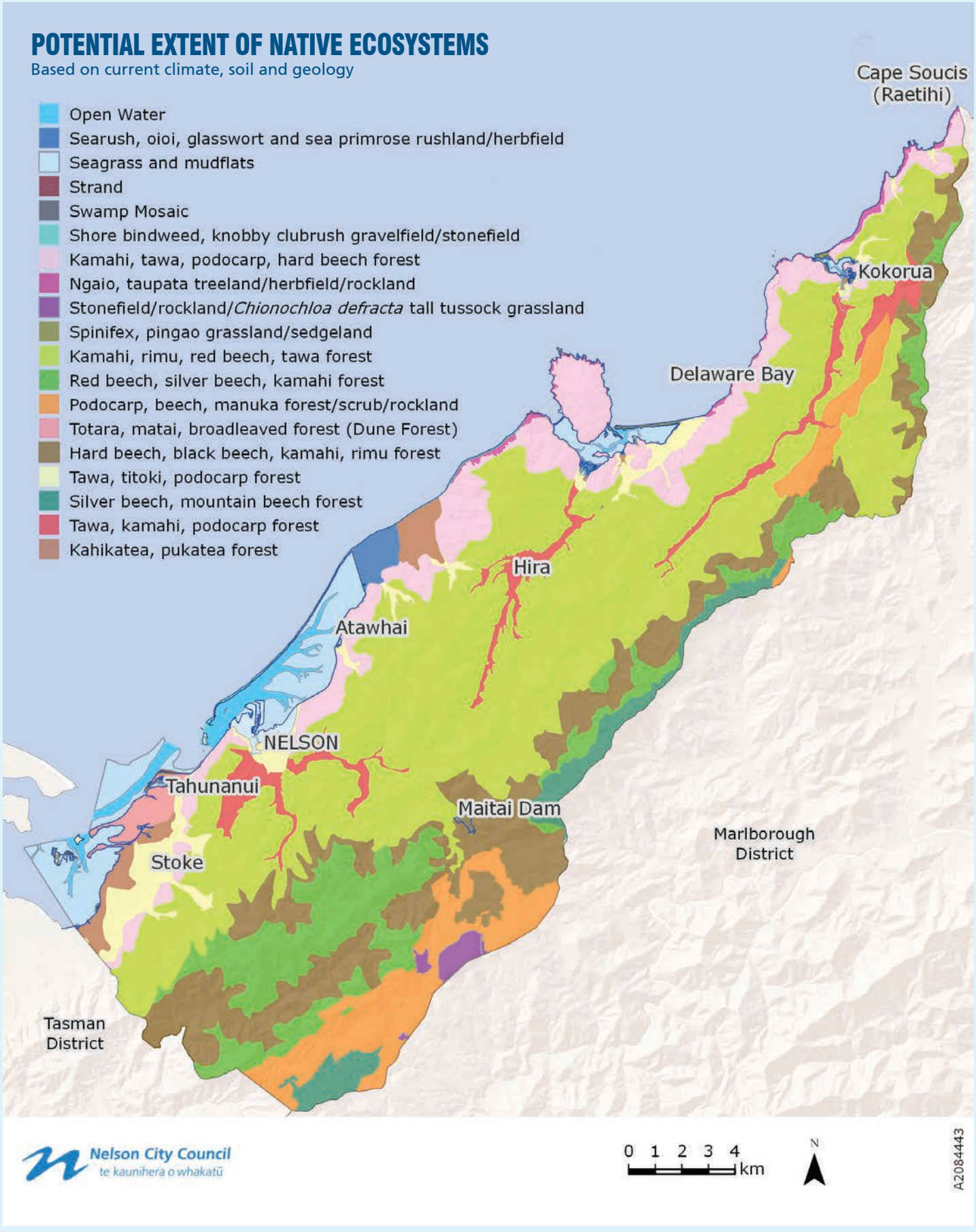
- Protecting and enhancing ecosystems and species in the Dun Mountain mineral belt, limestone outcrops and Maitai and Roding forest
- Protecting and restoring coastal ecosystems and species
- Working with private landowners to protect and enhance significant biodiversity sites on private land (SNAs)
- Enhancing the connection and condition of fragmented parts of the terrestrial environments through biodiversity corridors
- Enhancing native bird populations in an area extending from the Brook Waimarama Sanctuary (the Nelson Halo)

The sixth objective of protecting and enhancing freshwater biodiversity is delivered in combination with Council's Healthy Streams programme.

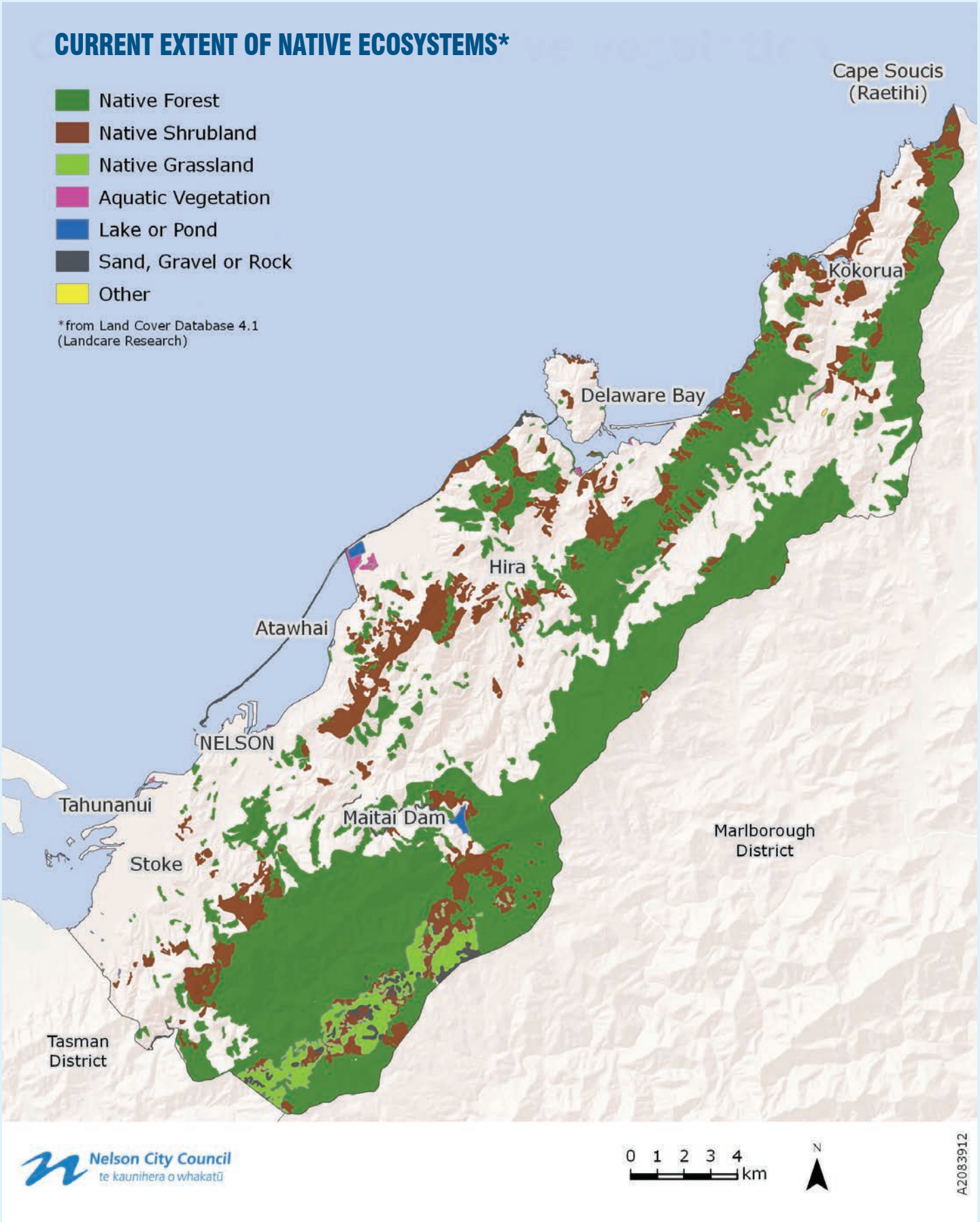
Council is also involved in a range of multi-stakeholder groups to improve the state of biodiversity within Nelson and beyond.

POTENTIAL EXTENT OF NATIVE ECOSYSTEMS

Based on current climate, soil and geology



CURRENT EXTENT OF NATIVE ECOSYSTEMS*



CASE STUDY: NELSON NATURE - WILDING CONIFER PROJECT

The Dun Mountain mineral belt is a nationally important ecosystem that is home to unique plant communities and threatened species. Wilding conifers, and particularly Douglas Fir, pose a significant threat to the mineral belt ecosystem by competing for space and shading out the low stature vegetation.

Between 2015 and 2018, Nelson Nature has more than doubled Council's financial investment in the control of wilding conifers in the Dun Mountain area. The programme has controlled the majority of dense infestations of wilding conifers in the Dun Mountain mineral belt and surrounding native forests.

This has enabled Council to make a significant reduction in the threat wilding conifers pose to the values of the mineral belt. By 2019/20 the ongoing management for wilding conifers will transition from intensive control to periodic surveillance of the site to maintain the area free of seeding wilding conifer.

This is a great outcome both for protecting the mineral belt's vulnerable biodiversity and Council's ongoing costs to manage the site.

In addition, retirement of all Council-owned Douglas Fir plantations by 2023 will remove the risk of these species spreading into and recolonising sensitive ecological areas, particularly the mineral belt area of Dun Mountain.

Myosotis monroi *mineral belt rare plant. Credit: Inaturalist/Duncan Cunningham.*

*Rare giant snail (*Powelliphanta hochstetteri consobrina*) only known from the Nelson mineral belt area.*

Low stature vegetation on Dun Mountain mineral belt.

2016

2018

Native forest on the edge of the Dun Mountain mineral belt before (left) and after (right) wilding pines were controlled. The orange trees are wilding conifers which have been controlled and left to rot on site so felling does not damage the surrounding forest.

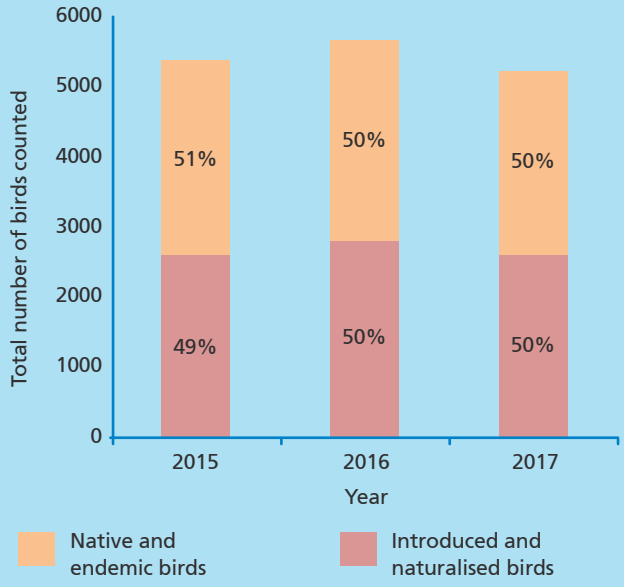
CASE STUDY: WHAT'S HAPPENING WITH THE BIRDS?

Nelson Nature is monitoring changes in abundance and distribution of birds in the Nelson region to measure the success of the Nelson Halo. The Nelson Halo is an area of predator control and habitat restoration to enhance native bird populations outside of the Brook Waimarama Sanctuary.

WHAT IS COUNCIL DOING?

The number of native and introduced birds observed over a five-minute period at 62 sites across Nelson is recorded four times each November. The counts have been completed annually since 2015.

A similar number of birds have been counted each year and approximately half of observations are native species, see the graph below. A total of 32 bird species have been recorded during bird counts, including 19 native species. With only three years of data collected so far, it is too early to expect a trend. However, over time the number of native bird species and observations in the Nelson Halo is expected to increase due to predator control and restoration of native vegetation.

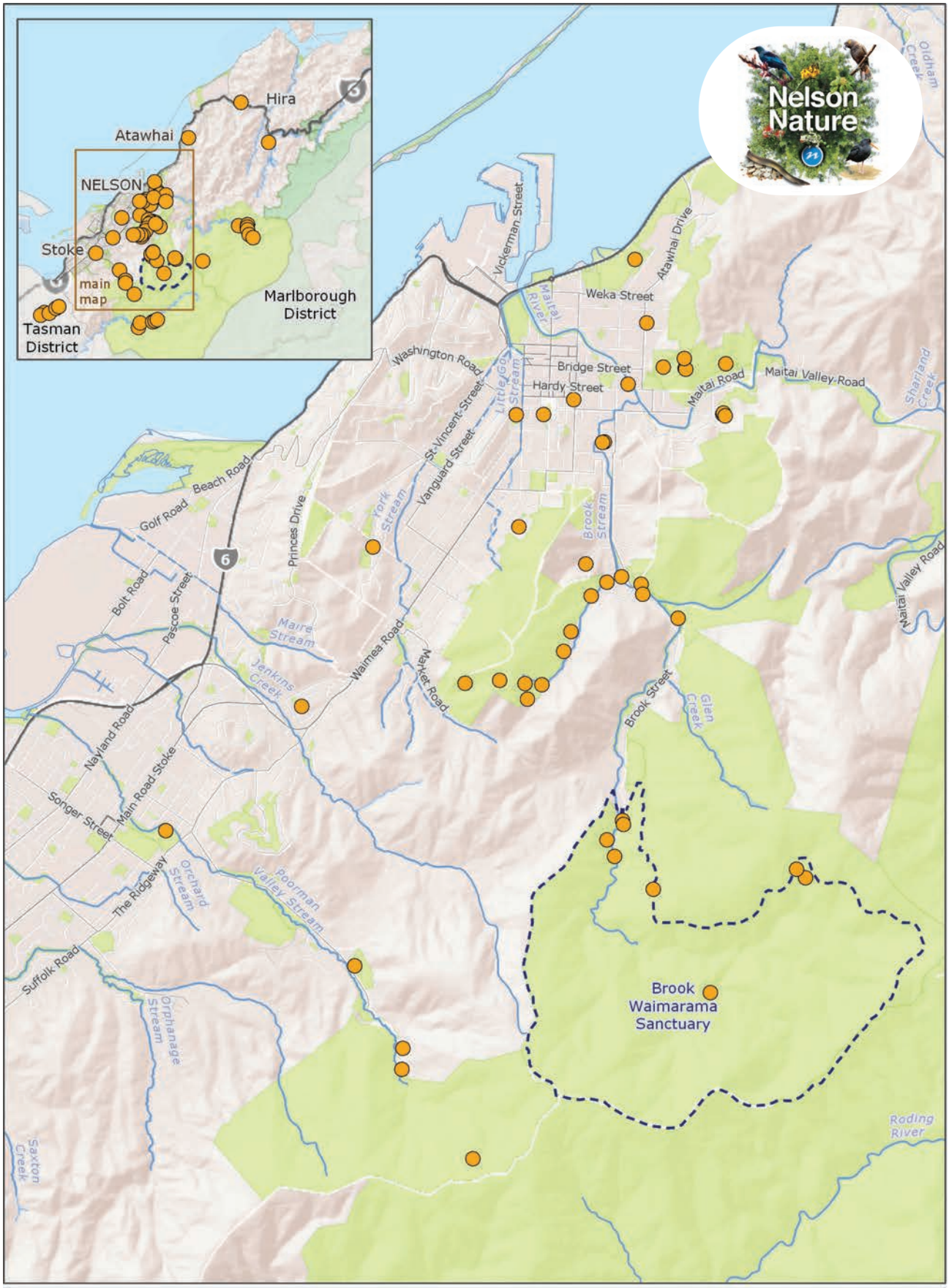


Total number of individual birds counted during five-minute bird counts carried out in Nelson City reserves, 2015-2017.

WHAT CAN YOU DO?

Citizen Science is an important part of measuring success of the Nelson Halo. The map shows observations of kererū in Nelson between 2015 and 2017 compiled from Nelson Nature's five-minute bird counts and two Citizen Science projects: the Great Kererū Count and iNaturalist. The distribution and abundance of native birds like kererū is expected to increase under the Nelson Halo and Biocorridors projects of Nelson Nature. Further information can be found at http://www.nelson.govt.nz/environment/nelson-nature/natural-environment/the-nelson-halo. You can help contribute to the understanding of trends in native bird populations in Nelson over time by recording your bird sightings at ebird.org or inaturalist.org

Kererū by Tony Stoddard.



Kereru Observations
(2015-2017)

Nelson City Council
te kaunihera o whakatū

Legend

- Kererū Observations
- Brook Waimarama Sanctuary

N

September 2018

0 0.5 1 1.5 2 km

File Ref: A2054056
SER. Original map size A4.

PO Box 645 Nelson 7040 New Zealand PH 03 5460200 nelson.govt.nz

Kererū observations from five-minute bird counts and Citizen Science projects between 2015-2017.

CASE STUDY: NELSON BIODIVERSITY FORUM

The Nelson Biodiversity Forum is a group of 32 member organisations who work together to identify and align actions to improve biodiversity in the Nelson area.

The Forum works to implement the Nelson Biodiversity Strategy, last revised in August 2018. The strategy links existing initiatives and actions under a common vision and introduces new actions that address the priority biodiversity management issues in the region.

The Forum is convened by Nelson City Council and meets quarterly to share progress on the implementation of the Nelson Biodiversity Strategy and identify opportunities to collaborate.

The Forum has developed a standardised Report Card system for reporting progress on achieving the seven outcomes of the Nelson Biodiversity Strategy. The Report Card for reporting progress with threatened species is shown here.

OUTCOME 1 - NATIONALLY AND REGIONALLY THREATENED INDIGENOUS SPECIES ARE SUSTAINED OR RESTORED

GRADING GUIDE

Achieved	Partly achieved	Partly achieved	Partly achieved	Not achieved
Excellent progress	Good progress	Moderate progress	Some progress	Poor progress

INTERMEDIATE OUTCOME 1.1

NATIONALLY AND REGIONALLY THREATENED SPECIES ARE UNDER ACTIVE MANAGEMENT.

General commentary on grade:

- Some progress on updating threatened species lists and identifying critical habitats and management needs
- Excellent progress on survey and habitat restoration for native freshwater fish
- Some progress to increase the range and security of giant land snail, Back Beach beetle, fernbird, banded rail and lowland totara but monitoring inadequate to assess success.

Progress on Actions

Action 1.1.1	Update threatened species lists for Nelson and identify the active management needs and critical habitats of each species. (Lead: Department of Conservation).	+
Action 1.1.2	Identify, and where necessary, recreate critical habitats for "nationally threatened" and "at risk" freshwater species including short jawed kokopu, lamprey, longfin eel, giant kokopu, and koaro, and implement physical and legal protection to safeguard habitats of these species. (Lead: Nelson City Council).	
Action 1.1.3	Increase the range and security of the rare, threatened, and/or iconic lowland totara, fernbird, banded rail, giant land snail, and back beach beetle. (Lead: Nelson City Council).	−

Summary of available monitoring information:

- 73 plants, 56 invertebrate, 37 bird, nine freshwater fish, six reptile species listed as threatened/at risk in Nelson (DOC, Council)

- Council (2015-2018) and Brook Waimarama Sanctuary annual bird counts – draft analysis which includes some threatened species (Council/Brook Waimarama Sanctuary Trust)
- Surveys for fernbird (Hutzler/TET 2018), banded rail (Cook 2012, TET 2014-18), Back Beach beetle (Council 2017-18) and giant land snail (Council 2017) and coastal birds (Council 2015-16), but insufficient data to indicate trends
- Biannual shorebird surveys show endemic shorebird species populations are stable or slightly increasing (OSNZ)
- Bird Atlas (OSNZ) 1994-2004, planning underway by OSNZ to repeat in future
- Annual freshwater fish survey and SOE monitoring
- Riparian habitat health monitoring at selected sites in Wakapuaka, Maitai (annually NMIT/Council)
- Cultural health indicator monitoring in Wakapuaka 2017/18 (Council/Tiakina)

Analysis and Recommendations

- Develop threatened species list for marine areas (pelagic birds already included in bird list)
- Peer review threatened bird species list for Nelson
- Develop regionally threatened species list for birds, invertebrates, lizards, freshwater fish
- Identify critical habitats/management needs for all threatened species
- Develop long term monitoring programmes for key threatened species
- Include iconic marine species in Action 1.1.3, e.g. flounder

INTERMEDIATE OUTCOME 1.2

PREDATOR FREE AND PREDATOR SUPPRESSED AREAS ARE SUSTAINED AS REFUGES FOR VULNERABLE SPECIES.

General commentary on grade:

- Good progress with near achievement of predator-free status by Brook Waimarama Sanctuary and increase in number of and support available for community trapping groups
- Some progress with planning for reintroductions of regionally extinct species into Sanctuary
- Some progress with strategic planning of Predator Free 2050 initiatives and development of training for community predator control

Progress on Actions

Action 1.2.1	Continue community collaboration and support for the ecological restoration of the predator-free Brook Waimarama Sanctuary and enhancement of the biodiversity values in the surrounding areas (halo). (Lead: Brook Waimarama Sanctuary inside the fenced sanctuary; Nelson City Council in the halo).	
Action 1.2.2	Reintroduce regionally extinct species into the Brook Waimarama Sanctuary. (Lead: Brook Waimarama Sanctuary).	
Action 1.2.3	Lead Nelson's engagement with Predator Free 2050 initiatives (Department of Conservation).	

Summary of available monitoring information:

- Approximately 900ha area under predator control by 12 community groups, plus 700ha likely predator free in Brook Waimarama Sanctuary
- Initial analysis in Brook Waimarama Sanctuary shows increases in fantail, tui and tomtits and increase in seedlings after the first ungulate/predator-free breeding season.
- No predators detected in most recent monitoring in Brook Waimarama Sanctuary. Result indicates that despite numerous breaches to the fence, including by falling trees and branches, contingency plans and responses by staff and volunteer teams have maintained the integrity of the fence. Incursions by two rats and three mice have been successfully dealt through trapping.
- Draft analysis of 5 min bird counts in Brook Waimarama Sanctuary (BWST) indicate increases in some species of bird inside the Sanctuary. Too early for trends to be interpreted from Halo bird counts (Council 2015-18)

Analysis and Recommendations

Future action to:

- Continue to collaborate between DOC, Council, BWST and community groups on Predator Free 2050 and Halo projects
- Collaborate on monitoring efforts to measure success of Halo, Sanctuary and community predator control

FRESHWATER BIODIVERSITY

New Zealand has a relatively sparse but interesting freshwater fish fauna, totalling 35 described native species, 16 of which are recorded in the Nelson region. Most of the native species belong to just four families of fish, and include twenty or more (pending identification) galaxiids, seven bullies, two eels, and two smelts.

Some 31 of the native species are endemic, only found in New Zealand, with inanga, koaro, shortfin eel and the Australian longfin eel also known from Australasia.

At least fifteen fish species have been introduced (legally, illegally and accidently) to New Zealand that are known to have breeding populations in more than one location. Two pest species, Gambusia (mosquito fish) and tench have previously been recorded in the Nelson region and eradicated. However, Gambusia are present in several Tasman District coastal creeks with potential to colonise other streams that feed the Waimea Estuary.

Causes for declines in native fish populations include impacts from declining water quality, effects of over water abstraction, loss of habitat via land-use change and land-use activities, river modification and predation or habitat competition from introduced fish species.

The banded kokopu is a relatively widespread and abundant whitebait species in the Nelson region and provides an indicator of water quality, habitat and fish passage connectivity in both urban and rural streams.

THREATENED FISH DISTRIBUTION IN THE NELSON REGION

Common Name	DOC Threat Status	Freshwater Management Units
Lamprey	Threatened – Nationally Vulnerable	**Stoke:** Poorman Valley Stream; **Maitai:** lower mainstem; **Wakapuaka:** mid mainstem; **Whangamoa:** mainstem and Collins River
Longfin eel	At Risk – Declining	Wide distribution - all streams
Torrentfish	At Risk – Declining	**Roding; Stoke:** Orphanage Stream; **Maitai:** lower mainstem, lower Brook Stream; **Wakapuaka:** lower mainstem
Bluegill bully	At Risk – Declining	**Stoke:** Lower Poorman Valley Stream; **Maitai:** lower and upper mainstem; **Whangamoa:** lower mainstem and Collins
Redfin bully	At Risk – Declining	Relatively wide distribution. All **Stoke** streams except Maire Stream; **Maitai:** lower mainstem, Sharland, South Branch, lower Brook, York Stream, Oldham Creek, Todd Valley Stream, Hillwood Stream; **Wakapuaka:** lower and upper mainstem, **Whangamoa:** lower and upper mainstem, Collins River and Denker Stream
Giant kōkopu	At Risk – Declining	**Stoke:** Orphanage Stream, lower Poorman Valley Stream
Koaro	At Risk – Declining	Wide distribution – all streams except Sharland Creek, York Stream, Lud River and Dencker Stream
Inanga	At Risk – Declining	Widely distributed – all lower stems of streams where expected to occur, except Maire Stream
Shortjaw kōkopu	Threatened – Nationally Vulnerable	**Stoke:** Lower Poorman Valley Stream

Of the nine recorded threatened species, the shortjaw kōkopu and giant kōkopu are recorded in two Stoke streams in Nelson. Shortjaw and giant kōkopu live mostly in small streams running beneath forest or bush canopies. Mudfish have not been recorded in the region but are likely to have been present when wetlands were more extensive.

Brown trout are present in low-moderate numbers as juveniles through to large adults in each of the large river catchments of the Roding, Maitai, Wakapuaka and Whangamoa. Brown trout are also present in small numbers in the Stoke Poorman Valley Stream. Trout spawn in gravel-bottomed, upland rivers and tributaries from late autumn to late winter. Trout redds (nests) have been observed in the Maitai, Brook and Wakapuaka catchment

The Maitai has historically afforded an important angling experience, with easy access to the river attracting young-novice and experienced anglers. However, anecdotal observations indicate adult trout numbers have declined in recent decades, reducing the trout fishery value of the Maitai compared to other rivers in the top of the south.

Yellow-eyed mullet shoaling in the lower reaches of Wakapuaka.

Banded kōkopu – widely distributed and relatively abundant fish in the Nelson region.

WHAT ARE WE DOING ABOUT IT?

- Managing and improving waterways through the Nelson Plan water quality objectives and limits that recognise fish biodiversity and recreational values, critical habitat for spawning and requirements to sustain fish species at the various stages of their lifecycles
- Creation and enhancement of fish habitat including stream channel morphology and riparian margins, constructed wetlands and improvements to consented activities influencing streams through adopting best practice and sound ecological advice
- Extending the Healthy Streams fish passage improvement programme with support to fixing barriers on private land
- Enhancement plantings and fencing of stream margins at coastal spawning areas for smelt, inanga and banded kōkopu and other galaxiid species spawning further inland
- Extending fish surveys across the region, targeting reaches that have not previously been surveyed and including surveys over summer and winter months to identify seasonal movements and habitat use of native fish
- Launched web app as a public educational tool to display all of the fish sightings across the region
- Funding and supporting national research, including NZ Fish Passage Guideline and Waikato fish passage trials, DOC whitebait regional stock assessments and assisting with trials for developing new fish survey techniques using fish molecular DNA sampled from rivers.

The upland bully is one of our few native freshwater fish species that spends its entire life in freshwater.

Juvenile lamprey (ammocoete) have been found in four river catchments, however, the locations of their spawning sites are unknown.

State of Environment electrofish survey on the Collins River.

CASE STUDY: FISH SPAWNING AND HABITAT

The whitebait run in New Zealand is made up of juvenile fish from five different species of freshwater fish, comprising inanga, kōaro, giant kōkopu, banded kōkopu, and short jawed kōkopu. These are all members of the family known as Galaxiids, which refers to the 'milky way' like patterning on their skin.

Inanga are also widely distributed across east and western Australia and South America, and kōaro are also found in south eastern Australia and Tasmania. All five of these species are migratory (*diadromous*) fish, spending portions of their lives in both fresh and saltwater environments, and migrating up and down streams at different stages of their life cycles.

INANGA

Breeding mainly in the summer months, inanga migrate downstream into estuarine environments and the lower reaches of tidally influenced streams, where they lay eggs among riparian vegetation in a zone defined by the saltwater-freshwater 'wedge'. Their eggs are generally deposited in swards of grass, such as fescue and at the base of flaxes, which remain damp to protect the eggs for several weeks until spring tides wash them out to sea. For several months over the autumn-winter period, the juvenile fish larvae live out at sea and feed on plankton, before migrating back upstream as whitebait in the following spring.

Straw bales are used as artificial spawning habitat for inanga whilst riparian vegetation is planted to restore habitat.

Inanga eggs found amongst straw bales.

Straw bales temporarily installed in the Orchard Creek channel to extend the available spawning habitat for inanga.

Kōaro and kōkopu species are thought to mainly lay their eggs from late summer to early winter amongst leaf litter and plants in shaded stream margins. Banded kōkopu are the most widely distributed of the kōkopu, and may lay eggs in suitable habitat throughout their range, including the lower reaches of rivers and headwaters of estuaries.

KŌARO

Kōaro are strong climbers and penetrate inland streams with flowing riffles and pools.

Surveys in Nelson's streams have revealed kōaro breeding in-stream, under rocks in the Brook Stream. This behaviour has not been recorded elsewhere in New Zealand or Australia, and may reflect high densities of kōaro and limited competition for habitat and food from other fish species in the upper catchment of the Brook Stream.

Kōaro eggs attached to the under-side of a stream boulder.

BANDED KŌKOPU

Banded kōkopu are relatively common and have adapted to life in modified urban streams. Their ability to climb culvert pipes and survive in small creeks and pools has enabled populations to become established in available habitat.

Banded kōkopu spawning has been recorded in the Pipers Park Reserve, an urban park that is linked to the Maitai via a network of stormwater pipes. Fish passage and riparian habitat work was undertaken in the Reserve in 2016, with spawning recorded for the first time in the winter of 2018. Stream habitat was improved following severe bank erosion and sediment inputs.

These records of kōaro and kōkopu spawning events are significant because there are few confirmed locations of spawning sites for these species around New Zealand, despite their biology being reasonably well understood. These observations also provide information to assist with their conservation management, to identify and protect other spawning habitat across the region and to inform our restoration work through Nelson Nature.

HOW CAN YOU HELP OUR NATIVE MIGRATORY FISH?

- If you are a whitebaiter, please follow the fishing regulations. Remember that four of the five species that comprise whitebait are declining and classified as At Risk or Threatened. Keep your catch small and release those species that are not whitebait
- Help keep streams free from pest plants, and leave margins in grasses. Protect these margins from trampling by humans, stock, and domestic pets
- Plant riparian margins on your property, or help plant on public esplanades
- Check streams and drains on your own property for barriers to fish passage – let Council know if you think you have a fish barrier on your land, or notice one elsewhere.

Banded kōkopu spawning habitat with eggs.

Banded kōkopu eggs deposited amongst a flat grass terrace with overhanging Carex/Holcus grasses.

Stream restoration in progress to create fish pool habitat and fish ladders and introduce woody-debris to the stream channel.

CASE STUDY: FISH PASSAGE - URBAN AND RURAL

Many of our native freshwater fish species undertake migrations, accessing the tributaries, streams and rivers between mountains and the sea at various stages of their lives. To ensure that our aquatic biodiversity can thrive, it is critical that fish are able to negotiate their way up and down our streams and rivers, without being impeded by barriers such as dams, culverts, pipes, or even more natural features such as large root balls or constructed stream falls.

Council has undertaken extensive fish passage remediation work in its urban stream environments over the last three years with most barriers now remediated at flows suitable for fish swimming. Some native fish are naturally good climbers and able to negotiate partial barriers. For example, kōaro, banded kōkopu and redfin bully have well-developed pectoral (front) fins that help them make their way up almost vertical wetted surfaces. Elvers and larger eels are able to climb and wriggle over land to by-pass barriers.

Migrating fish travel upstream and over barriers by following the attractant flow. Simple fish passage remediation methods, such as the spat rope and attractant flow installed at the Maitai Dam spillway, have proven effective ways of improving and maintaining fish passage for climbing fish species.

Ramps can also be used to assist fish in climbing up perched culverts as seen opposite in Elizabeth Stream, in the Whangamoa catchment. The ramp surface is also designed to reduce the velocity of the flow and provide rest areas for fish.

For 'non-climbing' species such as inanga, more complex solutions are needed as they are also not able to swim against moderate flows. Increasing the diversity of habitat depths, flows and resting areas and refuges can be achieved through the installation of strategically placed baffles, boulders and logs anchored in the stream bed.

Baffles are favoured in existing modified stream channels with culverts because they create standing waves, backwater effects and deflect flows to provide a range of places where fish can rest before continuing their journey upstream. Gravels are also deposited within the slower velocity areas between baffles, providing additional habitat for fish to hide from predators and also feed on aquatic insects.

Spat rope and attractant flow at the Maitai Dam spillway.

Baffles have been installed in many Nelson culverts, including the Nile Street Brook Culvert, and the 1.5 km enclosed York stream St Vincent Street culvert, where over 60 baffles are now in place.

Before and after installation of a fish passage ramp on a perched culvert, Elizabeth Stream.

The removal of the fish passage barrier is generally the most effective solution to enable fish passage at a range of flows. The concrete ford at Almond Tree Flats was the last significant barrier to fish migration in the lower Maitai River and was removed in 2016 following public consultation. The removal of the ford has not only increased the extent of upstream habitat available for inanga and other species at all times of the year, but is also of benefit to the recreational brown trout fishery and for access to spawning tributaries in the upper catchment.

Rural streams and rivers also contain barriers to fish passage. Not only structures in rural streams, but low river flows are impediments to fish passage. Even small drains running through private properties can be important habitat for native species, particularly where they lie close to the sea. If you know of a barrier on your property, Council would like to hear from you.

Nile Street underpass. Baffles allow resting pools and slow down water velocity to allow fish to move upstream.

Almond Tree Flat Ford prior to removal.

Removal of the ford enables fish to migrate further up river and reach smaller tributaries such as Groom Creek.

BIOSECURITY

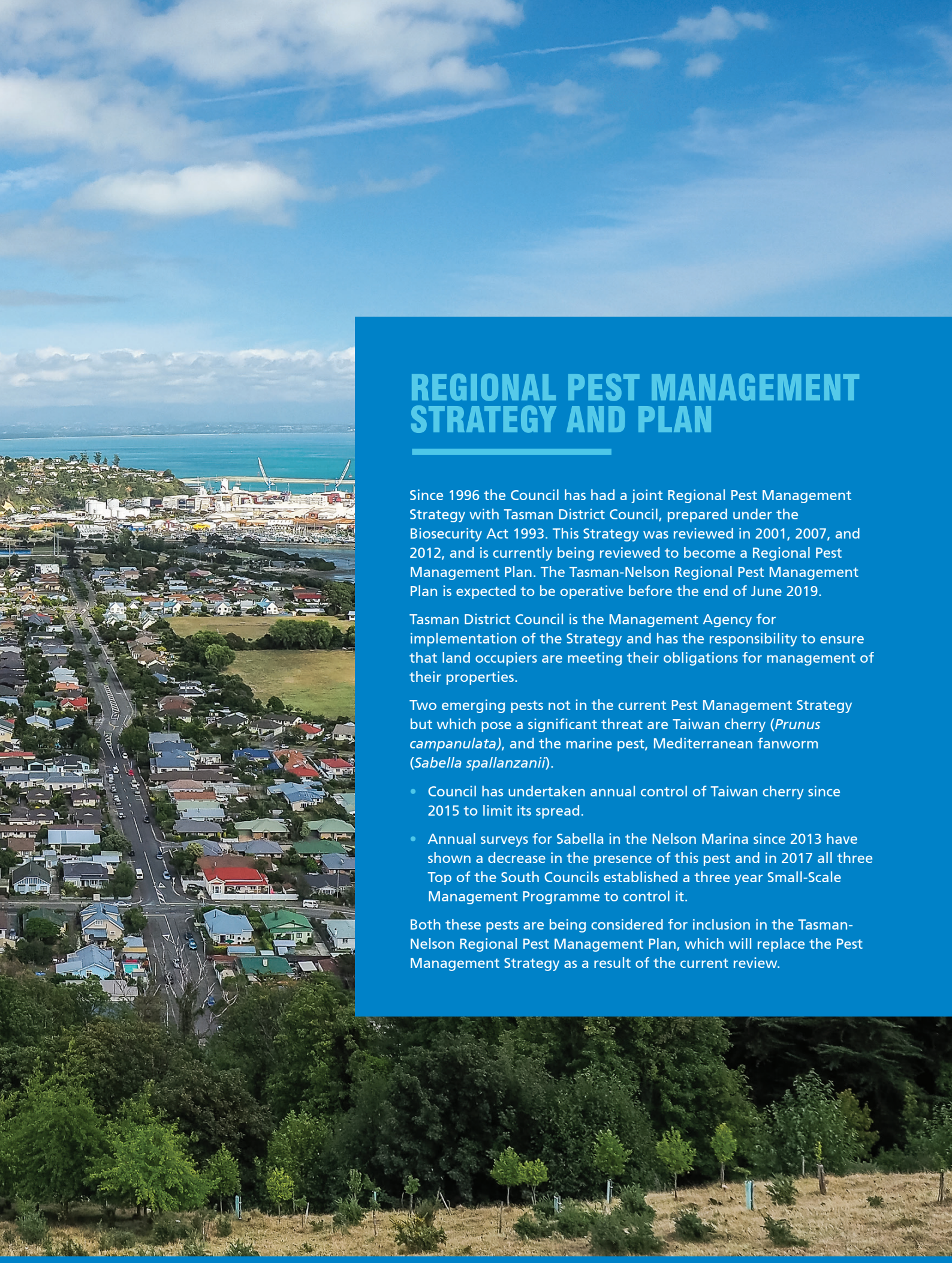
AT A GLANCE

Together, Nelson City Council and Tasman District Council operate the joint Tasman-Nelson Pest Management Strategy. The Strategy identifies 62 terrestrial, aquatic and marine pests that can cause significant damage to both regions' natural environments and primary industries. These pests are grouped into five categories, with different objectives and varying levels of intervention, from eradication to general surveillance. The objectives are largely on track to being achieved, with the exception of Argentine ants which continue to spread. The Strategy is currently being reviewed.

Progress against the objectives for the 62 pests included in the Strategy are outlined below.

Category	No of Pests	Objective	Progress
Total Control Pests	13	Eradication from all areas in Tasman/Nelson by 2022	On track
Progressive Control Pests	18	Reduce the distribution & density in Tasman/Nelson over the term of the Strategy	On track
Containment Pests	14	Prevent the spread to adjoining properties or other parts of Nelson/ Tasman that are not currently infested	On track except for Argentine ants which continue to spread
Boundary Control Pests	13	Control the spread from adjacent properties or road reserve to land that is clear, or being cleared, of these pests	On track
General Surveillance & Regional Surveillance Pests	4	Map the distribution; review literature to allow an assessment of risk posed and methods and costs of treatment; support collaborative projects aimed to provide more effective control	On track

Council is also actively involved in the Top of the South Marine Biosecurity Partnership with Marlborough District Council and Tasman District Council, as well as the Ministry for Primary Industries, and marine science and industry stakeholders. Since its establishment in 2009 the Partnership has worked to reduce marine biosecurity risks across the Top of the South (Te Tau Ihu).



REGIONAL PEST MANAGEMENT STRATEGY AND PLAN

Since 1996 the Council has had a joint Regional Pest Management Strategy with Tasman District Council, prepared under the Biosecurity Act 1993. This Strategy was reviewed in 2001, 2007, and 2012, and is currently being reviewed to become a Regional Pest Management Plan. The Tasman-Nelson Regional Pest Management Plan is expected to be operative before the end of June 2019.

Tasman District Council is the Management Agency for implementation of the Strategy and has the responsibility to ensure that land occupiers are meeting their obligations for management of their properties.

Two emerging pests not in the current Pest Management Strategy but which pose a significant threat are Taiwan cherry (*Prunus campanulata)*, and the marine pest, Mediterranean fanworm (*Sabella spallanzanii*).

- Council has undertaken annual control of Taiwan cherry since 2015 to limit its spread.
- Annual surveys for Sabella in the Nelson Marina since 2013 have shown a decrease in the presence of this pest and in 2017 all three Top of the South Councils established a three year Small-Scale Management Programme to control it.

Both these pests are being considered for inclusion in the Tasman-Nelson Regional Pest Management Plan, which will replace the Pest Management Strategy as a result of the current review.

CASE STUDY: TAIWAN CHERRY

Taiwan cherry (*Prunus campanulata*) is an invasive plant which was introduced to Nelson around 30 years ago in the Dodson Valley area. Seedlings are very shade tolerant and, unlike other woody weeds, Taiwan cherry invades all types of shrublands, light gaps in the forest, roadsides, gardens and reserves.

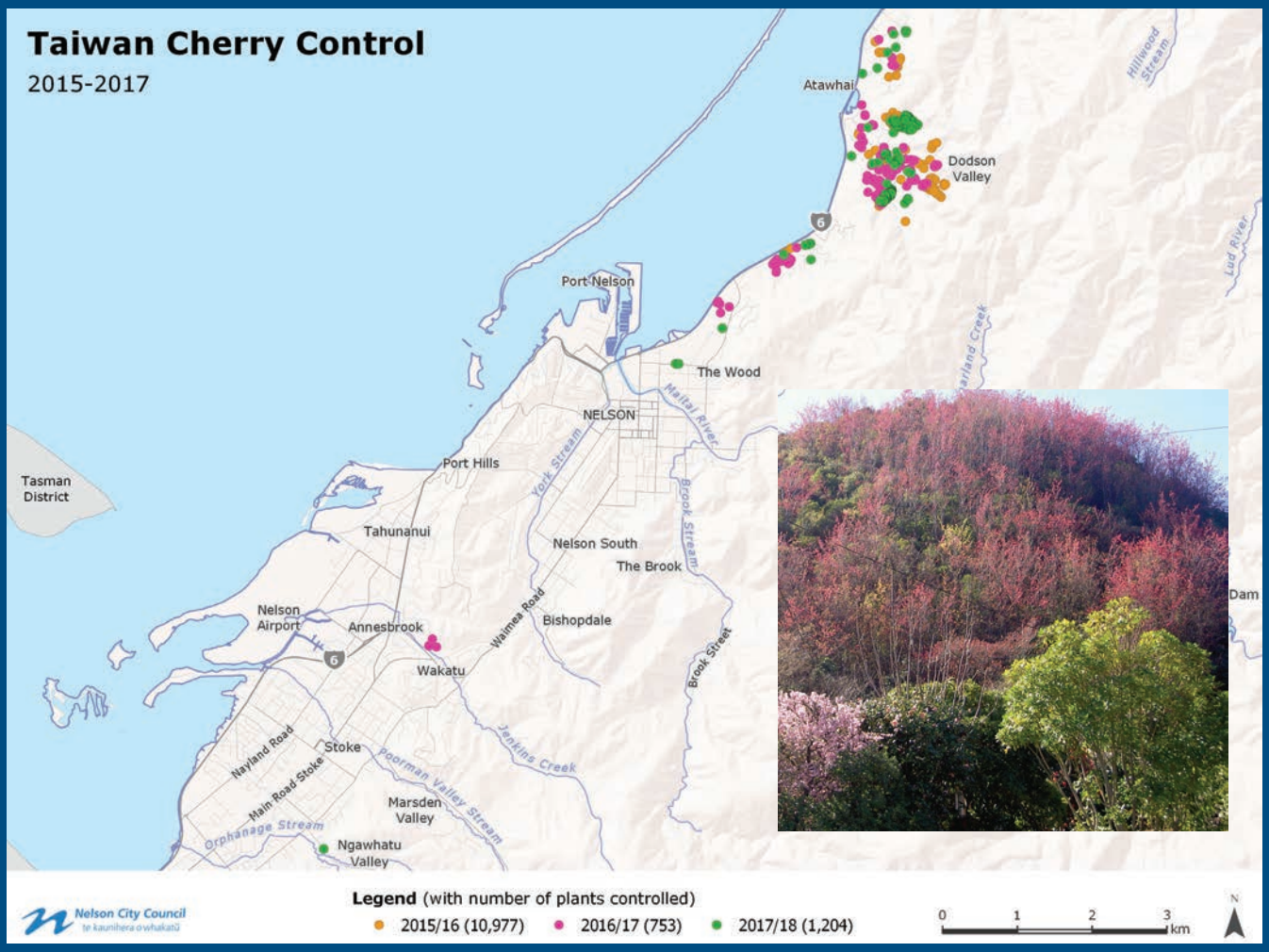
It has the potential to spread and dominate over native vegetation, displacing it and negatively impacting naturally occurring ecosystems.

Because of the significant threat posed to biodiversity values in the region, the Council initiated an annual control programme in 2015 to reduce the impact on Nelson's natural environment. In 2017/18 an estimated 1,204 plants were controlled under this programme, compared with 753 in 2016/17 and 10,977 in 2015/16.

See map below for annual extent and location of controlled Taiwan cherry plants.

WHAT YOU CAN DO:

Contact Council biosecurity staff to identify or report the presence of plants and get advice on control. Replanting with native species such as kōwhai, rata or cabbage trees is recommended.



MARINE BIOSECURITY

Council helped establish, and is an active partner in, the Top of the South (TOS) Marine Biosecurity Partnership with Marlborough District Council and Tasman District Council. The Partnership has reduced marine biosecurity risks in Nelson, Marlborough, and Tasman from 2009 to the present. It has also contributed to improving marine biosecurity for all of New Zealand.

Specifically the Partnership has:

- Established the TOS Marine Biosecurity Strategy, and had that formally agreed by central and regional government as guiding policy.
- Achieved national recognition by winning an inaugural NZ Biosecurity Award.
- Gained agreement from community, industry, stakeholders and other agencies to support the Strategy goals.
- Reduced biosecurity risks in the water by creating effective incident response, codifying that in a manual, and training all relevant parties in its application (thus reducing response time from years to hours).
- Inspected over 1,000 vessels for marine pests.
- Produced and distributed public awareness materials both in the TOS and neighbouring regions – see website: bionet.nz/control/marine-pests/top-of-the-south-biosecurity-partnership/
- Contributed to the development of new tools and knowledge, including publishing technical reports. An example of a new tool is the floating dock purchased in 2017 (FAB Dock shown in adjacent photo). This will allow up to 20m long vessels to be treated in emergency situations for harmful organisms growing on their hulls.
- Led suppression of Mediterranean fanworm – all three Councils have established a Small Scale Management Programme for *Sabella* (see following page).
- Supported industry, including marine farming and marinas, in the development of standards and processes.

SMALL-SCALE MANAGEMENT PROGRAMME FOR *SABELLA*

Mediterranean fanworm (*Sabella spallanzanii*) is a large, tube-dwelling worm – it is the largest fanworm in New Zealand measuring up to 20mm wide and 800mm long. It is a significant marine pest because it can live in most artificial and natural habitats in the marine environment and can form dense beds that are likely to out-compete other species and interfere with biological processes. Specifically, it has the potential to compete with native filter-feeding organisms for food and space, and in high densities is likely to impact commercially important species (eg mussels, scallops etc). *Sabella* will readily settle on mussel grow-out lines and may reduce mussel growth by altering water flow around the lines and competing with mussels for suspended food.

The ability of the species to attach to a wide variety of surfaces in varying environmental conditions, its fast rate of growth, and its prolific breeding habits, make it particularly competitive. It has no known predators in New Zealand.

In July 2017 the Council established a three year Small-Scale Management Programme for *Sabella* with the aim to control this marine pest until it is included in the Regional Pest Management Plan for Nelson.

Since 2013 the Council has undertaken an annual survey of vessels, piles and pontoons in the marina for *Sabella*. The presence of *Sabella* has declined each year since 2014, and none was found during the 2018 survey (see following page). It was, however, discovered on a vessel moored in Nelson Haven in November 2017. The vessel was treated and a follow up survey of the relevant swing mooring area detected no further sign of *Sabella*. During the annual survey several vessels were found to have another marine pest, *Styela clava* (clubbed tunicate/sea squirt) on their hulls – this was widely spread and in relatively high numbers, although the organism size was smaller than earlier surveys. The vessels were cleaned.

SABELLA SURVEYS, NELSON MARINA

Year	Number of *Sabella* found
2013	12
2014	22
2015	8
2016	4
2017	2
2018	0

WHAT WE ALL CAN DO:

You can help prevent the spread of marine pests by:

- Regularly cleaning your boat's hull – ideally keep fouling growth to no more than a light slime layer
- Applying good thorough coatings of antifouling paint and keep it in good condition
- Ensuring your hull is clean and free of fouling before you travel to a new region
- Cleaning and drying any marine equipment (e.g. ropes, lines, pots) before using in a new location
- Inspecting areas on your boat that retain water in case they're harbouring marine life
- Checking anchors, trailers and other equipment for tangled weeds

Sabella spallanzanii.

Nelson Marina – Mediterranean fanworm (*Sabella spallanzanii*) detections

Reported Sabella

- June 2017 (2)
- April 2016 (4)
- June 2015 (8)
- April 2014 (22)
- December 2013 (11)
- November 2013 (1)
- V Sabella found on Vessel
- (A) Pontoon Finger

0 50 100 150 m

Scale 1:5,000

N

December 2018

Nelson City Council
te kaunihera o whakatū

File Ref: A2101843
MSP: Original map size A4.

PO Box 645 Nelson 7040 New Zealand PH 03 5460200 nelson.govt.nz

'Centre of New Zealand', Nelson City.

SUSTAINABLE LAND

TE WHENUA TOITŪ

LAND USE

AT A GLANCE

The way in which land is used can impact the quality of our freshwater environments, estuaries and oceans.

FMU	Area (ha)	Indigenous Forest	Exotic Forestry	Pastoral	Urban
Whangamoa	11,224	53%	40%	3%	
Wakapuaka	9,276	38%	33%	22%	
Maitai *	13,038	47%	22%	11%	12 %
Roding	4,946	85%	8%		
Stoke	3,757	11%	17%	26%	41%

**The Maitai FMU includes the Hillwood, Oldham and Todd Valley streams.*

The Nelson region covers over 42,000 ha with over 582 km of streams. Of this land, 48% is indigenous bush, 27% exotic forestry, 12% pastoral farming, 6% is in exotic vegetation and 8% is in the urban zone.

Impacts include nutrient inputs, sediment, or pollutants from the urban environment.

A letter from the children at Hira Kindergarten

Dear Adults

This is our river and we love it. Please can you look after it and keep it clean for us.

- So we can swim in it and put our heads under and even open our mouths
- So little and big fish can live in it and grow stronger and swim out to the sea
- So birds can find things to eat and have little drinks
- So we can play in it
- So it can keep on being a river for ever

We are going to help by

- Wearing our pants when we go swimming in it and not do poos and wees
- Never ever throwing rubbish in it of anywhere else
- Tell our parents to do the right thing...no rubbish, no fish guts, no poos, no poison stuff, no plastic

Thank you

LAND USE TYPE AND CATCHMENT STATISTICS

Natural processes such as wind, rain, earthquakes or floods have impacts for soil and biodiversity. The way in which land has been used historically, and how this has changed over time, can exacerbate or mitigate the effects of natural processes.

In the urban environment, stormwater inputs and runoff from roads and houses contribute heavy metals, and trace elements into urban streams. In the rural environment, nutrient discharges from land use including E.coli, nitrogen, phosphorous and sediment, are all contributors to water quality issues.

age of *E. coli* contamination, which can be used to guide actions to address these issues.

The Maitai catchment is also impacted by both forestry and pastoral land uses. Again this is reflected in ecosystem health indicators, phosphorous, and sediment levels.

The Stoke catchment experiences the most complex set of impacts, being a mix of urban and rural land, which supports both forestry and pastoral use. All three land uses are likely to be impacting on ecosystem health, nitrogen and phosphorous inputs, and sediment.

MCI sampling with children from Wakapuaka Catchment.

Council works to address these issues through both regulatory methods, such as consenting processes, and through non regulatory methods including working with the community to provide a range of resources such as printed educational material, fencing and planting grants for riparian management, and farm plans.

Council has established five fresh water management units (FMUs), each with a different, but equally complex, range of issues derived from the predominant land use in the catchment.

The Whangamoa and Roding catchments have high quality freshwater and are impacted to a relatively small degree from land use practices. Sediment, most likely the result of bank erosion and forestry practices, is having an effect on the Whangamoa River and estuarine environment.

The Wakapuaka River catchment is impacted by both forestry and pastoral use. Monitoring results indicate that these two land practices impact on ecosystem health, nutrient levels, and sediment, with pastoral land use having an impact on faecal contamination. Council is undertaking intensive *E. coli* monitoring in this catchment which will assist in identifying the source and

There are relatively few commercial farms in the Nelson region (over 100 ha) with most pastoral land being comprised of small lifestyle blocks. Council is working with these landowners, particularly on land in steeper erosion prone catchments, to implement good management practices and to work at a community level to improve water quality through increased riparian planting and exclusion of stock.

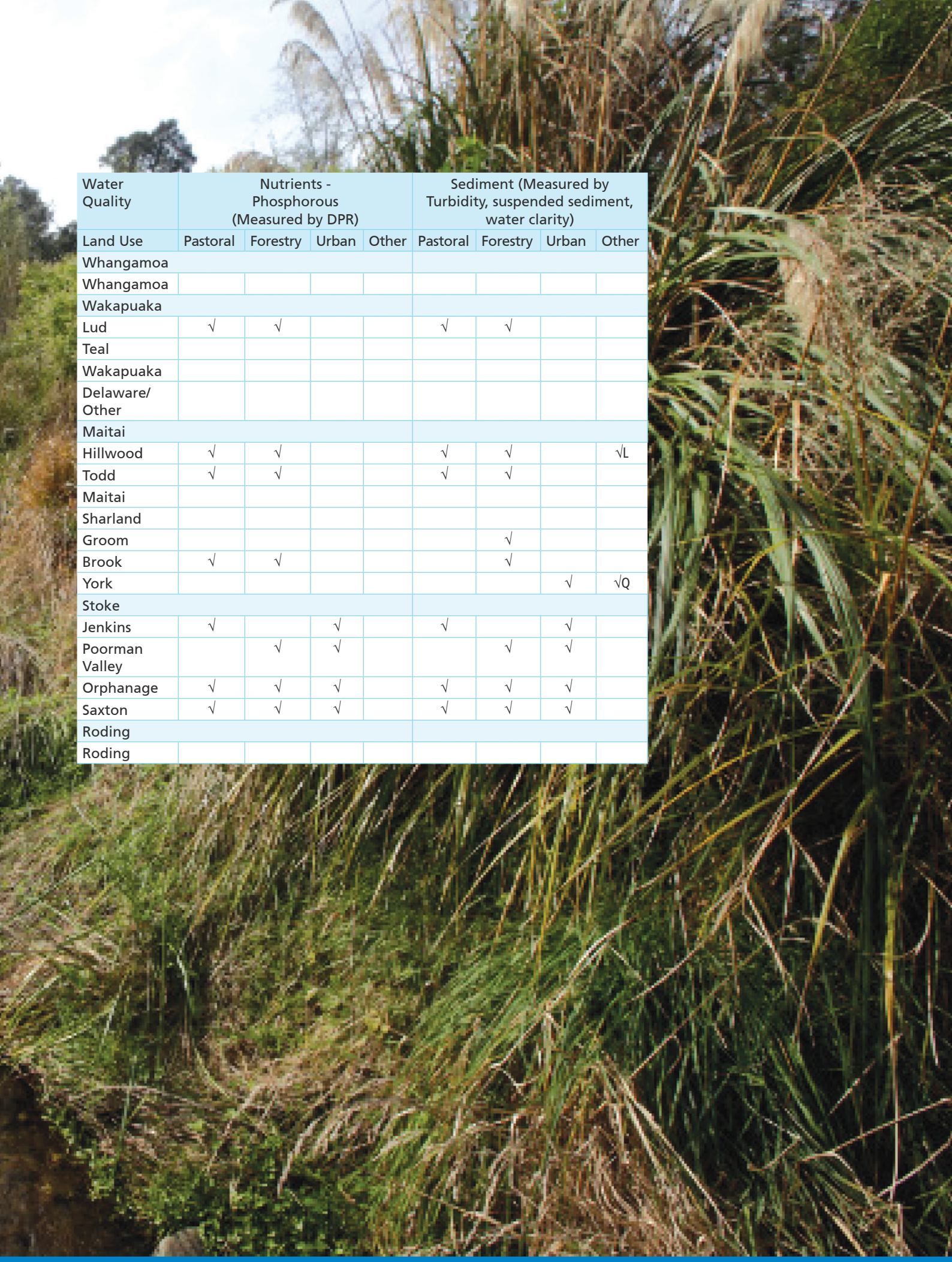
Forestry in the region is a major land-use, with most occurring on steep to very steep country. State of the Environment monitoring results indicate forestry is a significant contributor to sediment in waterways. The issues of both sediment and nitrogen from forestry tends to be associated with harvesting and the five years following harvest as new plants are establishing thus stabilising land. Associated earthworks, and stream crossings by vehicles, also have an impact. Council has itself retired one fifth of its own forestry lands (149 ha), on its steepest country. The recently introduced National Environment Standards for Plantation Forestry (NES-PF) sets standards for all forestry activities, and the Council is closely monitoring activities in light of this.

LAND USE CONTRIBUTION TO WATER QUALITY ISSUES

C.B = Cyanobacteria. MCI = Poor Micro Invertebrate Index. L = Landfill. Q = Quarry.

Water Quality	Poor Ecosystem Health (Measured by MCI, Periphyton, Native fish communities)				Faecal Contaminants (Measured by faecal tracking and *E.coli* count)				Nutrients - Nitrogen (Measured by SIN, Nitrate-N, Ammoniacal-N)			
Land Use	Pastoral	Forestry	Urban	Other	Pastoral	Forestry	Urban	Other	Pastoral	Forestry	Urban	Other
Whangamoa												
Whangamoa												
Wakapuaka												
Lud	√MCI	√MCI			√				√	√		
Teal		√MCI										
Wakapuaka	√MCI	√MCI										
Delaware/ Other												
Maitai												
Hillwood	√MCI	√MCI		√L								
Todd	√MCI	√MCI										
Maitai	√C.b	√C.b		√C.b								
Sharland										√		
Groom										√		
Brook												
York	√MCI	√MCI	√MCI		√MCI	√MCI	√MCI					
Stoke												
Jenkins	√MCI		√MCI		√					√		
Poorman Valley					√							
Orphanage	√MCI	√MCI	√MCI		√				√	√	√	
Saxton	√MCI	√MCI	√MCI		√				√	√	√	
Roding												
Roding												

Riparian planting on rural land in the Lud Valley.



Water Quality	Nutrients - Phosphorous (Measured by DPR)				Sediment (Measured by Turbidity, suspended sediment, water clarity)			
Land Use	Pastoral	Forestry	Urban	Other	Pastoral	Forestry	Urban	Other
Whangamoa								
Whangamoa								
Wakapuaka								
Lud	√	√			√	√		
Teal								
Wakapuaka								
Delaware/ Other								
Maitai								
Hillwood	√	√			√	√		√L
Todd	√	√			√	√		
Maitai								
Sharland								
Groom						√		
Brook	√	√				√		
York							√	√Q
Stoke								
Jenkins	√		√		√		√	
Poorman Valley		√	√			√	√	
Orphanage	√	√	√		√	√	√	
Saxton	√	√	√		√	√	√	
Roding								
Roding								

CASE STUDY: HABITAT RESTORATION - GROOM CREEK WETLAND

Wetlands provide a number of eco-system services. They benefit water quality by slowing water flow and enabling particles to disperse, and the plants supported in wetlands filter nutrients and add oxygen to the water. Heavy rainfall is absorbed in wetlands and released slowly, thereby reducing the impacts of flooding while also maintaining water levels in periods of low rainfall. In addition, wetlands provide habitat for plants, insects, birds and aquatic life. Of the 27 species of native freshwater fish, eight can be found in wetlands.

The Nelson Region, like most of New Zealand, is largely depleted of the wetlands that occupied our lowland areas pre-colonisation. Urbanisation and agricultural practices drained wetlands into functional channels, so that our remaining natural wetlands are highly valued as important eco-systems.

Constructed wetlands have an important role to play as engineered solutions, using natural processes. Constructed wetlands act to remove pollutants and assist in reducing flooding, in much the same way as natural wetlands. On farms they can be used to intercept agricultural runoff, while in urban areas they can be used to intercept urban stormwater pollutants. An example of this can be seen in the Trafalgar Centre carpark and along the nearby Maitai walkway.

MAITAI WETLAND AT GROOM CREEK

The Maitai River has a number of small tributaries. One of these is Groom Creek which flows from the Tantragee Saddle through forestry land and into the Maitai River. Groom Creek has higher dissolved nitrate nitrogen concentrations than the Maitai River.

Analysis of several years' data by Cawthron Institute found higher mean values in all nutrients and total suspended solids in Groom Creek, relative to the Maitai River. The NO3-N (Nitrogen nitrates) load in Groom Creek made a significant contribution to levels in the Maitai itself, particularly during higher flows (e.g. up to 34% of Maitai NO3_N load).

To test the ability of constructed wetlands to treat sediments and nitrates on a small scale, it was decided to construct an artificial wetland where Groom Creek meets the Maitai River. This site was likely once a wetland, though of a more ephemeral type than one designed to improve water quality.

The design of the wetland involved realigning Groom Creek to a path similar to that shown in aerial photographs from the 1950s. The wetland is designed to trap sediment and contaminants from the creek using specifically selected plants. These plants allow physical, chemical and biological treatment to take place in the wetland.

The wetland also provides valuable habitat for many native species. It has been carefully designed to improve fish passage and with plants that provide habitat for insects, which in turn provide a food source for fish, koura and bird species.

HOW DOES THE WETLAND WORK?

1) **Inlet Diversion Forebay** – Flows from Groom Creek are diverted into the wetland via a forebay to capture sediments.
2) **Bypass Channel** – During very large storm events, flows bypass the wetland via the former Groom Creek channel.

Planting natives at Groom Creek wetland.

3) **Pool Riffle Sequence** – Naturalised channel section moves flows down into the upper wetland zone, aerating the water and providing habitat.

4) **Shallow Marsh** – The wetland has areas of shallow water depth (less than 200 mm) that support aquatic plants to help trap contaminants.

5) **Deep Marsh** – The wetland has areas of deep water depth (less than 500 mm). Deeper areas provide for invertebrates and other aquatic species and help remove nutrients through denitrification.

6) **Weir** – Maintains the permanent water level in the upper treatment wetland. Controls the flow down into the lower wetland.

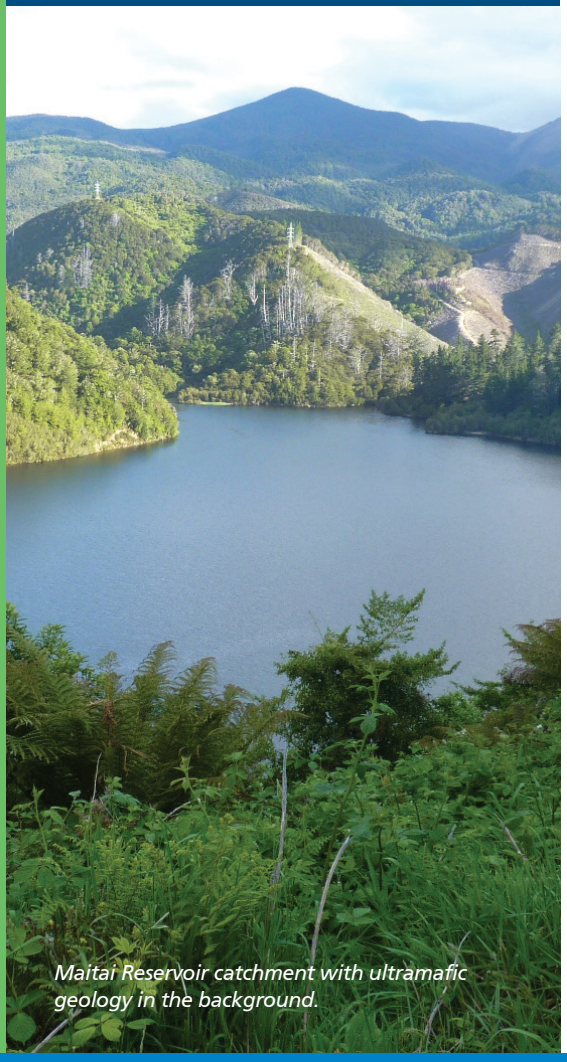
7) **Outlet Pool** – The open water slows the flow down and provides habitat in deeper water. Treated flows then make their way across the original flowpath to join the Maitai River as they once did. The outlet manhole weir is below water level and draws cooler water which most of our fish and invertebrates prefer.

Wetland habitat at Groom Creek wetland.

AT A GLANCE

Fifteen soil monitoring sites are to be established across five different land use types, and seven key soil quality indicators will be measured. Council is undertaking soil monitoring to:

- Provide information on the physical, chemical and biological properties of soils
- Identify the effects of land uses on long term soil productivity so that any issues can be detected early and monitored as required
- Provide information required to determine the effectiveness of regional policies and plans
- Contribute to the national picture of soil quality



Maitai Reservoir catchment with ultramafic geology in the background.

SOIL IMPORTANCE AND CLASSIFICATION

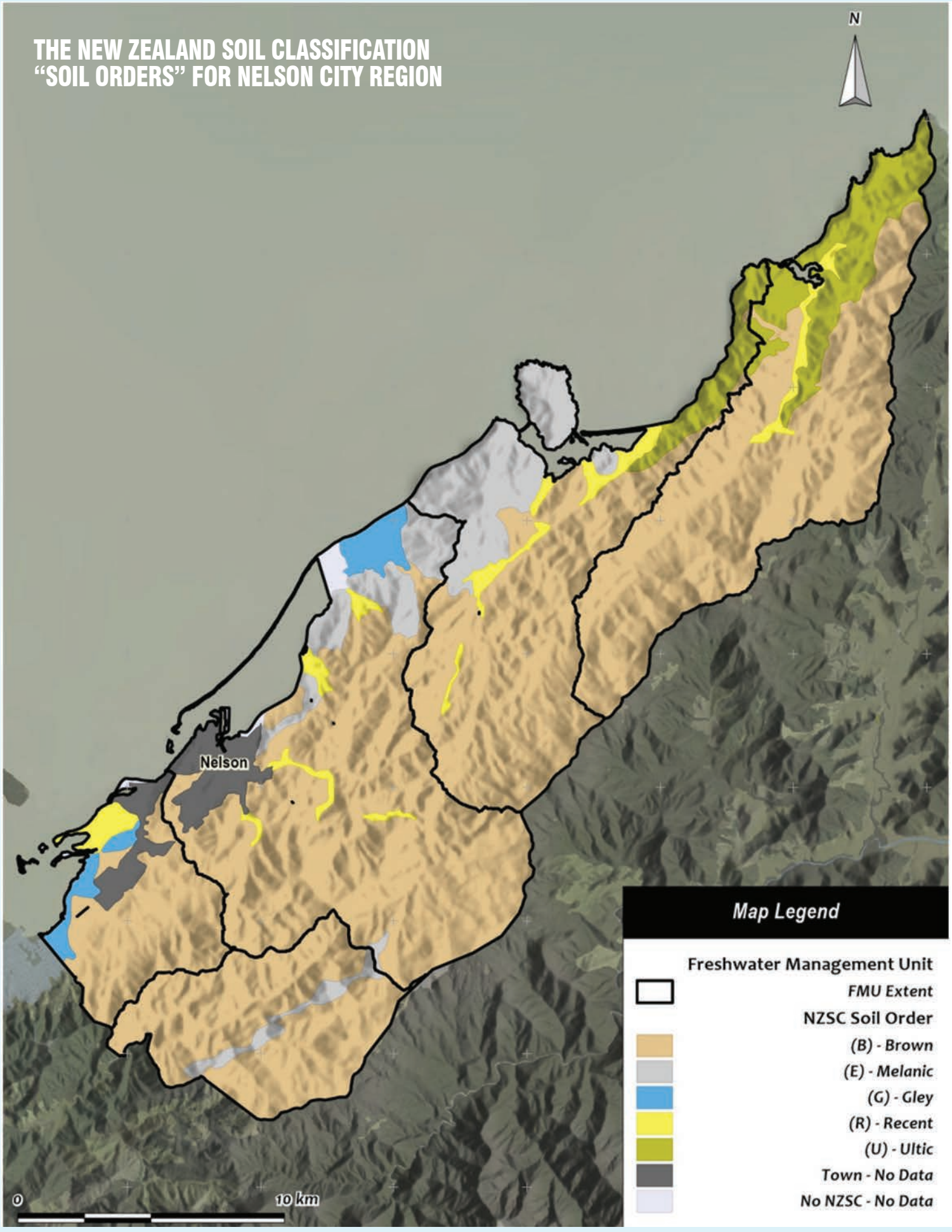
Soil is a complex mix of organisms, minerals, organic matter, water and air. It is as much a living ecosystem as our waterways, our oceans, and our forests. Healthy soil is essential to the overall health of people, land and water, including the ability to grow food, to have clean water, to break down contaminants, and to support biodiversity.

The soil has evolved over millions of years, influenced by underlying geology, climate, and aspect. Humans have impacted soils through land practices.

Across New Zealand, there is a wide range of soil types and these are classified using the New Zealand Soil Classification system. There are 15 Soil Orders found in New Zealand, of which five are represented in the Nelson City region – see page 41. These soils are:

- Ultic soils: derived from quartz-rich sediments which have weathered to clay or sandy clay
- Brown soils: the most common type of soil in New Zealand with the brown colour of the soil caused by iron oxides weathered from the underlying parent rock
- Melanic soils: naturally fertile soils which are biologically active with high levels of soil organisms
- Gley soils: representative of the original wetland cover in New Zealand which have been significantly reduced through agricultural drainage practices
- Recent soils: occurring on young land surfaces such as alluvial flood plains and steep slopes, and are aged at less than 1000 to 2000 years

Soil Order is then divided into Soil Group and further into Soil Sub-groups. Individual soils are often referred to by their regional Soil Series names (for example, Waimea or Atawhai soils). The use of Soil Series predates the New Zealand Soil Classification but is still sometimes used to distinguish soils at a finer level of classification than is possible with the New Zealand Soil Classification - see map on page 41.


THE NEW ZEALAND SOIL CLASSIFICATION
"SOIL ORDERS" FOR NELSON CITY REGION
N
Nelson
0
10 km
Map Legend
Freshwater Management Unit
FMU Extent
NZSC Soil Order
(B) - Brown
(E) - Melanic
(G) - Gley
(R) - Recent
(U) - Ultic
Town - No Data
No NZSC - No Data

SOIL MONITORING PROGRAMME

WHY DO WE MONITOR SOIL?

- To provide information on the physical, chemical and biological properties of soils
- To identify the effects of land uses on long term soil productivity so that any issues can be detected early and monitored as required
- To provide information required to determine the effectiveness of regional policies and plans
- To contribute to the national picture of soil quality

The Nelson programme reflects the relatively small size of the region and range of land uses. Initially, 15 sites have been established across five different land use types: indigenous vegetation; plantation forest; pasture; cropping; and horticulture.

Soil scientist collecting samples.

SOIL QUALITY INDICATORS

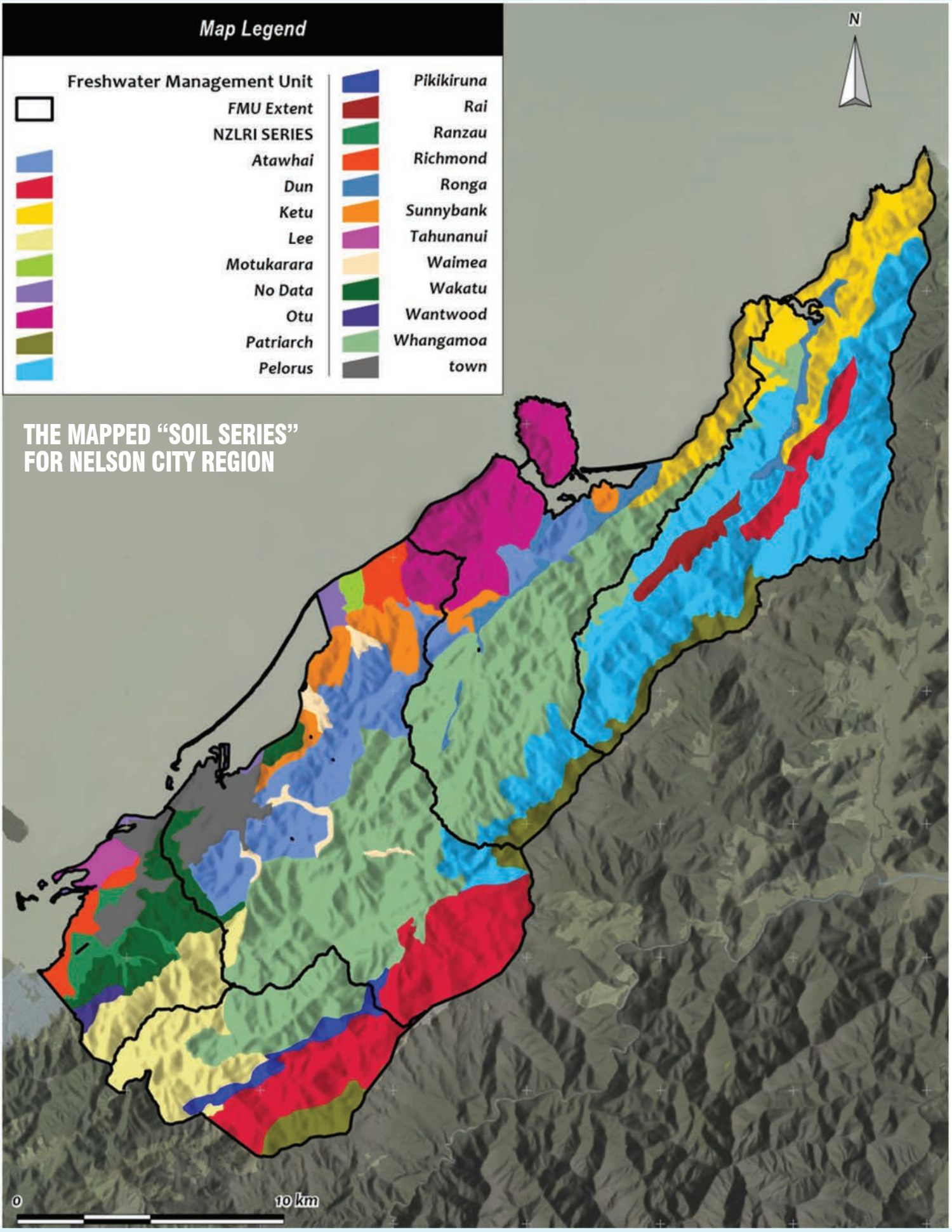
Biological components: Total carbon, total nitrogen, anaerobic mineralisable nitrogen. Total carbon is used to estimate the level of organic matter in the soil as this indicates good soil structure, important for retaining moisture and nutrients. The remaining indicators measure the level of nitrogen in soil. Nitrogen is essential for plant growth, however too much nitrogen risks nitrogen loss to waterways that can occur through leaching, cropping practices, soil erosion, and run off.

Chemical components: Soil pH and Olsen P. Plants have optimal pH ranges for growth with levels influencing how available nutrients are to plants. Olsen P (Olsen Phosphorous) measures available phosphorus in the soil. Too little phosphorous restricts plant growth while too much can cause losses from the soil to waterways causing excess algal growth.

Physical components: Bulk density and macroporosity. These measures are used to determine the level of soil compaction, and as a result, how water and air can move through the soil. These properties have an impact on root development and plant growth.

A number of trace elements are also measured, as these can accumulate in soil as a result of land use practices and at high levels can be toxic. These trace elements include heavy metals such as cadmium, arsenic and zinc. A number of additional soil parameters are included in the monitoring programme, including those that will contribute data to the revision and development of the biological soil quality indicator.

Sampling across all sites will be undertaken every 3-5 years, and compared with the sampling results of the soil quality monitoring programmes of the adjoining Tasman and Marlborough districts.

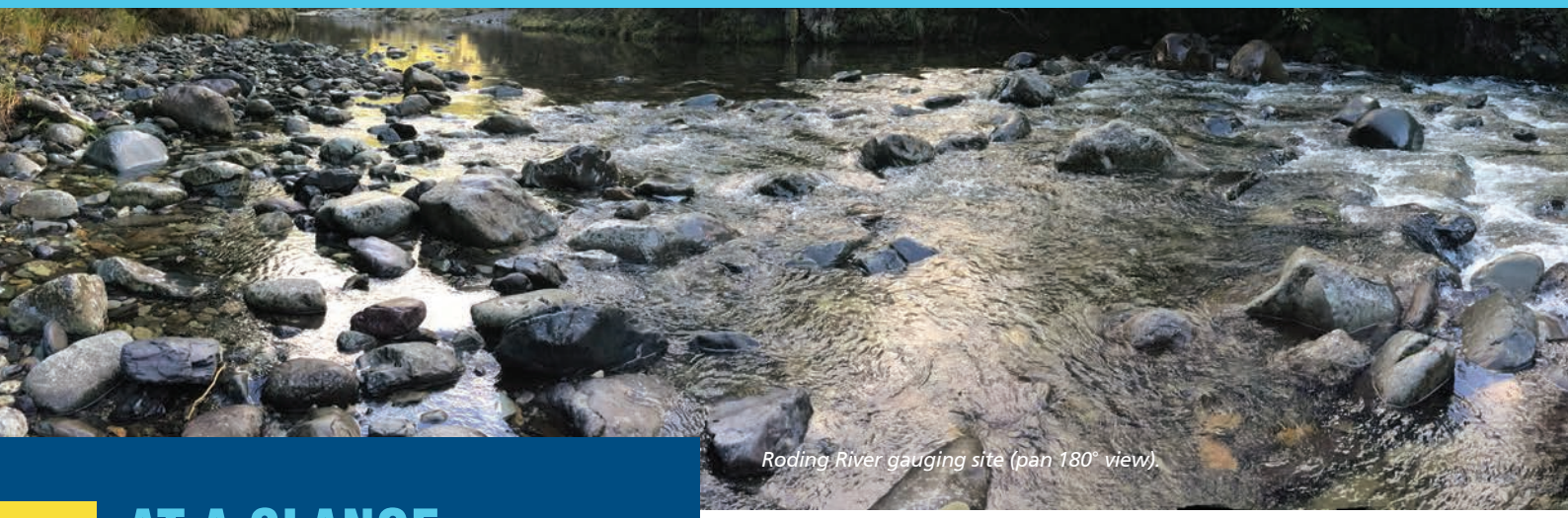

Map Legend
Freshwater Management Unit
FMU Extent
NZLRI SERIES
Atawhai
Dun
Ketu
Lee
Motukarara
No Data
Otu
Patriarch
Pelorus
Pikikiruna
Rai
Ranzau
Richmond
Ronga
Sunnybank
Tahunanui
Waimea
Wakatu
Wantwood
Whangamoa
town
N
THE MAPPED "SOIL SERIES"
FOR NELSON CITY REGION
0
10 km

Council scientists gauging the Brook Stream.

SUSTAINABLE WATER

TE WAI TOITŪ

WATER QUANTITY



Roding River gauging site (pan 180° view).

AT A GLANCE

- Nelson City Municipal Supply abstracted 6.7 million m³ of water from the Maitai and Roding catchments for the city in 2017/18.
- During 2017/18 there were water restrictions due to low river flows in December
- Storm and cyclone events in February 2018 resulted in higher than average rainfall totals for the month
- The hydrometric network, which measures river flows, is being upgraded to replace aging equipment and improve data quality
- A groundwater monitoring programme is being developed to help better understand this resource
- Five Nelson streams are over-allocated "on-paper", but actual water use is much less than the consented allowance. Work is underway to bring these catchments back within allocation
- Council are working to protect our freshwater resources through community education and engagement

PRESSURES ON WATER QUANTITY

WHY DOES IT MATTER?

The greatest demand for surface water in Nelson comes from drinking water supply and irrigation. Whilst the consented water takes are low compared to other regions around the country, numbering less than 50, the takes need to be managed appropriately to reflect the region's small rivers and streams.

Water for the Nelson municipal water supply comes from the Maitai and Roding Rivers and supplies rural and urban areas from Saxton to the Glen. In the 2017/18 year, the Nelson reticulated supply used 6.7 million m³ of water. This is typical of water use in the last five years which ranged between 5.7 million m³ and 8.1 million m³.

Depending on the size of a water take, consent holders are required to report on how much water they use and when. In most cases use is less than the total amount allowed over a year. However, on paper some rivers are over-allocated. That means, if everyone took their full allowance there could be negative consequences for our waterways.

Interesting Fact

Did you know there is life in groundwater? There are highly specialised species of invertebrate that live their whole life without light. In 2004 water mites known as stygofauna were found in a Nelson well. Not much is known about the communities living underground so chances are there are plenty more that haven't even been discovered or named yet!

CURRENT "ON-PAPER" ALLOCATION OF WATER RESOURCES IN NELSON STREAMS AND ACTUAL WATER TAKEN IN THE 2017/18 REPORTING PERIOD

River	Allocation	Actual use
Roding	Full	30%
Poorman	Over	<5%
Saxton	Over	100%
Jenkins	Partial	<5%
Maitai	Full	30%
Oldham	Over	<5%
Todd Valley	Over	<5%
Hillwood	Over	<5%
Teal	Partial	<5%
Lud	Partial	<10%
Wakapuaka	Partial	<10%
Whangamoa	Partial	<10%

In some cases, estimates have been used where data is not available.

The biggest pressure on our streams and rivers is during low flows, which usually occur during summer months. This is when streams and the fish that live in them are most vulnerable. Water use alone is not accountable for all the pressures on our streams, it can be the activities that we are using the water for that in turn alter the natural state of a river.

WHAT ARE WE DOING ABOUT IT?

At the Council we monitor our rivers so that we can make informed decisions and prepare for the future. We are currently developing a new unitary plan, which includes reviewing the amount of water that is allocated or allowed to be taken from our rivers. We are reviewing current allocation and working with consent holders to reduce over allocation of water resources. We are also working on projects to educate and engage our community in water conservation. We have a program to upgrade our continuous monitoring sites to ensure we collect quality data and we are increasing the amount of gauging we do on smaller streams we know less about.

WHAT WE CAN ALL DO

Water is precious and every drop really does count. We want to be able to provide for our communities' needs whilst making sure we don't put undue pressure on the outstanding natural environment Nelson is so well renowned for.

At home, school, and work or on the farm there are simple ways you can help:

- **Reduce** - think about how and when you use water, when replacing or installing new appliances choose water efficient models, and don't leave taps running
- **Reuse** - have you considered using greywater in the garden
- **Harvest** - check out our rainfall harvesting brochure to get started on collecting the free water that falls on your roof

Please make sure you follow Council requirements during water restrictions.

Roding at Caretakers flow gauging site.

THE HYDROLOGY NETWORK

WHAT WE MONITOR

Council's hydrometric network monitors rainfall and river flow at 15 sites across the region, which consists of seven rainfall and 11 continuous water level/flow sites. These sites provide near real-time data about what is happening across our region. Our longest record is in the Roding catchment where rainfall recording began in 1944. We also take manual measurements of river flow known as "spot gaugings" at many other stream and river locations across the region.

RAINFALL

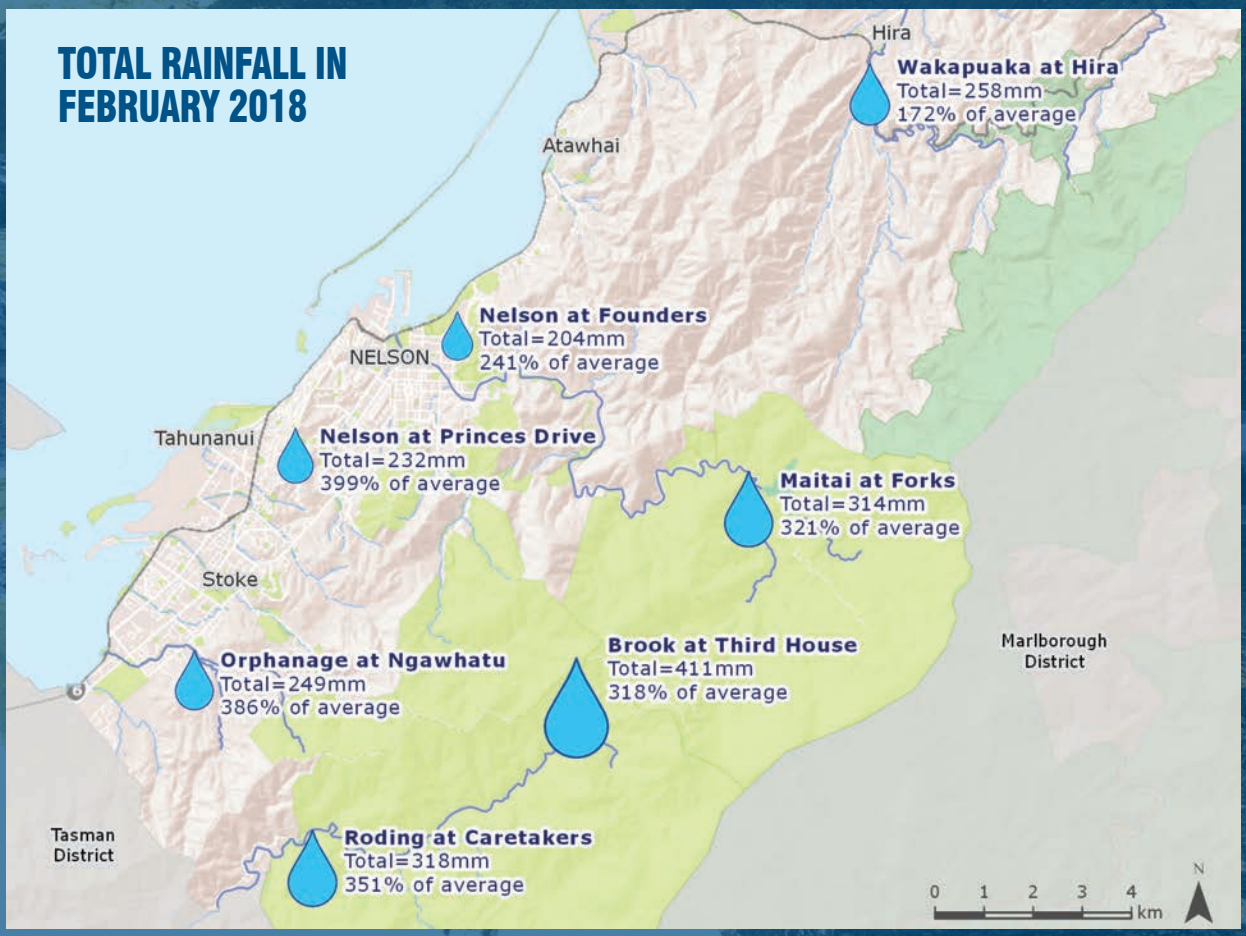
The rainfall map shows how high February rainfall totals were compared to average February totals across the region.

During 2017/18 monthly rainfall totals at Founders Park were particularly high in January and February, more than 100% of the 5 year average, whilst June was much drier than usual, totals were less than 50% of long term averages.

Interesting Fact

On the 23rd of March 2018, the rainfall recorder at Princes Drive recorded 67.5 mm in 2 hours. This is an event that has the probability of occurring once every 50 years.

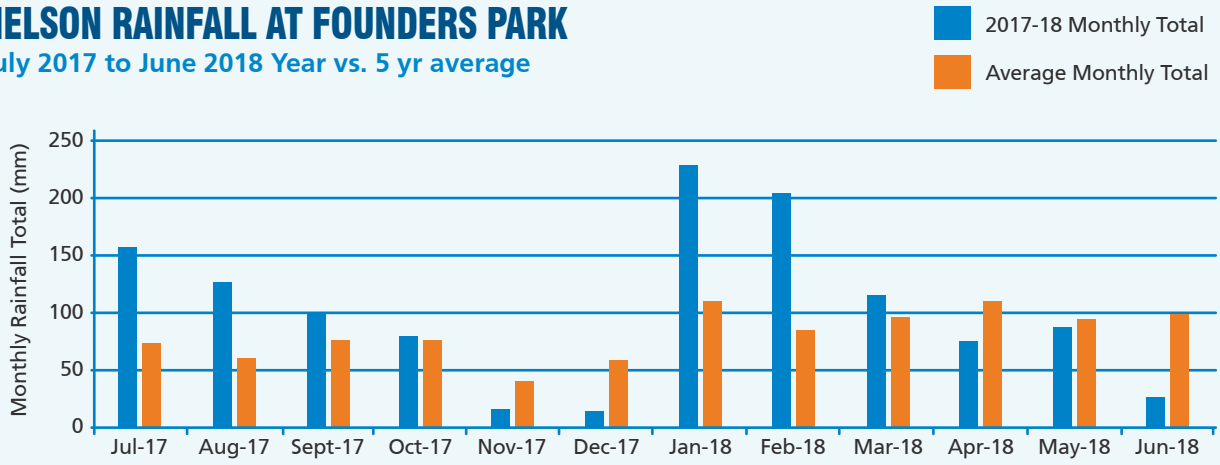
Wakapuaka at Hira



Illustrative map of monthly rainfall totals at Nelson rainfall recording sites for February 2018 and the % of normal or average February rainfall for that site.

NELSON RAINFALL AT FOUNDERS PARK

July 2017 to June 2018 Year vs. 5 yr average



Graph showing actual monthly totals for 2017-2018 compared to average monthly totals for the Founders Park rain gauge.

During 2017/18 monthly rainfall totals at Founders Park were particularly high in January and February, more than 100% of the average totals over time. Whilst June was much drier than usual, totals were less than 50% of long term averages.

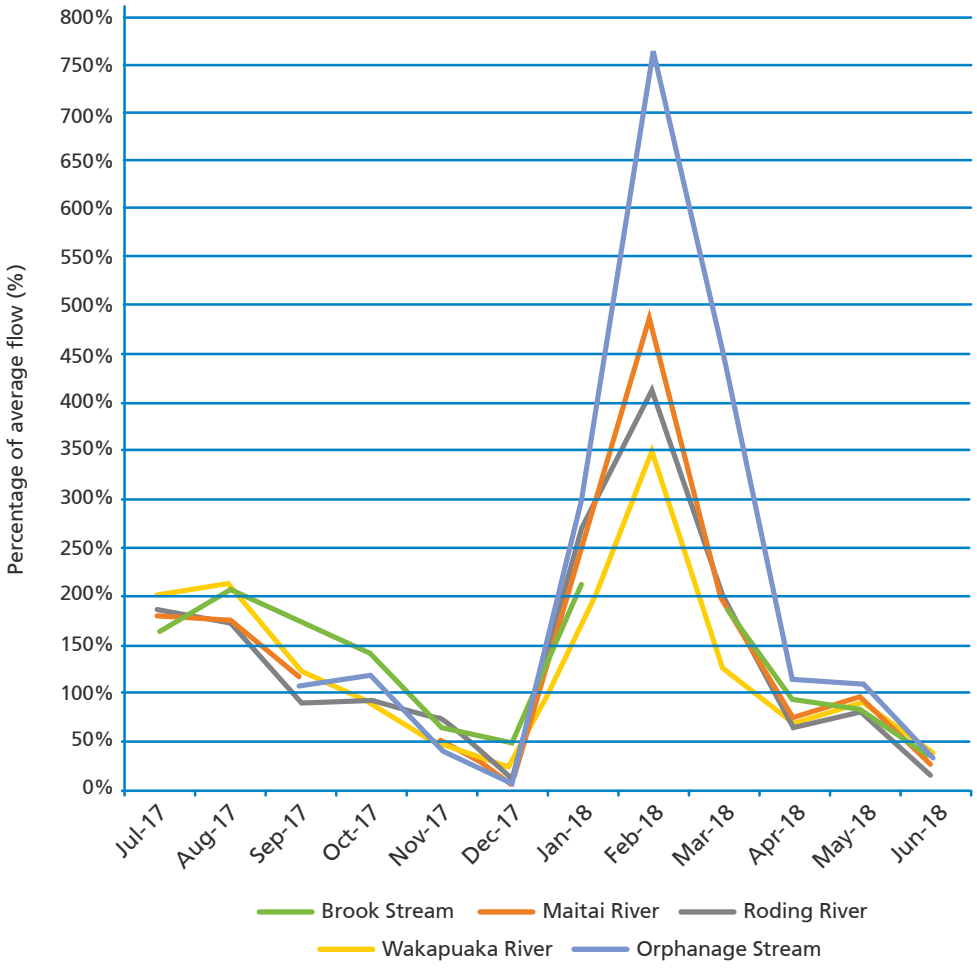
RIVER FLOW

Below average rainfall during November and December 2017 resulted in low river levels during this period. Water restrictions were enforced in December; however, the frequent and high rainfall events during January and February 2018 alleviated pressure on our rivers during the summer season.

Flood warning alarms were activated twice on the Maitai River. The largest flow event occurred on 11 February. The river reached a peak expected to occur once in every 8 years.

Graph showing % of average flow over the year for key Nelson Flow sites.

AVERAGE RIVER FLOW OVER 2017/18



GROUNDWATER

Nelson does not have vast or extensive groundwater resources. Council has embarked on a programme to collate existing information and develop a monitoring programme to find out more so that we can better understand and manage the resource. Monitoring of groundwater involves measuring how far down the groundwater is (depth) and testing different water quality parameters just like we would for surface water.

Groundwater in Nelson has been classified into two broad categories; groundwater closely connected to surface water and groundwater poorly connected to surface water.

CLASSIFYING OUR AQUIFERS

An aquifer is simply an underground body of rock, soil or sediment that serves as a storage reservoir for large volumes of water.

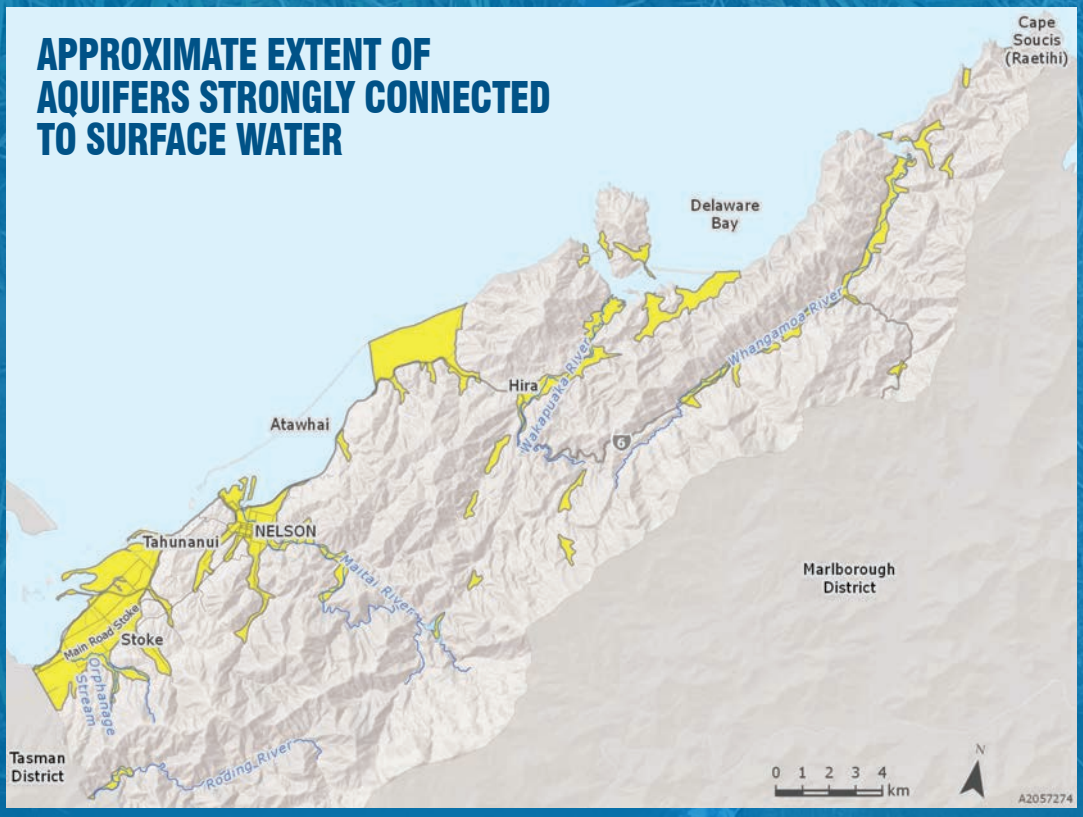
The aquifers in Nelson that are strongly connected to surface water are made up of alluvial terraces and flood plain deposits from the Quaternary period, 1.8 million years ago.

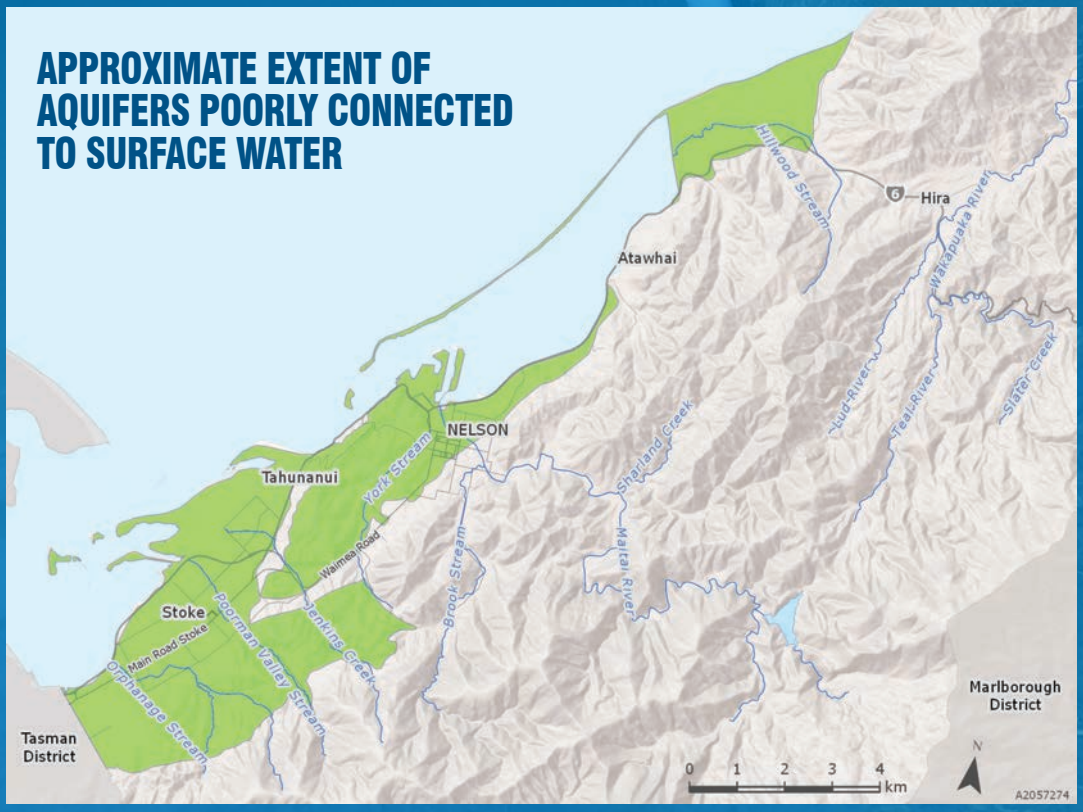
The aquifers that are poorly connected to surface water are made up of Moutere gravels and Port Hill gravels, these are deeper deposits, and the Moutere gravels can be more than 1 km deep. The age of the Port Hill gravels is between 3.6 and 11.2 million years old whilst the Moutere gravels are between 1.8 and 5.3 million years old.

In some areas the deep groundwater that is poorly connected to surface water is overlaid by younger groundwater that is strongly connected to groundwater.

WHO USES OUR GROUNDWATER?

Due to the limited spread of Nelson's groundwater resources, consented groundwater takes are restricted to about 18 local businesses, irrigators and domestic users.





Map showing the location and extent of aquifers strongly and poorly connected to surface water in Nelson.

AT A GLANCE

FRESHWATER MANAGEMENT UNITS

Nelson has five Freshwater Management Units (FMUs): Roding, Stoke, Maitai, Wakapuaka and Whangamoa (see map on page 55). These are defined spatially by the catchment or area of land that includes all the small tributaries that merge to form the main river system. The Nelson region has a network of streams totalling approximately 580 km. However, less than 10% of these waterways are classified as fourth order rivers or larger, the order of the waterway indicating the level of branching. Each FMU has water quality monitoring sites, which include reference sites in the upper catchment and sites in the lower catchment that reflect land and water use within the entire catchment.

We measure the state and trend of our streams and rivers to get an idea about whether our water is suitable for use for various purposes, and to quantify the effect of different pressures on the condition of our freshwater resources. The National Policy Statement for Freshwater Management (2017) sets the limits and targets to protect water quality values for sustainable water use and to safe-guard Te Mana o te Wai. The water quality values generally describe the natural state for each waterway (i.e. the desired state that would be expected with no influence from human activities) and are being used to set the water quality limits and targets in the draft Whakamahere Whakatū Nelson Plan.

WATER QUALITY ISSUES

Escherichia coli (*E. coli*) and *Enterococci* bacteria are indicators for the presence of waterborne pathogens and associated human health risks. Long term monitoring of Nelson's recreation bathing sites over five years shows that beach sites have Fair to Good water quality grades with a low human health risk, for the majority of time over summer months.

The Maitai River at Collingwood Street bridge and Wakapuaka River at Hira and Paremata Flats Reserves have the highest *E. coli* bacteria exceedances during wet weather from faecal contaminated storm water, received largely from local and upstream rural land discharges.

Nelson streams have occasional nuisance algae blooms, driven by elevated water temperatures and dissolved nutrients. The nitrate and phosphorous levels in the larger rivers, the Maitai, Wakapuaka and Whangamoa, have relatively low nitrate-nitrogen levels based on international guidelines for managing nuisance algae. A number of small streams, including the Lud, Sharland, Groom, York, Jenkins, Orphanage and Poorman have occasional elevated nitrate concentrations that encourage periodic algae blooms and can degrade water quality values.

Cyanobacteria toxic algae is relatively common across Nelson streams and rivers, though mostly below 5% cover which presents a low risk to the public. Long term monitoring since 2009 shows the highest cyanobacteria cover is found in the Maitai River at Avon Terrace, occurring annually at around 20% cover.

Discharge of sediment from land erosion occur mainly during storm events. Suspended and deposited sediment is impacting on water quality and the receiving environment including our rivers, estuaries and coastal waters. The impacts are largely to the stream bed habitat and associated biodiversity but can also reduce available habitat for fish and contribute sediment-bound minerals that exacerbate growth of nuisance algae over summer months. Sediment and algae blooms are contributing to declines in the macroinvertebrate (small aquatic animals) communities by smothering the cobble habitat across most monitoring sites, though the relative contribution of stressors have not been quantified yet.

WATER QUALITY TRENDS

The ten year water quality trends for Nelson's streams and rivers are described below for each FMU. They are reported nationally on the LAWA web portal (see National Monitoring and Reporting frameworks on page 56).

LAWA TEN YEAR WATER QUALITY TRENDS FOR NELSON FRESHWATER MANAGEMENT UNITS

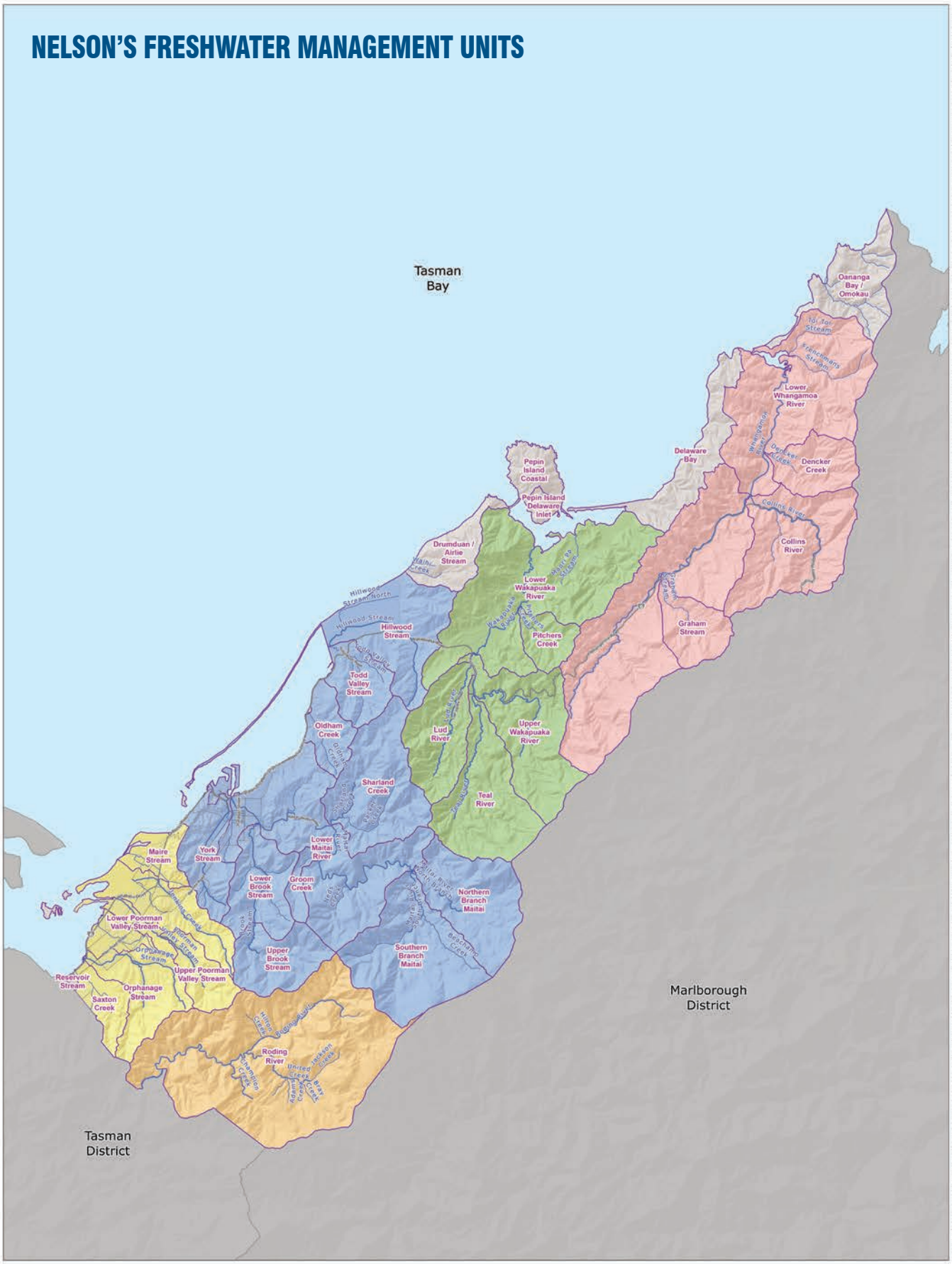
	Stoke FMU	Maitai FMU	Wakapuaka FMU	Whangamoa FMU
No. of monitoring sites	4	11	6	5
***E. coli* Bacteria**	*E. coli* is slightly elevated in Jenkins and Orphanage, with a moderate risk for human health. Both sites show an improving 10-year trend. 	Overall *E. coli* levels at all sites are within water quality guidelines for protecting human health and show an improving 10-year trend. 	Overall *E. coli* levels at all sites are within water quality guidelines for protecting human health. The lower catchment shows a degrading 10-year trend. 	Overall *E. coli* levels at all sites are within water quality guidelines for protecting human health and show an improving 10-year trend. 
Nutrient-nitrogen	Overall dissolved nitrogen is below levels for nuisance algae. There is insufficient data to show total nitrogen water quality trends over time.			
Nutrient-phosphorous	Elevated phosphorous in Orphanage, Poorman and Jenkins though overall not showing a water quality trend. 	Overall phosphorous is below levels for nuisance algae though show a degrading 10-year trend. 	Overall phosphorous is below levels for nuisance algae though show a degrading 10-year trend. 	Overall phosphorous is below levels for nuisance algae though show a degrading 10-year trend. 
Water clarity and turbidity (cloudiness)	Overall water clarity in the Stoke streams is good with an improving 10-year trend.  Increasing deposited sediment in Poorman and Orphanage is impacting on water quality, including macroinvertebrate diversity.	Overall water clarity in the Maitai and tributaries is good with an improving 10-year trend.  However, increasing turbidity is declining water quality in York and Hillwood tributaries.	Overall water clarity in the Wakapuaka and tributaries is good with an improving 10-year trend. 	Overall water clarity in the Whangamoa is good, though a degrading 10-year trend in the Collins. Turbidity also shows a degrading 10-year trend in the Collins and lower Whangamoa catchment. 
MCI	Overall, macroinvertebrate diversity is poor in the mid and lower Stoke streams. There is a general degrading 10-year trend. 	Overall, macroinvertebrate diversity is fair in the lower Maitai and Brook. However, there is a general degrading 10-year trend. 	Overall, macroinvertebrate diversity is good in the Wakapuaka, Teal and Lud. However, there is a general degrading 10-year trend. 	Overall, macroinvertebrate diversity is good in the Whangamoa, Collins and Graham. However, there is a general degrading 10-year trend. 

LONG TERM WATER QUALITY INDICATORS NOT REPORTED ON LAWA

Water quality indicators with seasonal trends	Stoke FMU	Maitai FMU	Wakapuaka FMU	Whangamoa FMU
Filamentous algae cover on stream bed	Water quality is moderately impacted by algae in Jenkins, Orphanage and lower Poorman	Water quality is moderately impacted by algae in Groom, Riverside, Sharland, York and lower Brook	Water quality is moderately impacted by algae in the Lud and lower Wakapuaka catchment	Water quality is moderately impacted by algae in the lower Whangamoa catchment
Cyanobacteria toxic algae cover	Overall water quality is not impacted year round by cyanobacteria toxic algae cover. The Maitai at Avon Terrace and Maitai Camp has occasional blooms greater than 20% cover.			
Continuous water temperature	Overall, water quality is moderately impacted by elevated water temperatures in all of the urban Stoke streams, lower Brook, York, Hillwood and Lud waterways.			

The Roding catchment is predominantly native vegetation with pristine water quality. Water quality is measured by annual resource consent biomonitoring for the Roding Dam, which is not reported on here.

NELSON'S FRESHWATER MANAGEMENT UNITS



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NATIONAL MONITORING AND REPORTING FRAMEWORKS

NATIONAL ENVIRONMENTAL MONITORING STANDARDS

Demand is increasing from the wider community for readily available, high quality environmental information. The National Environmental Monitoring Standards (NEMS) project aims to ensure consistency in the way environmental monitoring data is collected and handled throughout New Zealand. The NEMS project is led by regional councils, and working groups with Ministry for the Environment (MFE), NIWA and industry partners.

These documents prescribe technical standards, methods and other requirements associated with the continuous monitoring of a number of environmental parameters. The agencies that developed these standards are responsible for the majority of hydrological and continuous environment-related measurements within New Zealand.

DATA CONSISTENCY

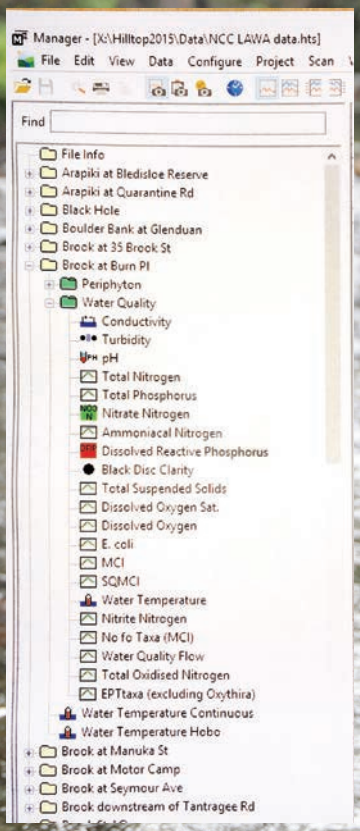
Data consistency is critical for national level reporting and comparison of environmental information between regions. This will be achieved through clear guidance on processes, methodologies, and techniques to be applied as standard practice in environmental monitoring across New Zealand.

ENVIRONMENTAL MONITORING AND REPORTING

Data consistency underpins the Environmental Monitoring and Reporting (EMaR) Framework, a partnership between the Regional Council Sector, with the Ministry for the Environment and Statistics New Zealand.

The overarching objective of EMaR is to provide integrated regional/national environmental data collection networks and widely accessible reporting platforms. Data will be available to Central Government for national reporting purposes and to the public via the Land, Air, Water Aotearoa (LAWA) website.

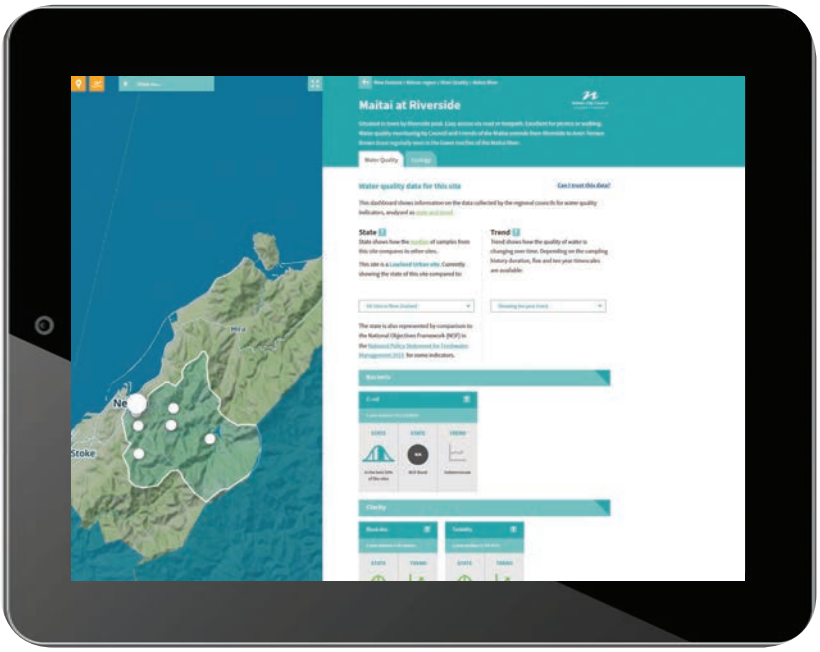
A snip of the Hilltop monitoring site list and measurements.



LAND, AIR, WATER AOTEAROA (LAWA)

The LAWA web portal is managed by 16 regional councils and unitary authorities which collect, analyse and report environmental information. LAWA currently presents information on fresh water and beach water quality, freshwater quantity, air quality and land cover. More topics will be added in the near future.

Monitoring information is presented by region and reporting topic and supported by fact sheets. The river quality data is reported as state and trend. The state shows how the median of samples from a site compares to other similar sites in New Zealand. The trend shows how the quality of the water is changing over time. Most of the Nelson trends are based on 10 year trends to provide sufficient sample sizes.



SCREEN SHOT OF TRENDS PAGE

lawa.org.nz/explore-data/nelson-region/river-quality/maitai-river/maitai-at-riverside/

NATIONAL POLICY STATEMENT FOR FRESHWATER MANAGEMENT

Nelson's regional resource management plans and policies are under review with the intent to update and integrate within one plan, known as the draft Whakamahere Whakatū Nelson Plan (draft Nelson Plan). The draft Nelson Plan must give effect to the National Policy Statement for Freshwater Management (2017) or NPS-FM (2017), which requires councils to take specified steps in relation to the management of freshwater.

The NPS-FM (2017) requires councils to consider and recognise Te Mana o te Wai and requires them to safeguard the life supporting capacity of freshwater ecosystem processes and indigenous species, and the health of people and communities, when managing the use and development of land, discharges of contaminants and the take, use and damming or diversion of water.

In undertaking the NPS-FM (2017) requirements, councils are also required to:

- maintain or improve water quality, protect the significant values of outstanding waterbodies and wetlands and improve degraded water bodies
- incorporate the National Objectives Framework (NOF), to identify freshwater management units, and develop freshwater objectives, attribute states and limits

CASE STUDY: CULTURAL MONITORING - WAKAPUAKA CATCHMENT

Cultural monitoring incorporates Māori values of tikanga and mātauranga Māori into the monitoring undertaken to evaluate the health of the environment, including waterways. This is carried out by three individuals in a group, from a personal perspective, measuring the mauri or "health" of the environment.

Within this perspective mahinga kai values are assessed based on whether the site has current or future potential for harvest. This applies not only to the apparent water quality, but to food, stone, plants and animals to be found at the site. It is a method used to assess water eco-systems spatially, and to measure change over time from an iwi/hapū perspective. Assessments made through this process, alongside western science monitoring, build a more complete picture of the state of our freshwater environments.

Tangata whenua and Tiakina Te Taiao have developed a framework and periodically undertaken cultural health indicator monitoring in Nelson's water catchments for over 15 years.

The CHI (Cultural Health Indicators) cultural framework identifies Atua domains (Ngā Atua Kaitiaki) within Ranginui and Papatūanuku as the primordial parents of Te ao Māori. They include Tāne Māhuta (forests and birds), Tangaroa (oceans and inland waterways), Tūmatauenga (people and war), Tāwhirimātua (weather), Rongomātāne (peace and agriculture), Haumiatiketike (wild food) and Rūaumoko (geological phenomena).[1]

Iwi monitors assessing aquatic biodiversity.

CULTURAL INDICATORS ORGANISED BY ATUA DOMAINS – TIAKINO TE TAIAO:

Tangaroa

- Water clarity
- Water flow
- Water quality
- Shape and form of river, riverbank condition, sediment
- Insects
- Fish

Tāne Māhuta

- Riparian vegetation
- Catchment vegetation
- Bird life (species)
- Ngahere/Taonga
- Pests
- Haumia tiketike
- Mahinga kai
- Rongoa

Haumia tiketike

- Mahinga kai
- Rongoa

Tūmatauenga

- Human activity, use of river
- Access
- Cultural sites

Tāwhirimātua

- Smell

Mauri/Wairua

- Feeling, taste, wellbeing

During June and July 2018, cultural monitoring was undertaken by Tiakina Te Taiao in the Wakapuaka Catchment. The map broadly indicates the sites that were monitored.

1 Tiakina report on cultural health indicators October 2012

After consideration of all sites against all Atua domains, a number of recommendations are made.

Increased riparian planting	Sites: 1, 2, 3, 4, 6, 8
Sediment management from roads	Sites: 3, 6, 8
Education needed about dog waste and its impact on freshwater	Site: 4
Measures to address sediment from forestry such as bridge installations and native tree planting	Site: 8
Fencing to prevent bank erosion	Sites: 1, 2
Impacts of whitebaiting	Site: 1
Improved weed management practices	Sites: 2, 4

Tiakina Te Taiao iwi monitors.

Maitai River at Sunday Hole.

SUMMER MONITORING OF WATER QUALITY AT RECREATION SITES

MONITORING WATER QUALITY AT RECREATION SITES

Nelson's swimming holes and beaches are regularly used by locals and visitors over summer. Bacteria levels are monitored and reported weekly at our recreational bathing water sites over summer (from November until March). *E. coli* and *Enterococci* bacteria are used as indicators of harmful-waterborne bacteria and viruses that may be present.

Water samples are collected on the scheduled monitoring date irrespective of weather conditions, so samples may incorporate dirty water from storm events and generally during times when the public is not swimming.

HOW DO WE MONITOR AND REPORT?

Nelson City Council reports bacteria results within 24 hours of sampling to the Nelson Marlborough District Health Board (NMDHB) and ***Can I Swim Here*** LAWA website.

The water quality results reported reflect the human health risk at the time of sampling. The NMDHB is consulted on the potential sources of bacteria, the risk to public health and the appropriate action required, which may include public health warnings.

A traffic light system of green, amber and red is used for freshwater and marine bacteria counts per 100 ml to assess the level of risk and implement further actions, including additional water sampling to determine if elevated bacteria is still present and signage to warn the public.

FRESHWATER	< 260	260 - 550	< 550
MARINE	< 140	140 - 280	< 280

Sites with elevated Amber Alert or Red Action bacteria counts that have unexplained sources are re-sampled within 24 hours.

RIVER SWIMMING SITES

There was an increase in the number of Red Action samples across all monitoring sites over 2016/17 and 2017/18 summers and general decrease in % compliant days due to more frequent and intense stormwater events in the summer of 2017/18.

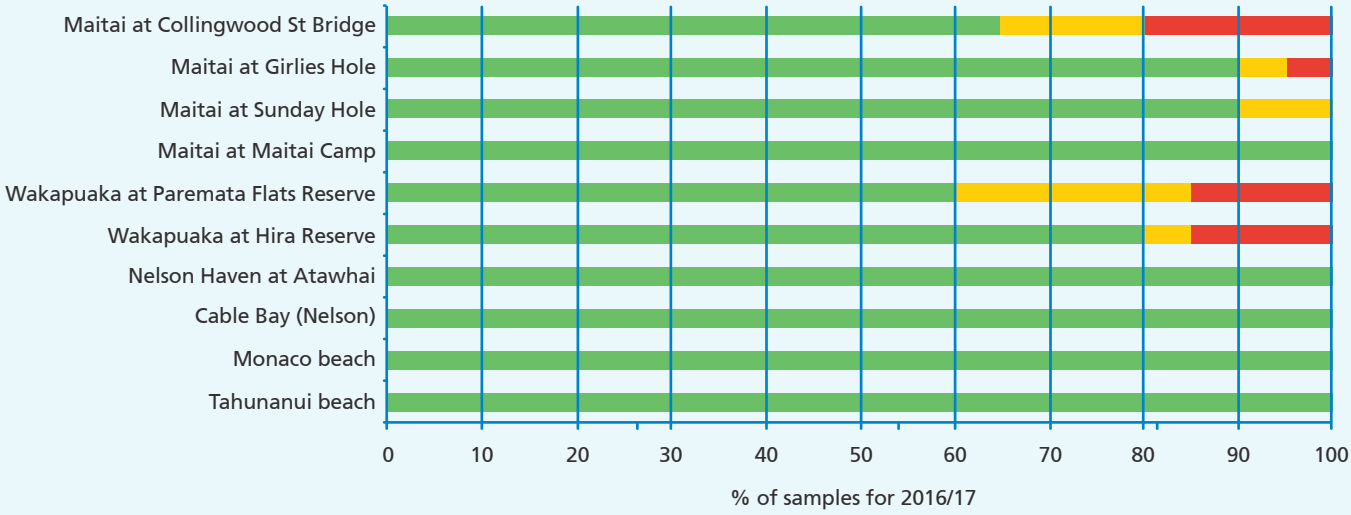
Recreation bathing sites monitored at Maitai Camp and Sunday Hole are generally suitable for swimming. The lower reaches of the Maitai at Collingwood Street Bridge are impacted by high water marine tides and urban runoff, including bacteria from wildfowl, dogs and wastewater during stormwater events.

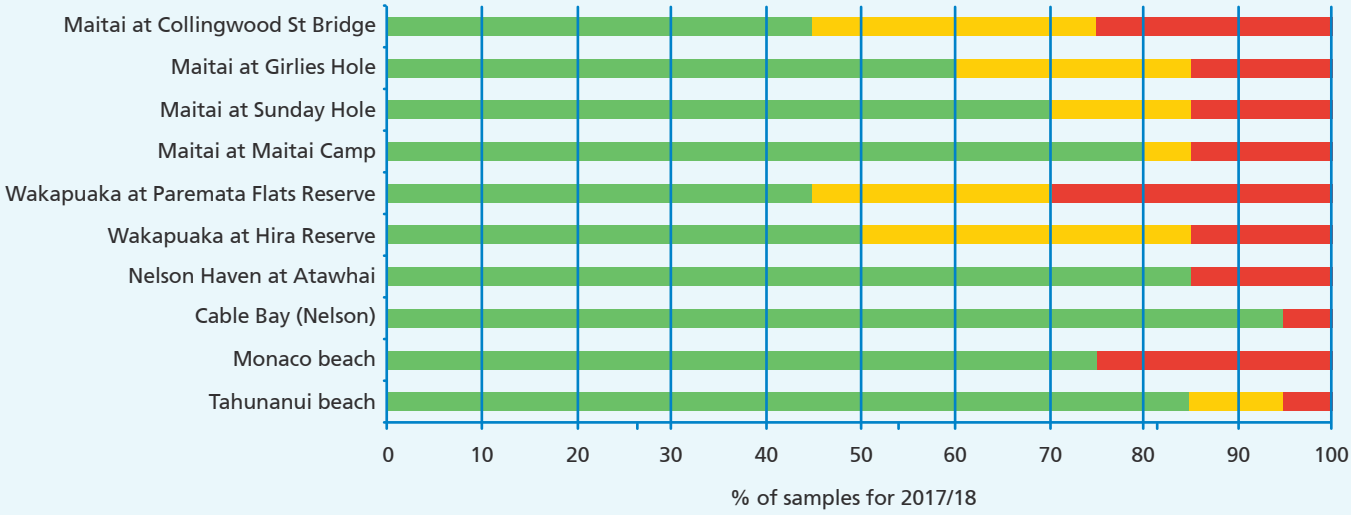
The Wakapuaka sites at Hira and Paremata Flat Reserves are impacted by rural runoff, including feral and stock animals and potential septic tank discharges and unsuitable for swimming following wet weather.

BEACH SWIMMING SITES

Overall the marine recreation sites have good water quality, and are generally good for swimming. There were no Red Action exceedances in the summer of 2016/17. All of the exceedances in 2017/18 were due to extreme weather events. Monaco and Nelson Haven sites were particularly affected by multiple urban storm water discharges and also because of their semi-enclosed estuarine environments, retaining stormwater during tidal cycles.

RECREATION BATHING SITES - % OF GREEN, AMBER AND RED SAMPLES





STORMWATER INFLUENCE

All Red Action bacteria exceedances at monitoring sites occurred during storm events and are likely to have been caused by stormwater contaminants. Wet-weather days with elevated flows accounted for 20% and 40% of sampling days in the summers of 2016/17 and 2017/18.

The number of rainfall days for the Maitai and Wakapuaka catchments increased slightly from 34 and 33 days, respectively in the summer of 2016/17 to 39 and 36 days in 2017/18. However, rain events were more prolonged and intense in 2017/18, including cyclones Fehi and Gita, with 790 mm falling in the Maitai and 670 mm in the Wakapuaka catchments, almost **double** the rainfall recorded in 2016/17.

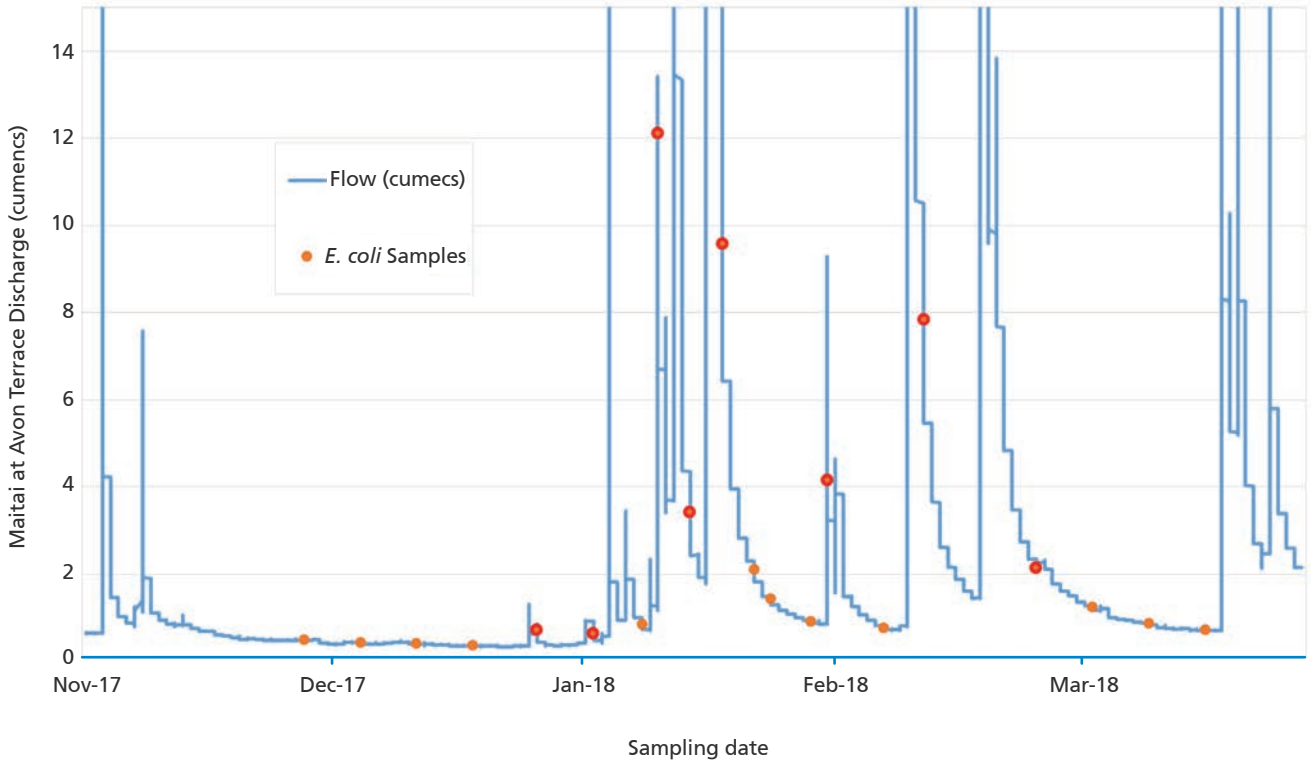
WHAT ARE WE DOING ABOUT IT?

Council is reducing the public health risk of contact with water borne pathogens through numerous programmes across the region, including reducing urban wastewater leaks, inundation and infiltration to stormwater and managing stormwater to reduce peak flows and inundation of the water network. The public health risk can be reduced by avoiding contact recreation within 48 hours of rainfall or when the water is discoloured. This advice is reflected in new signs erected at all designated recreation sites. The Healthy Streams – Wakapuaka Bursting with Life programme is also working with the community to understand water quality issues and ways to work collaboratively to improve the local environment through community and stakeholder workshops, citizen science stream monitoring and sharing local knowledge.

THE OCCURRENCE OF WATER SAMPLES AND ELEVATED RIVER FLOWS IN THE MAITAI, SUMMER 2017/18

The red dots show the samples recorded as Red Alerts (>550 *E. coli*/100mL)

E.coli recreation exceedances caused by stormwater runnoff from land to waterways



Surf at the Boulder Bank, Glenduan.

Swimming hole at Maitai Camp.

YEAR-ROUND MONTHLY MONITORING OF RIVERS AND STREAMS FOR PLANNING AND REPORTING

NATIONAL POLICY STATEMENT FOR FRESHWATER MANAGEMENT – HUMAN HEALTH ATTRIBUTE

The general state of water quality in our rivers for human health is based on year-round *Escherichia coli* (*E. coli*) bacteria levels, measured every month at state of environment monitoring sites. The State of Environment water quality sites are geographically representative of the region's streams and rivers, and generally reflect the upper (pristine reference sites) and lower catchment state and pressures rather than water quality at specific recreation bathing sites.

The *E. coli* limits and bands in the NPS-FM (2017) are included as limits in the draft Whakamahere Whakatū Nelson Plan (draft Nelson Plan). These are based on four metrics of monthly state of environment data, including the median, 95th percentile and the percentage of samples with *E. coli* above 260 and 540 cfu/100mL.

The *E. coli* attribute states introduced in 2017 require a minimum of 60 samples over a five year period collected on a regular basis regardless of weather and flow conditions. The attribute state for Nelson's fourth order rivers will be reported on in 2020 when the sample size is sufficient to satisfy all numeric attribute states.

RIVER 'SWIMMABILITY' TARGETS FOR NELSON

In 2017 the Ministry for the Environment determined 'swimmability' grades for New Zealand's fourth order or larger rivers. Sections of medium sized (fourth order) rivers in each region were classed as Excellent, Good, Fair, Intermittent and Poor for 'swimmability' in the Ministry for the Environment Clean Water Report (2017). Rivers were classified based on nationwide state of the environment data from 1990 to 2013 and other modelled variables. 'Swimmable' rivers were classed as rivers with Excellent to Fair grades where the criteria were met more than 80% of the time.

The report concluded that 100% of Nelson's fourth order rivers are 'swimmable', based on the national model and rated as follows:

- **Whangamoa** – Good
- **Wakapuaka** – Excellent in the upper reaches and Fair in the lower reaches
- **Maitai** – Excellent
- **Roding (upper reaches)** – Excellent (no State of Environment data available; modelled)

In Nelson, State of Environment *E. coli* data are available for the Whangamoa, Wakapuaka and Maitai Rivers, and were used as part of the national assessment. The Ministry for the Environment require councils to set regional targets and monitoring plans to maintain the extent of 'swimmable' rivers as a minimum, with programmes in place to support improvement where possible.

Nelson City Council's draft target is to continue to meet the 'swimmable' measure of 100% for all our fourth order rivers.

To achieve this target all the monitored sites in our fourth order rivers need to retain their Excellent to Fair grades, with criteria being met more than 80% of the time.

ECOSYSTEM HEALTH

NATIONAL POLICY STATEMENT FOR FRESHWATER MANAGEMENT – ECOSYSTEM HEALTH ATTRIBUTES

The National Policy Statement for Freshwater Management (NPS-FM 2017) defines the attribute states relevant to assess ecosystem health values for regional councils. Other objectives and limits are needed to ensure ecosystem health and human health for recreation are fully safe-guarded and Te Mana o te Wai is considered and provided for.

The ecosystem health freshwater attribute states for rivers include:

- **Nitrate (toxicity)** – measured by milligrams nitrate-nitrogen per litre
- **Ammonia (toxicity)** – measured by milligrams ammoniacal-nitrogen per litre
- **Dissolved oxygen** – measured below point discharge sources by continuous monitoring
- **Periphyton (Trophic state)** – measured by milligrams chlorophyll-a per square metre over a minimum three year period

The freshwater values include a national "bottom line", which is the minimum water quality level that all water bodies must achieve, and a range of higher water quality "attribute states".

The National Objective Framework (NOF) nitrate and ammonia toxicity attributes use a two-number guideline and management framework based on the Australia New Zealand Environment and Conservation Council (ANZECC) (2000) guidelines risk-based methodology to provide various levels of ecosystem protection.

Water quality attributes applied as limits in plans are those that are managed to meet a freshwater objective. These additional objective and supporting attributes will be reported on in time with the development of the NPS-FM (2017) and the draft Nelson Plan.

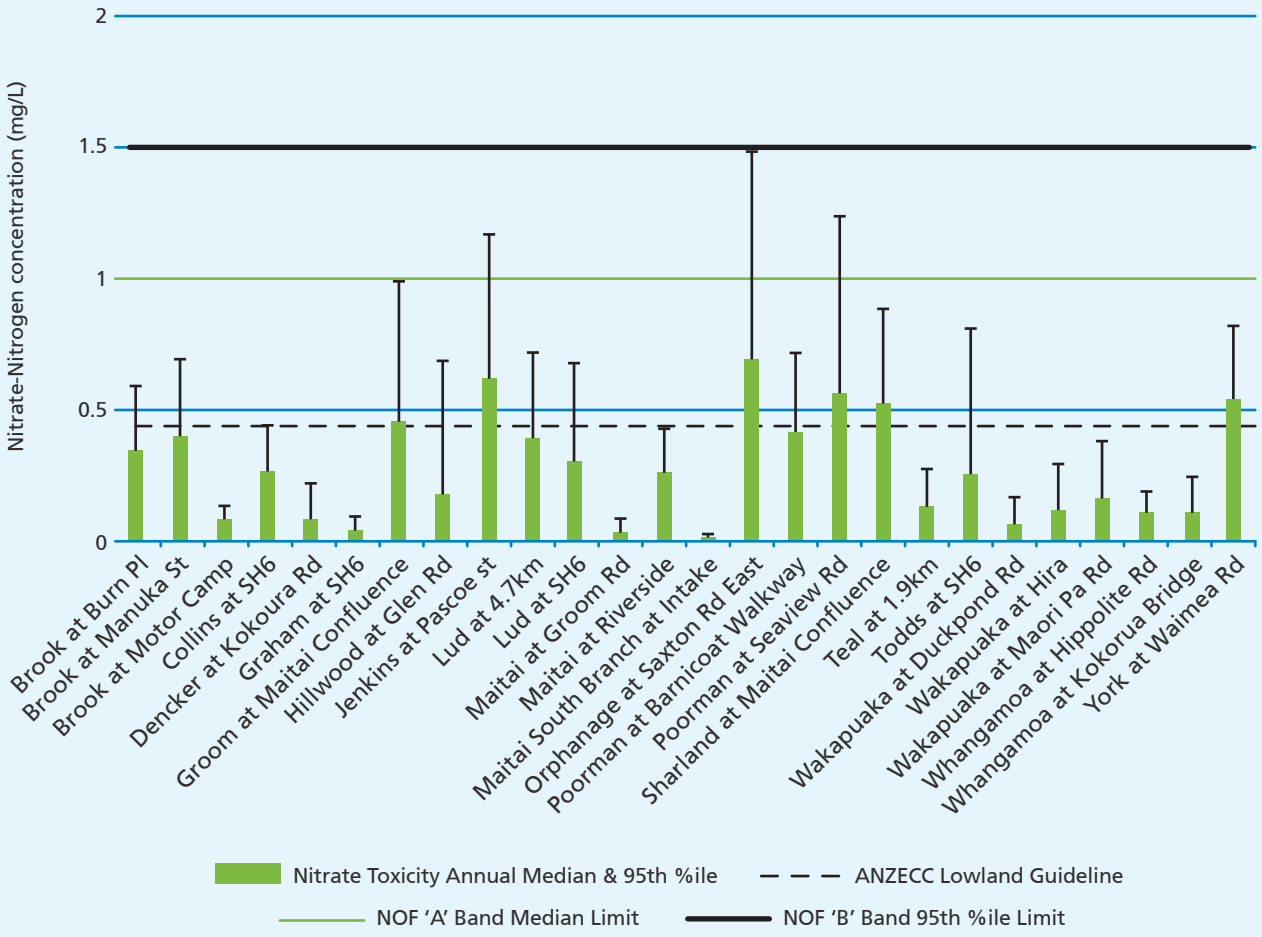
Nelson College for Girls surveying the Maitai River.

NITRATE TOXICITY

Nitrate-nitrogen at high concentrations in water can be toxic to aquatic organisms and humans. The NPS-FM (2017) includes a nitrate-nitrogen toxicity attribute for assessing ecosystem health in streams and rivers. The nitrate toxicity attribute in the NPS-FM (2017) will be addressed in the Nelson Plan.

The 2017 nitrate-nitrogen levels in all Nelson streams and rivers have median values well within the NOF 'A' band, and well below the nitrate toxicity National Bottom Line of 6.9 mg nitrate-nitrogen per litre.

Stoke streams (Orphanage, Poorman and Jenkins) have the highest nitrate-nitrogen 95th percentile values, which were below the NOF 'B' Band 95th percentile and are well below the nitrate toxicity National Bottom Line of 9.8 mg nitrate-nitrogen per litre.

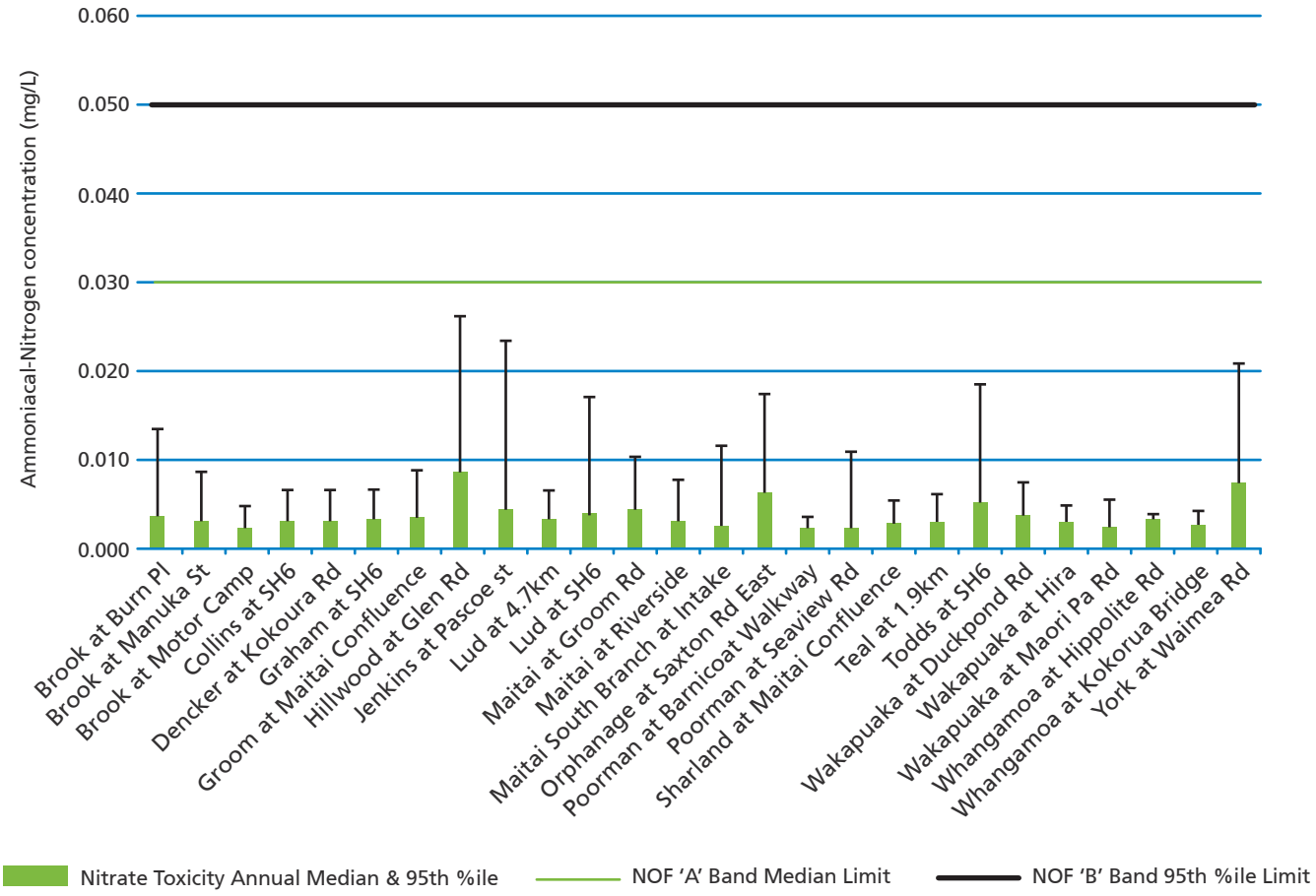


Summer swimming in the Maitai River.

AMMONIA TOXICITY

Ammonia in the form of ammonia-nitrogen in water can be toxic to aquatic organisms when at high concentrations. Both temperature and pH affect the ionisation of ammonia and the associated toxicity to aquatic species, with unionised ammonia-nitrogen and toxicity increase with alkalinity (particular > pH 8.5).

The 2017 adjusted ammonia-nitrogen levels in all Nelson streams and rivers have median and maximum values well below the ammonia toxicity NOF 'A' band and the National Bottom Line of 1.5 mg and 2.2 mg, ammonia-nitrogen per litre, respectively. The total ammonia-nitrogen values reported were adjusted to standard pH 8 using ANZECC (2000) correction ratios.



DISSOLVED OXYGEN

In 2017, the Maitai South Branch and York Stream were monitored downstream of consented point discharges. Both monitoring sites achieved the NOF 'A' Band numeric attribute states.

BENTHIC CYANOBACTERIA (TOXIC ALGAE)

WHAT IS BENTHIC CYANOBACTERIA?

Benthic cyanobacteria - also known as 'toxic algae' and 'blue-green algae' because of the cyano colour of cells, are true bacteria that live like algae and are naturally present in many New Zealand waterways. Benthic cyanobacteria are found growing on the beds of streams and rivers in 'clean' rivers and less likely to be present in high nutrient waters where filamentous algae grow. The growth of benthic cyanobacteria is encouraged when river flows are low and stable, and temperatures are consistently warm.

WHAT DO THE MATS LOOK LIKE?

Benthic cyanobacteria mats are dark brown or black and grow attached to rocks on the river bed. Mats that come loose from the river bed can wash up on the river bank or form floating 'rafts' in shallow areas. Where exposed, the mats may dry out and turn a light brown colour. They also produce a strong musty odour, which may attract dogs to eat the mat. The cyanobacteria mats may potentially produce toxins, such as anatoxin, which if ingested can result in serious illness to humans and death for dogs and livestock.

Thick cyanobacteria mat.

Cawthron students and Council scientists surveying the extent of cyanobacteria mats at Avon Terrace.

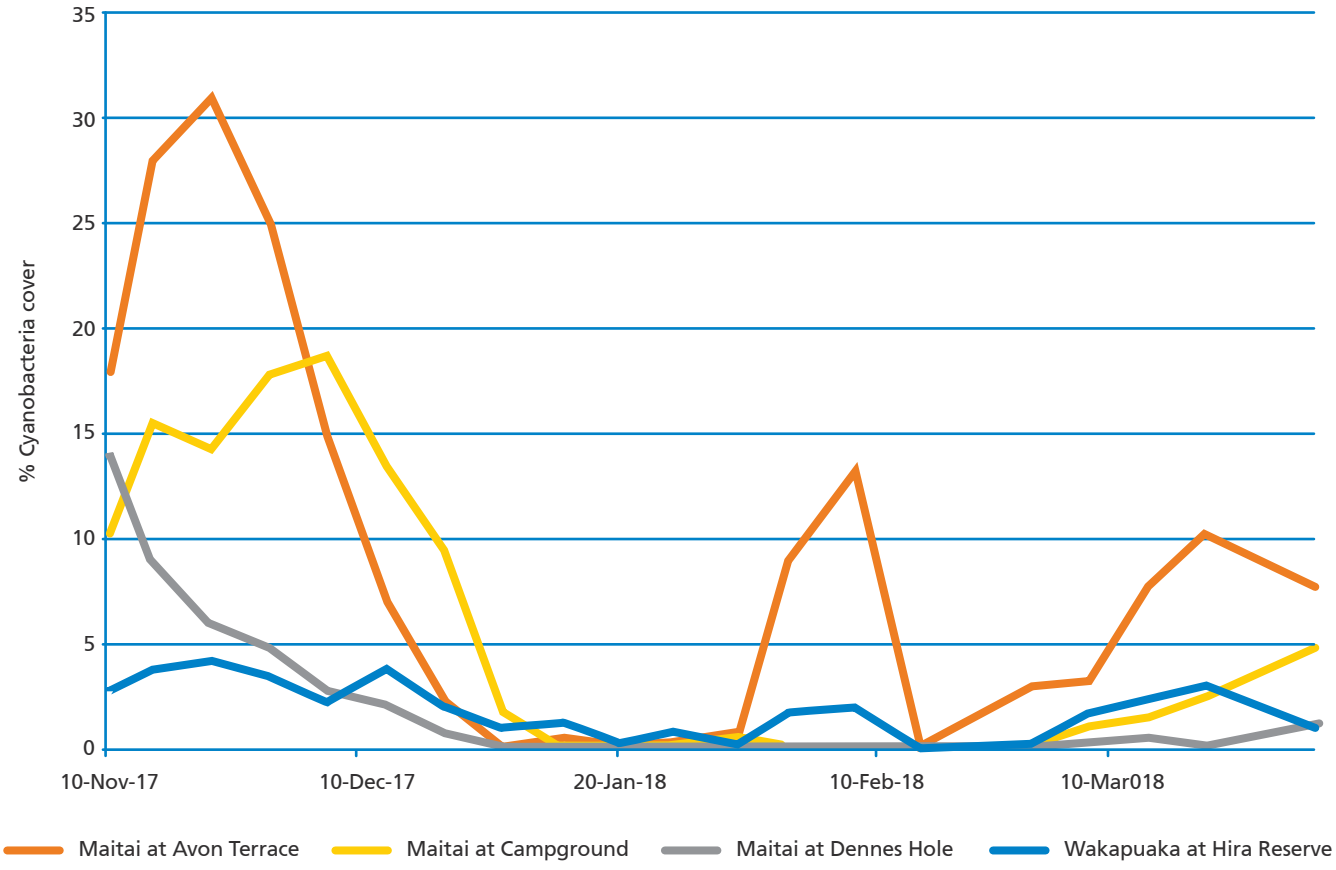
MONITORING BENTHIC CYANOBACTERIA

Benthic cyanobacteria surveillance monitoring is undertaken weekly every summer at bathing sites on the Maitai and Wakapuaka Rivers. The percentage cover of cyanobacteria mats is estimated in shallow riffles (turbulent areas) where it commonly grows, as opposed to deeper bathing holes.

The risk assessment is based on the percentage of river bed covered by cyanobacteria mats at each site. The guidance for managing cyanobacteria sets a level of 20% cover for initiating surveillance monitoring, and 50% cover for the alert level that requires informing the public of potential risks and testing for toxins. The risk of contact with cyanobacteria toxins may also be increased when cyanobacteria mats detach and are carried downstream to other recreation sites.

Over the 2017/2018 summer there was only one occurrence of cyanobacteria above 20% cover (requiring further surveillance monitoring) at the Maitai at Avon Terrace site in mid-November, which reached 31% cover. The Maitai Camp site had a maximum cyanobacteria cover of 19% in early December. The cyanobacteria cover at other recreations sites at Maitai at Dennes Hole and Wakapuaka at Hira remained below 5% cover for most of the summer. There were no incidences of dogs ingesting cyanobacteria toxins reported by the Nelson veterinary services. Storm flood events in January and February 2018 flushed away cyanobacteria mats.

WEEKLY SURVEILLANCE MONITORING FOR CYANOBACTERIA IN SHALLOW RIFFLE AREAS AT RECREATION SITES



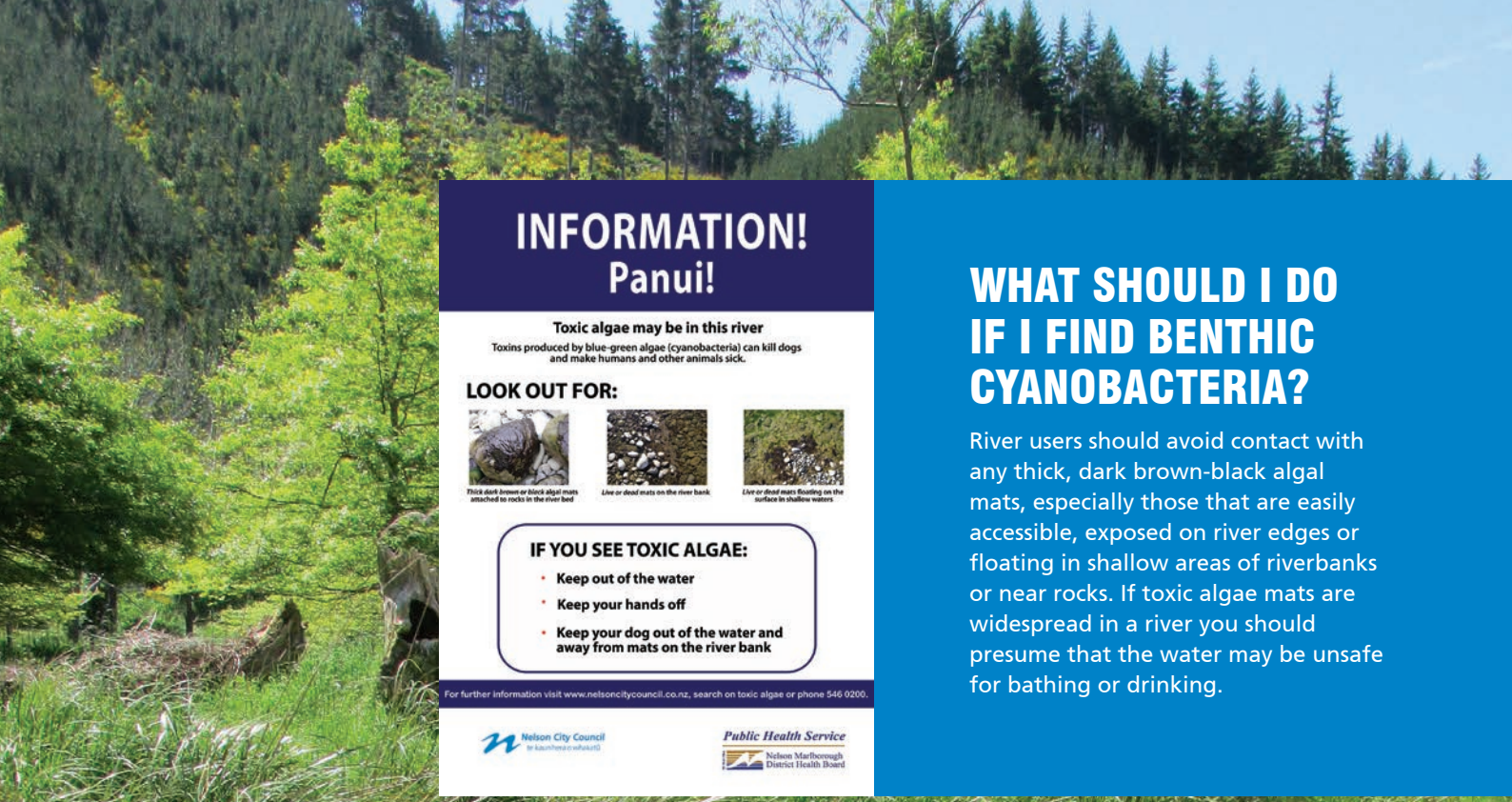
Benthic cyanobacteria is also monitored each month in all of the main streams and rivers across Nelson for State of Environment human health monitoring. All of the monitoring sites, except Maitai at Avon Terrace had less cover than the 20% cyanobacteria cover required to initiate surveillance monitoring. Annual Plan targets will be used to measure and track progress against limits over time.

RESEARCH ON BENTHIC CYANOBACTERIA

Recent research by Cawthron Institute has tested anatoxin levels in *Phormidium* mats nationally. Anatoxin total concentrations vary spatially and temporally in the Maitai River mat samples, which to date are substantially lower than levels measured in many streams nationally.

Future reporting of cyanobacteria risks include modelling drivers for growth, including sediment, nutrients, water temperature and flow. Recent studies have been used to develop a model that predicts *Phormidium* cover at the Avon Terrace site, available at https://cawthron.shinyapps.io/Maitai_Phormidium/

Council scientists assessing the types of stream algae present.



WHAT SHOULD I DO IF I FIND BENTHIC CYANOBACTERIA?

River users should avoid contact with any thick, dark brown-black algal mats, especially those that are easily accessible, exposed on river edges or floating in shallow areas of riverbanks or near rocks. If toxic algae mats are widespread in a river you should presume that the water may be unsafe for bathing or drinking.

Cyanobacteria surveys near the Maitai Camp.

MACROINVERTEBRATES

MACROINVERTEBRATES CURRENT STATE AND TRENDS

Macroinvertebrates are small animals. They include the larvae of insects, worms, and snails that live on or just below the stream-bed and are an important food source for fish and graze on stream algae.

The macroinvertebrate community index (MCI) is used by scientists to monitor changes in macroinvertebrate populations because different macroinvertebrates species are responsive to multiple environmental changes such as flow, habitat, temperature, water quality and sediment. Macroinvertebrates are therefore used as an indicator of the wider health of waterways and have a high ecological value.

The MCI uses presence/absence of invertebrate data to calculate community scores that reflect levels of water quality degradation. The MCI assigns a score to each species or taxon (from 1 to 10), based on its tolerance or sensitivity to organic pollution, and then calculates the average score of all taxa present at a site.

At the national level, the MCI trend shows two out of five monitored sites are likely or very likely to be degrading; and the Nelson MCI water quality monitoring sites follow this trend. Whilst the Nelson macroinvertebrate index scores generally indicate that the larger rivers are in good ecological health, the lowland urban streams of Stoke and the Maitai catchments are under pressure from multiple stressors, including modified stream channels, stormwater, sediment and elevated water temperatures. Small flashy streams are also more susceptible to impacts from existing land use pressures, as well as recent natural flood events.

It should also be noted that Nelson's lowland coastal streams such as Orphanage, Hillwood, Todd Valley and York Stream have clay and fine sediment substrate in their lower reaches and typically provide habitat for communities with relatively low MCI scores.

The Wakapuaka and Whangamoa have scores indicating good ecological health. However, the ten year trend for most sites indicate likely degrading ecological health. The trends are subject to inter-annual variability, and in the last ten years have been influenced by extreme flood and drought events, resulting in loss of habitat. The urban streams have required ongoing removal of flood debris, which may also impact on macroinvertebrate habitat.

Stonefly Stenoperla *in the Brook Stream.*

GRADES FOR MEASURING ECOLOGICAL HEALTH USING THE MACROINVERTEBRATES COMMUNITY INDEX

Excellent: Stream in excellent ecological condition. Indicative of excellent water quality and/or habitat conditions. **MCI Score:** > 119

Good: Stream in good ecological condition. Indicative of good water quality and/or habitat conditions. **MCI Score:** 100 - 119

Fair: Stream in fair ecological condition. Indicative of only fair water quality and/or habitat conditions. **MCI Score:** 80 - 90

Poor: Stream in poor ecological condition. Indicative of poor water quality and/or habitat conditions. **MCI Score:** < 80

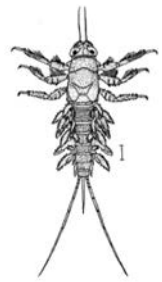
Stoke Freshwater Management Unit	MCI 5-year Median	Ecological Health	10-year trend
Orphanage at Saxton Rd East	70		Indeterminate
Jenkins at Pascoe St	71		Indeterminate
Poorman at Seaview Rd	72		Likely degrading
Poorman at Barnicoat Walkway	127		Likely improving

Maitai Freshwater Management Unit	MCI 5-year Median	Ecological Health	10-year trend
York at Waimea Rd	64		Likely degrading
Todds at SH6	88		Indeterminate
Hillwood at Glen Rd	93		Likely improving
Brook at Manuka St	93		Likely degrading
Maitai at Riverside	95		Likely degrading
Groom at Maitai Confluence	99		Likely degrading
Maitai at Groom Rd	105		Likely improving
Brook at Burn Pl	106		Likely degrading
Sharland at Maitai Confluence	107		Indeterminate
Brook at Motor Camp	124		Indeterminate
Maitai South Branch at Intake	143		Likely improving

Wakapuaka Freshwater Management Unit	MCI 5-year Median	Ecological Health	10-year trend
Lud at SH6	106		Likely degrading
Wakapuaka at Maori Pa Rd	108		Indeterminate
Wakapuaka at Hira	111		Very likely degrading
Lud at 4.7km	112		Very likely improving
Teal at 1.9km	126		Very likely degrading
Wakapuaka at Duckpond Rd	129		Very likely degrading

Whangamoa Freshwater Management Unit	MCI 5-year Median	Ecological Health	10-year trend
Dencker at Kokorua Rd	114		Very likely degrading
Whangamoa at Kokorua Bridge	120		Very likely degrading
Collins at SH6	123		Likely degrading
Graham at SH6	134		Likely degrading
Whangamoa at Hippolite Rd	137		Likely degrading

The 10-year MCI trends include annual MCI monitoring data from 2008 to 2017.

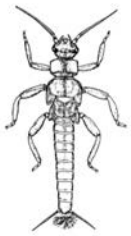


Spiny gill mayfly

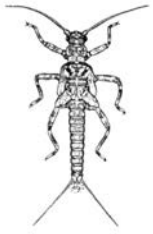
Swimming mayfly

Flat mayfly

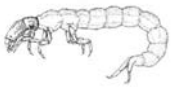
Stenoperla stonefly



Tail gill stonefly



Spotty stonefly



Free living caddisfly

Woody-cased caddisfly

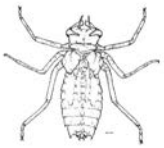
Stony-cased caddisfly

Smooth-cased caddisfly

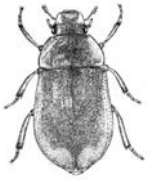
Spiral-cased caddisfly

Oxyethira & Paroxyethira

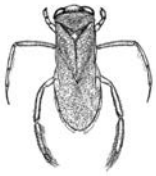
Damselfly



Dragonfly



Beetle



Backswimmer & water boatman

Pond skater

Dobsonfly

Cranefly

Midge

Sandfly

Other maggot-like flies

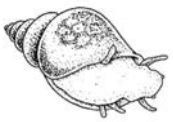
Mosquito

Flatworm

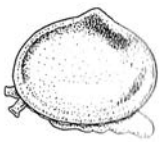
Latia limpet

Flat spiral shell

Freshwater mussel

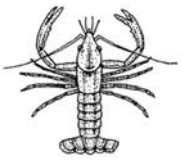


Rounded snail

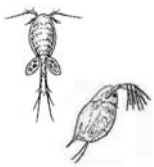


Fingernail clam

Mite

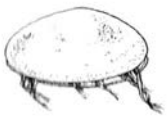


Crayfish



Water fleas

Amphipods & isopods

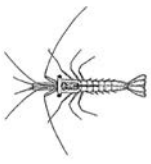


Seed shrimp

Leech

Oligochaete worm

Spider



Shrimp

Crab

Horsehair worm

CREDIT: NIWA – BUGBOX IDENTIFICATION GUIDE

WHAT ARE WE DOING ABOUT IT?

Monitoring plans are being developed for all streams with median MCI scores less than 80, as part of the NPS-FM (2017) requirement to identify the main pressures on degraded waterways, and initiate freshwater improvement programmes to improve their ecosystem health. These plans will include more detailed analysis of the types of macroinvertebrates that occur over time, and their sensitivity to pollutants, disturbance and changes in river flows. This information will be used to target programmes to address the cause of the degrading macroinvertebrate communities.

The monitoring plans require continuous monitoring programmes, including turbidity and sediment sampling, to quantify stressors over time and particularly at higher flows when sediment and *E. coli* bacteria are generally at their greatest. Continuous turbidity sensors are being installed at permanent flow recording sites on Orphanage, Maitai and Wakapuaka rivers to measure peak turbidity and evaluate the suspended sediment effects on fish and invertebrates.

Whangamoa River – overhanging vegetation, fast flowing riffles and bouldery stream beds provide the most productive habitat for diverse macroinvertebrate communities

MAITAI RESERVOIR BIOMONITORING

The Maitai Reservoir was commissioned in 1984, with the Maitai dam located on the north branch of the Maitai River. The reservoir is monitored for compliance with the resource consent to abstract water for the Nelson municipal water supply and to describe the ecosystem health of the reservoir water body.

The Cawthron Institute report on the reservoir biomonitoring to council each year to describe the seasonal water temperature and dissolved oxygen, which are monitored for resource consent conditions.

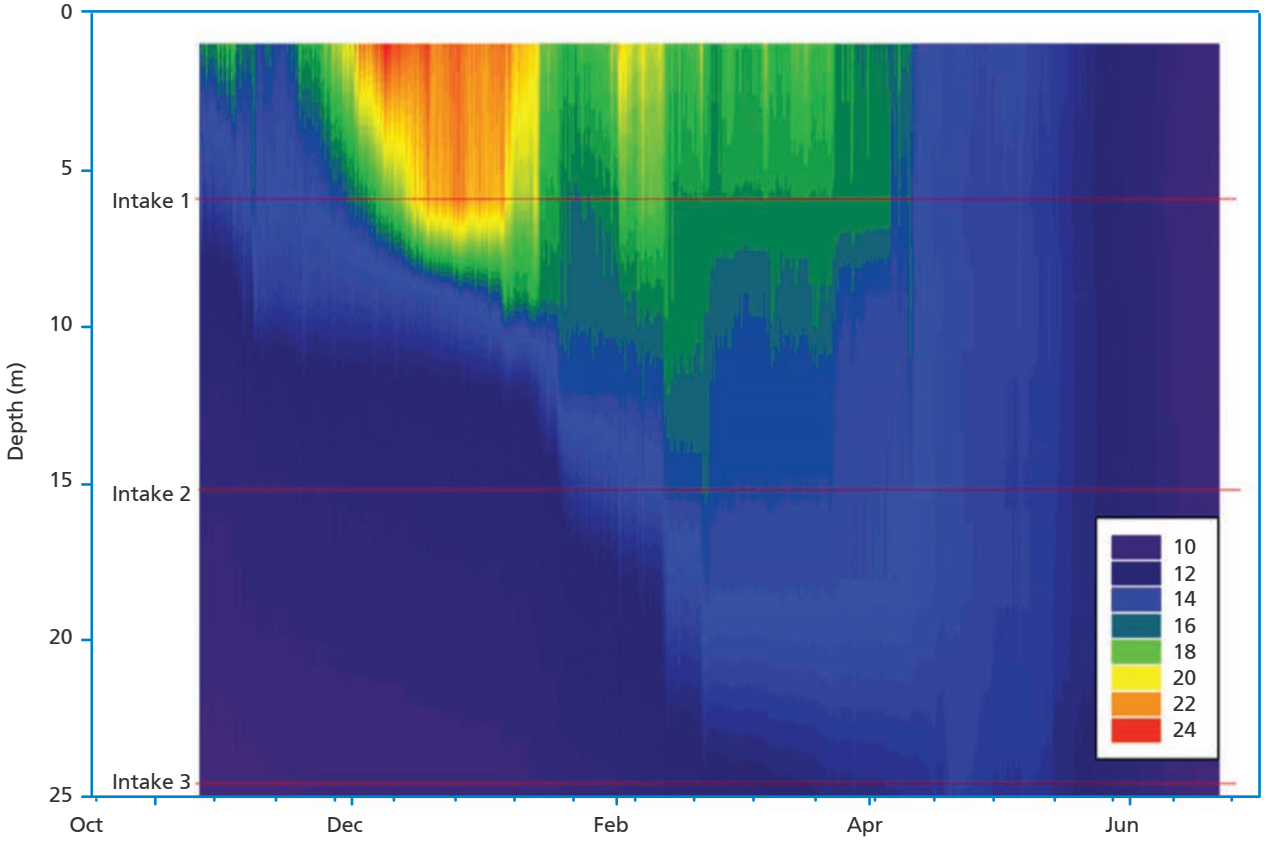
Council also monitors planktonic cyanobacteria levels over the summer months for the Drinking Water Cyanobacteria Action Plan, which includes an assessment of drinking water contaminants for the catchment.

A synopsis of the reservoir biomonitoring is outlined here to describe the ecological condition of the North Branch tributary at the Maitai dam. This biomonitoring is required to manage the reservoir water quality to maintain safe drinking water and to protect the ecological integrity of the north branch and lower south branch tributaries of the Maitai River.

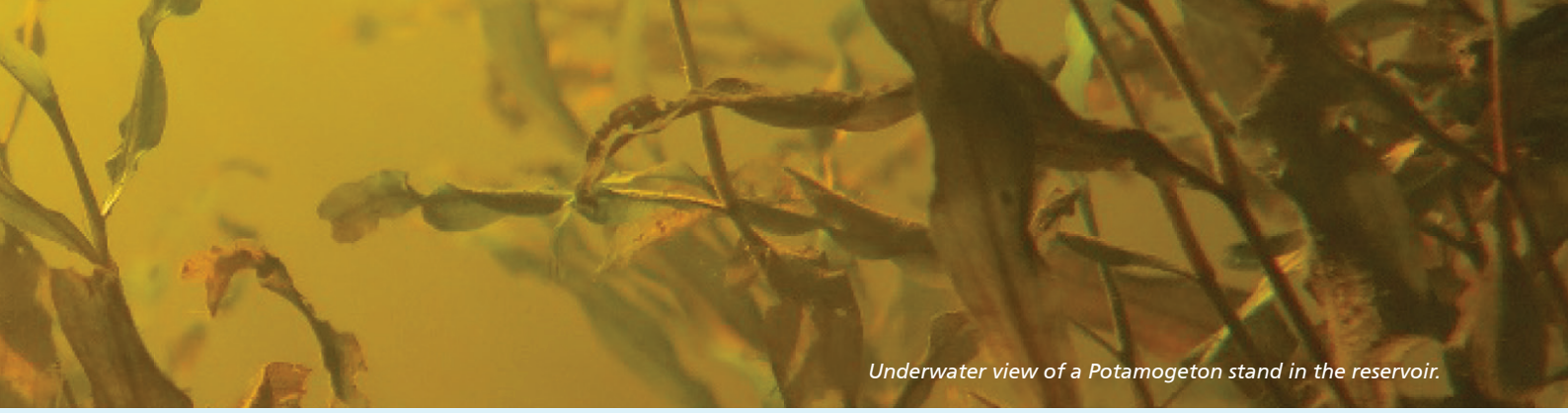
WATER TEMPERATURE

The Maitai Reservoir thermally stratifies each summer between November and March. Thermal stratification is a natural process in moderate to large reservoirs that have sufficient depth to allow a temperature difference to occur between surface and bottom layers. Surface water temperatures were as high as 24˚C during the early part of summer (December 2017 and January 2018) when weather conditions were unseasonably warm and clear. The bottom water layer remained cool below 14 ˚C.

MAITAI RESERVOIR TEMPERATURE STRATIFICATION



Maitai Reservoir thermal stratification October 2017 to June 2018. Temperatures are in oC.



Underwater view of a Potamogeton stand in the reservoir.

DISSOLVED OXYGEN

The upper surface layer of the reservoir water column remained oxygenated over the summer. Dissolved oxygen conditions in reservoir bottom waters declined linearly between November and March, when conditions late summer were anoxic (oxygen depleted) in bottom waters. The water temperature and dissolved oxygen stratified conditions persisted until around mid-April, when the overturn and the reservoir rapidly mixed bottom and surface layers.

RESERVOIR TROPHIC STATE

Concurrent state of the environment monitoring commenced in 2015 to provide supporting information on the ecosystem health of the water body.

The reservoir monitoring includes bimonthly water sampling to determine the trophic state (productivity) of the water body, based on water quality samples from the top 10m of the water column. The nutrients, total nitrogen and total phosphorous, and chlorophyll-a plankton concentrations are measured with water clarity to determine a trophic level index, which describes the ecological communities with reference to natural conditions occurring in a lake.

ANNUAL MONITORING DATA FOR 2016 AND 2017 (6 SAMPLES PER YEAR) ARE COMPARED TO THE NOF LAKE ECOSYSTEM HEALTH ATTRIBUTES

	Annual Median	NOF Band	Narrative Attribute State	Bottom Line
Phytoplankton Chlorophyll-a (Trophic state)	**2016** 2.20 mg/m³	**B** (2 to 5 mg/m³)	Lake ecological communities are healthy and resilient, similar to natural reference conditions	12 mg/m³
	2017 1.35 mg/m³	**A** (<2 mg/m³)		
Total Nitrogen (Trophic state)	**2016** 175 mg/m³	**B** (160 to 350 mg/m³)	Lake ecological communities are slightly impacted by additional algal and/or plant growth arising from nutrient levels that are elevated above natural reference conditions	750 mg/m³
	2017 185 mg/m³	**B**		
Total Phosphorous (Trophic state)	**2016** 8 mg/m³	**A** (<10 mg/m³)	Lake ecological communities are healthy and resilient, similar to natural reference conditions.	>50 mg/m³
	2017 108 mg/m³	***D** (>50 mg/m³)	*Lake ecological communities have undergone or are at high risk of a regime shift. Note: see the comment on Trophic Level Index	

The Maitai Reservoir is classed as a low productivity water body based on the Trophic Level Index of 3.30 and 3.70 for annual monitoring data from February 2016 to December 2017. The increase in Total Phosphorous in 2017 will be investigated in 2018-2019 to assess whether the increase is maintained and requires further investigation.

Maitai Reservoir monitoring site buoy and intake tower. Pollen on the surface of the reservoir.

PLANKTONIC CYANOBACTERIA

Monthly summer plankton sampling commenced in November 2018 to assess the presence and levels of planktonic cyanobacteria in the reservoir. Planktonic cyanobacteria occurs naturally in lakes and reservoirs with species that potentially produce toxins.

Monitoring of planktonic cyanobacteria is therefore required as part of the catchment risk assessment for drinking water supplies and will be reported on annually to the Nelson Marlborough District Health Board.

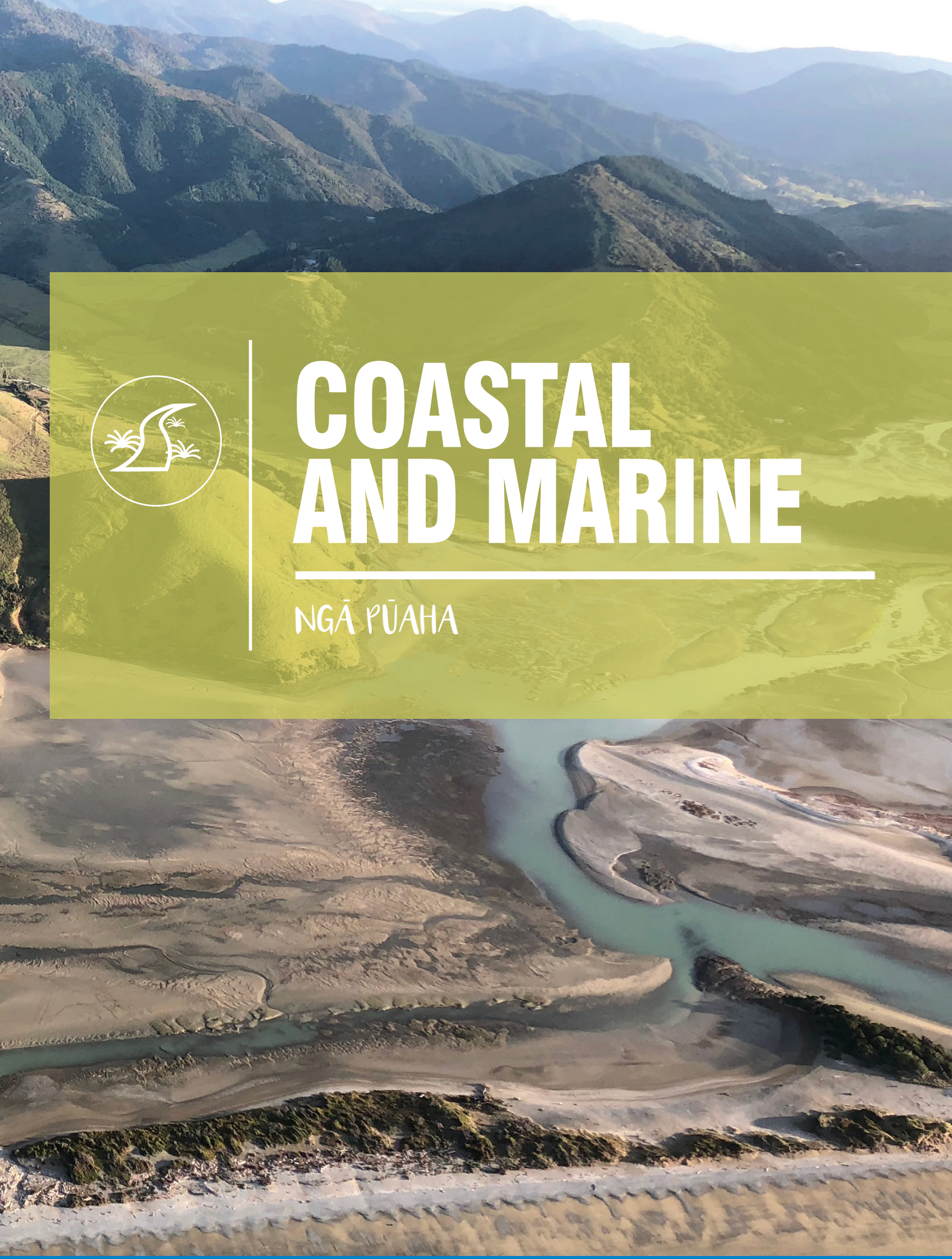
LAKE SUBMERGED PLANT INDEX

In June 2017, the Cawthron Institute surveyed the ecological condition of the Maitai Reservoir for Council based on key features of the macrophyte (higher plant) community structure and composition and presence of invasive aquatic weeds. The surveys assessed as five transects including the shoreline margin of the reservoir.

The reservoir's ecological condition was assessed as "moderate" (>20-50%) using the Lake Submerged Plant Index. Three native lake plant species were recorded with blunt pondweed (*Potamogeton ochreatus*) found at a maximum depth of 2.1m. Rushes (*Juncus sp.)* and raupō bullrush *(Typha orientalis)* were also recorded along the edge of the reservoir. No invasive weed species were observed.

Maitai Reservoir August 2017.

Delaware Estuary.



COASTAL AND MARINE

NGĀ PŪAHA

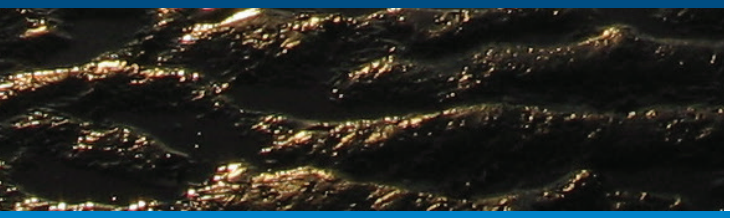
AT A GLANCE

Nelson coastal terrestrial and marine areas are small compared to those of other regions, but many areas are important for multiple species and ecosystems. Council has identified a range of sites in the terrestrial coastal zone (above Mean Low Water) with important coastal biodiversity values.

These include boulderbanks, estuaries, saltmarsh and swamps, dunes, coastal cliffs, islets and stacks and coastal forests. Valuable marine areas for biodiversity include shellfish reefs, reef and seaweed communities, sponge gardens and bryozoan beds.

Thirty three nationally threatened and at risk species have been identified in the terrestrial coastal zone and at least twelve species of threatened migratory fish or marine mammals occur in Nelson's maritime environment.

Terrestrial coastal ecosystems and species are amongst those most at risk from the impacts climate change, through erosion, inundation and salt water intrusion. In addition, many ecosystems and species are threatened by the impact of plant and animal pests. Nelson Nature is working with public and private landowners to protect these coastal biodiversity values from current threats as well as future proofing these values against climate change impacts, e.g through managed retreat.



ESTUARIES

The Nelson region has four large shallow, intertidal dominated estuaries (Waimea, Nelson Haven, Delaware and Kokorua) and several smaller tidal river/stream mouth estuaries. The larger estuaries are partially separated from the sea by a range of physical features, including barrier islands, sand bars and boulder banks, and have a variety of habitats including saltmarsh, seagrass, sponge gardens, tubeworm reefs, and extensive intertidal flats that support significant shellfish beds and provide internationally important bird feeding and roosting habitat[1].

All of the estuaries have been modified from their natural state in the past, largely as a consequence of land disturbance (e.g. elevated inputs of fine muds, nutrients, and disease causing organisms) and habitat loss (e.g. saltmarsh drainage, reclamation, shoreline armouring). While this has diminished the ecological integrity of parts of the estuaries, particularly through increased muddiness, they all support significant biological diversity and have high cultural, human use, and economic value.

There are a number of initiatives being undertaken in the region to improve estuary quality.

- Council is contributing to the improvement and restoration of the Waimea coastal and estuarine ecosystems through actively supporting the Waimea Inlet Management Strategy and development of an Action Plan to implement the Strategy.
- Council has been working with local iwi, residents and the boating and fishing community to manage access for boat launching and retrieval at Delaware (Wakapuaka) Estuary to minimise vehicle impacts on the delicate estuarine ecosystem and to respect cultural values held by local iwi.
- Council is working with Tasman District Council to update the best practice guidance for managing sediment and erosion control and is also finalising the Nelson Tasman Land Development Manual, providing for a consistent regional approach.
- Council is also supporting community groups through the Healthy Streams programmes to control weeds, pests, and invasive species, where practical and promoting sustainable land management to reduce faecal, sediment and nutrient discharges to waterways.
- Treaty settlements and their associated statutory recognitions have defined roles for local iwi in looking after our estuaries. These roles must be better acknowledged.

1 Stevens, L.M. and Robertson, B.P. 2017. Nelson Region Estuaries: Vulnerability Assessment and Monitoring Recommendations. Prepared by Wriggle Coastal Management for Council. 36p + appendices.

NELSON REGION ESTUARY VULNERABILITY ASSESSMENT (2017)

A recent assessment looked at the condition and vulnerability of the larger estuaries. It assessed how estuarine ecosystems are likely to react to the presence of key stressors, in particular excessive nutrients and fine sediment. The report provides recommendations on monitoring and summarises where management actions can protect and improve estuary condition. Some key report findings are outlined on pages 83-85.

Key management recommendations for all the estuaries include:

- Management of estuary sediment at a catchment scale by retaining current sedimentation rates relative to natural rates. Sedimentation >5 times natural rates are likely to result in significant ecological stress
- Coastal planning to prevent further loss of important habitat and to allow saltmarsh to migrate inland as the sea level rises
- Reduce faecal coliform and other contaminant inputs to meet bathing and shellfish standards

MUDDINESS (EXCESSIVE FINE SEDIMENT INPUTS)

Natural sedimentation provides a number of important functions (e.g. supplying nutrients, and buffering coastal erosion). However, if fine sediment inputs exceed the rate of assimilation, environmental problems can occur. This has the potential to alter the structure and function of estuarine and embayment ecosystems in particular. The major sources of fine sediment are from land disturbance activities such as urban subdivisions, roading, forest harvesting and intensive pastoral farming. Inputs from these activities are often accelerated when land disturbance coincides with storm events.

The vulnerability assessment found Waimea and Kokorua estuaries have a high risk of muddiness impacts, and Delaware and Nelson Haven moderate risk. This is reflected by the extent of intertidal soft mud - 36% and 20% in Waimea and Kokorua respectively, and ~10% in Nelson Haven and Delaware Inlet. Land use changes, particularly forest harvesting, will affect these risks in the future. Low deposition rates measured throughout Waimea Inlet over the past decade indicate that the majority of terrestrial sediment inputs are likely being deposited in Tasman Bay.

NUTRIENT ENRICHMENT (EUTROPHICATION)

If excessive nutrient inputs are deposited in estuaries they can cause nuisance algal blooms. Macroalgae are highly effective at utilising excess nitrogen and, at nuisance levels, can form mats on the estuary surface which adversely impact underlying sediments and animals, other algae, fish, birds, seagrass, and saltmarsh. Macroalgae that becomes detached can also accumulate and decay in subtidal areas and on shorelines causing oxygen depletion and nuisance odours and conditions.

As nutrients are often associated with fine sediments, the two issues of nutrient enrichment and muddiness are generally interlinked and can be exacerbated when they occur together. Based on current nitrogen load estimates, with flushing and dilution factored in, Kokorua and Waimea inlets have a high risk of enrichment, and Delaware Inlet and Nelson Haven have a moderate risk.

Pipi and cockle shell bed.

SALTMARSH

Saltmarsh is one of the most productive environments on earth and serves as an important wildlife habitat, high tide nursery ground and spawning area for fish. Saltmarsh also provides benefits for humans including flood and erosion control, nutrient uptake, sediment trapping, and carbon absorption.

Historical saltmarsh losses have been extensive in Waimea, Delaware and particularly Nelson Haven, placing a high importance on protecting remaining areas. Future losses from reclamation are not expected to be significant, but remaining saltmarsh is commonly confined on the landward margin by armouring from seawalls, causeways and reclamations, constraining its ability to migrate inland in response to sea level rise. Terrestrial weeds are also common in the upper tidal reaches. As such it has a high vulnerability rating.

SEAGRASS

Seagrass (Zostera) is a marine plant of high ecological value that grows in the estuaries and shallow embayments of the Nelson region. Seagrass is important because it provides food and habitat for birds, fish, crabs, shellfish and other marine organisms. It traps sediment thereby protecting shorelines from erosion, and contributes to improved water quality. It is highly vulnerable to inputs of fine muds which smother beds and reduce water clarity, limiting the depths to which it can grow.

The extent of seagrass in Nelson's estuaries would historically have been relatively high, but has reduced by ~40-60% from measured baselines. The largest remaining beds are in Nelson Haven (120ha, 14% of the estuary) with <2% remaining in Waimea, Delaware and Kokorua (34, 6, <1ha respectively). Historical losses and ongoing reductions result in a high vulnerability rating.

Patch of remnant saltmarsh, Nelson Haven.

Oioi jointed rush at Delaware Spit.

NATURAL VEGETATED TERRESTRIAL MARGINS

Densely vegetated estuary margins filter and assimilate sediment and nutrients, acting as an important buffer to introduced grasses and weeds. They are also an important habitat for a variety of species including whitebait, provide shade to help moderate temperature fluctuations in smaller tributaries, and improve estuary biodiversity. All of the region's estuaries have had their natural margin significantly reduced, but some reversal of impacts is underway with planting initiatives in the Waimea, Nelson Haven and Delaware estuaries.

ECOLOGICAL CHANGE THROUGH CLIMATE INDUCED SEA TEMPERATURE AND pH CHANGE

A lack of long-term observational data means direct evidence of changes attributable to climate impacts is unavailable in Nelson. However, the experimental evidence indicates that all shoreline habitats (including estuaries) bathed by ocean waters in the Nelson region are at high and ongoing risk from predicted climate induced increases in ocean acidity and temperature.

ELEVATED HUMAN HEALTH RISK

Runoff from farmland, urban areas, and human wastewater often carries a variety of disease-causing organisms or pathogens (including viruses, bacteria and protozoans) that, once discharged into the coastal environment, can survive for some time. Desk-top risk assessment criteria indicate that Nelson's estuaries have an elevated human health risk associated with bathing and shellfish consumption for short periods following heavy rain in the catchments. At other times there is likely to be a relatively low human health risk from bathing.

To ensure the effective management of estuaries in the region, the Nelson and Tasman Councils collaboratively monitor our estuaries and contribute to a national programme undertaken by regional councils. Both Councils are committed to long term estuarine monitoring in conjunction with coastal and freshwater monitoring programmes.

CASE STUDY: INTERNATIONALLY IMPORTANT SHOREBIRD SPECIES & ROOST SITES

The coastal area of the Top of the South Island has extensive estuaries and large tidal flats that are visited by thousands of shorebirds annually. Shorebird surveys at the Top of the South Island started at Farewell Spit in 1961, and since 1983 biannual shorebird counts have been undertaken by members of BirdsNZ, formerly the Ornithological Society of New Zealand (OSNZ).

At least 38 of the total of 68 shorebird species known in New Zealand have been recorded from the Top of the South Island.

Eight coastal areas in the Golden and Tasman Bay region are of international importance for at least one species of shorebird: Westhaven Inlet, Farewell Spit, Pakawau, Collingwood, Rototai, Motueka Sandspit, West Waimea Inlet, including Grossi Point and No-Mans Island and the Nelson East Waimea Inlet, including Rabbit Island East, Bell Island Shellbank and Sand Island, and the Nelson Airport Area.

Shorebirds are dependent on estuaries and coastal habitat for foraging and breeding.

LOCALS OR MIGRANTS?

Endemic shorebirds breed in New Zealand and, if migratory, stay within New Zealand or, as in the case of banded dotterel (*Charadrius bicinctus)* stay within Australasia. Migratory shorebirds breed in the northern hemisphere and migrate to spend the non-breeding season in New Zealand; the broad migration route used by these birds, together with the breeding and non-breeding areas, is known as the East Asian-Australasian Flyway.

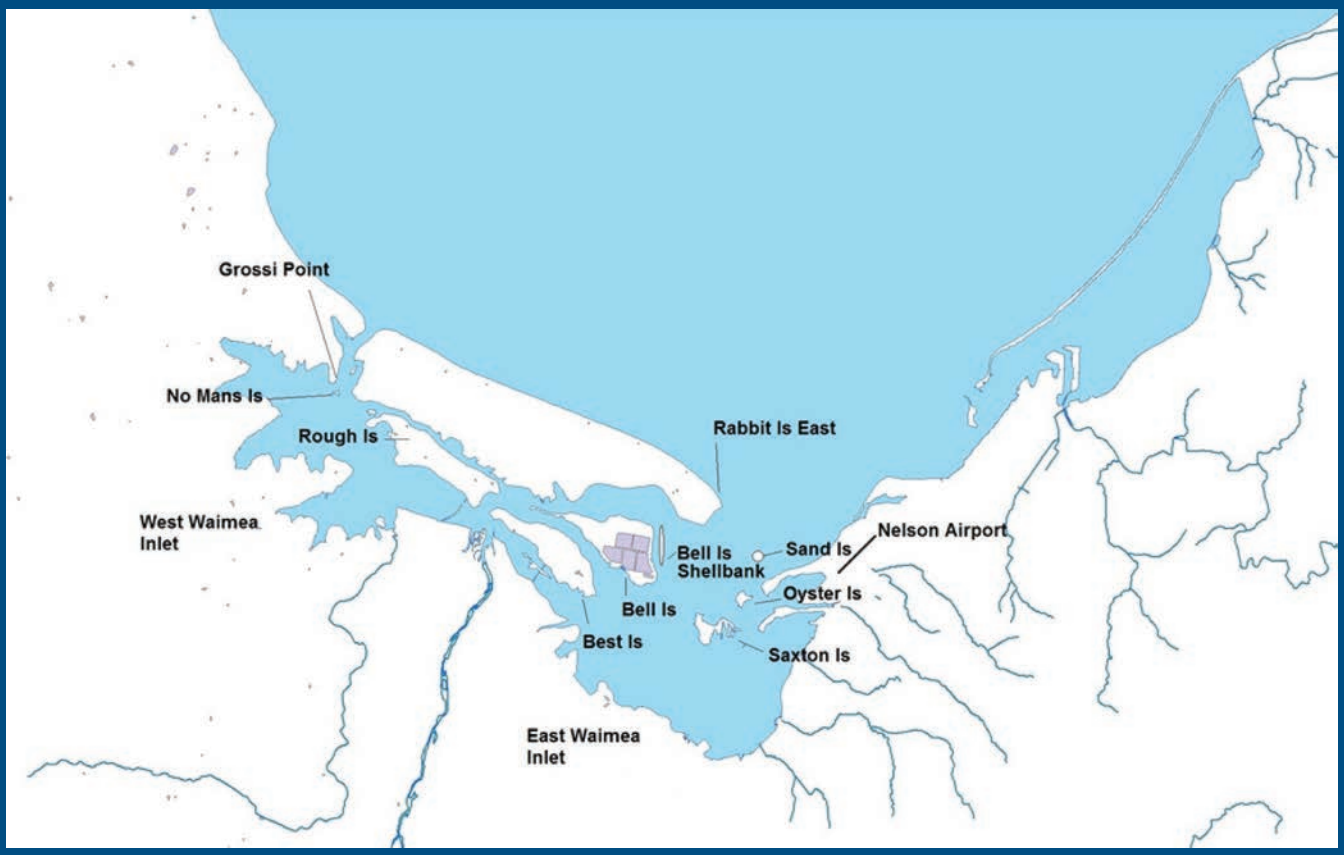
Shorebirds utilise New Zealand tidal flats throughout the year, but the species' composition changes. During the winter, most shorebirds in the coastal area are endemic species like South Island pied oystercatcher (*Haematopus finschi)*, variable oystercatcher (*Haematopus unicolor)*, pied stilt (*Himantopus himantopus)*, banded dotterel and wrybill (*Anarhynchus frontalis)*. In spring, most endemic species have moved inland to breed. Those species remaining on the coast are mostly long distance migrants like red knot (*Calidris canutus)*, bar-tailed godwit (*Limosa lapponica)*, ruddy turnstone (*Arenaria interpres)*, and pacific golden plover (*Pluvialis fulva)*.

During the late summer the coastal wetlands host long-distance migrants as well as endemic species that have returned to the coast after breeding. Food demands on the tidal flats are highest during this summer period, when invertebrate biomass has to meet the needs of both endemic and migratory birds.

SHOREBIRD DISTRIBUTIONS

Most shorebirds forage on intertidal flats. As the tide rises, birds gather at communal roosting sites where they remain for several hours. When the ebbing tide uncovers the flats, birds resume foraging. Roost sites are used regularly; however birds may move between sites in response to short-term factors such as human disturbance and extreme weather conditions.

The dynamic nature of the coastal environment means that physical changes occur as a result of erosion and deposition. The changing coastal dynamics can affect shorebird distribution. An island has developed between Nelson Airport and Rabbit Island, referred to as 'Sand Island' following the disappearance of the sand beach at the eastern end of Rabbit Island in the winter storms of 2009. This island has hosted the most significant number of roosting shorebirds in the whole of eastern Waimea Inlet on high tides, and has been an important breeding



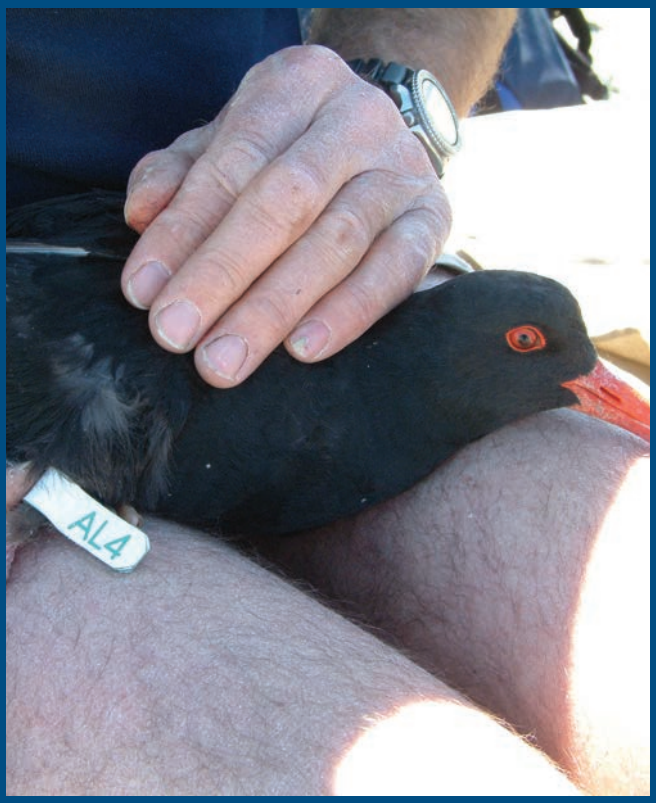
Map of shorebird roosting sites in the Waimea Inlet.

site for birds such as variable oystercatcher, white-fronted tern (*Sterna striata)* and black-billed gull (*Larus bulleri)*.

The red knot, bar-tailed godwit and South Island pied oystercatcher are the most numerous shorebird species in New Zealand estuaries. In Tasman Bay, during low spring tides, bar-tailed godwits roost at a number of sites such as the head of Nelson Haven, the Bell Island Shellbank and Sand Island, as well as Motueka Sandspit, but on king tides the majority of the Waimea Inlet godwits (>4,000 birds) are forced to Motueka Sandspit, as this is the last remaining site as the others become inundated.

THREATS

Human disturbance can occur in foraging and breeding areas, potentially resulting in abandonment of nests/young and reduced feeding opportunities. The greatest human use of the coast over summer coincides with the breeding season of local shorebirds and the period when Arctic breeding shorebirds are fattening prior to migration. Climate change-induced sea level rise and inundation are likely to impact more on coastal biodiversity where landward retreat of the high-water mark is constrained due to morphology, geology (e.g., rock outcrop) or coastal defences, where intertidal areas and their associated ecosystems may be reduced and potentially 'squeezed out'.



Tasman Bay is an important regional nursery area for variable oystercatchers. BirdsNZ (OSNZ) are colour banding birds and studying their movements within Golden and Tasman Bay.

School native plantings at Tahnuanui back beach and sand dunes

HEALTHY COMMUNITIES

NGĀ HAPORI ORA

AIR QUALITY

AT A GLANCE

Nelson air quality monitoring is undertaken in three gazetted airsheds: A (Nelson South); B – split into B1 (Tahunanui) and B2 (Stoke); and C (Nelson North).

Air quality has shown a steady and significant reduction in PM_{10} emissions since 2001.

In 2017 air quality met the National Environmental Standard (NES) in all airsheds except for Airshed B1 (Tahunanui). The three exceedances in the Tahunanui area all occurred on dry, windy days outside of winter and were likely to be due to high levels of airborne dust.

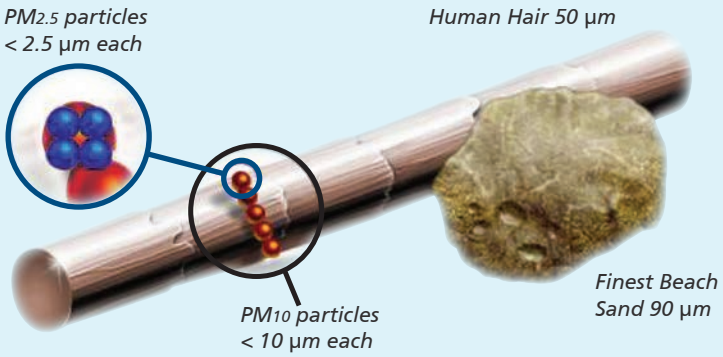
Council is also monitoring $PM_{2.5}$ in Airsheds A and B1, which is an emerging issue and will be required to be monitored following the proposal signalled by the review of the National Environmental Standards for Air Quality (NESAQ). $PM_{2.5}$ monitoring will provide information on human generated ultra-fine air-borne pollutants that have a potential impact on people's health and excludes larger particles such as sea salt.

Fifeshire Rock and the Kahurangi ranges on a clear winter day.

WHAT CAUSES AIR POLLUTION?

Air pollution comes from many sources, some produced by human activities, including burning fuels such as diesel, petrol, wood, gas and oil, and from natural sources such as windblown dust, pollen and sea salt. The burning process releases chemicals and small particles (particulates) into the air that are harmful to humans and lead to brown hazes and unpleasant odours.

PM_{10} are particles less than 10 microns in diameter and $PM_{2.5}$ particles are less than 2.5 microns in diameter.



Size of PM_{10} and $PM_{2.5}$ particles compared to human hair and beach sand.

The NESAQ for PM_{10} is a 24 hour average of 50 µg/m³. This can only be exceeded on one day a year.

Council started monitoring PM_{10} in the Victory Square area (Airshed A) in 2001 and Airshed B1 in 2002. Monitoring was re-established in Airshed B2 in 2015 after stopping in 2010; and in 2014 in Airshed C after stopping in 2009.

In 2001, in Airshed A, maximum concentrations of PM_{10} reached 165 micrograms (µg/m³) per cubic metre and the annual average PM_{10} concentration was 42 µg/m³. The NESAQ was exceeded on 81 days in 2001.

WHAT DRIVES AIR POLLUTION IN NELSON?

Nelson has a settled coastal climate and is surrounded by hills, which can result in periods of calm weather, with little wind to dissipate smoke away from chimneys.

During winter when Nelson has clear and calm skies, the air near the ground can be colder than the air above, which is referred to as a meteorological 'inversion' in the atmosphere. This temperature inversion forms a layer that can trap smoke from domestic chimneys, factories and vehicle exhausts, holding it near to the ground.

The result of this still, clear weather pattern is that smoke concentrations during winter months can be much higher than normal for a city of this size.

During the spring and summer periods, natural sources such as sea salt, pollen and dust can comprise a significant proportion of fine particles.

Air quality in Nelson can also be affected by chemical pollution not related to burning. Standards are in place for these pollutants and their levels are monitored.

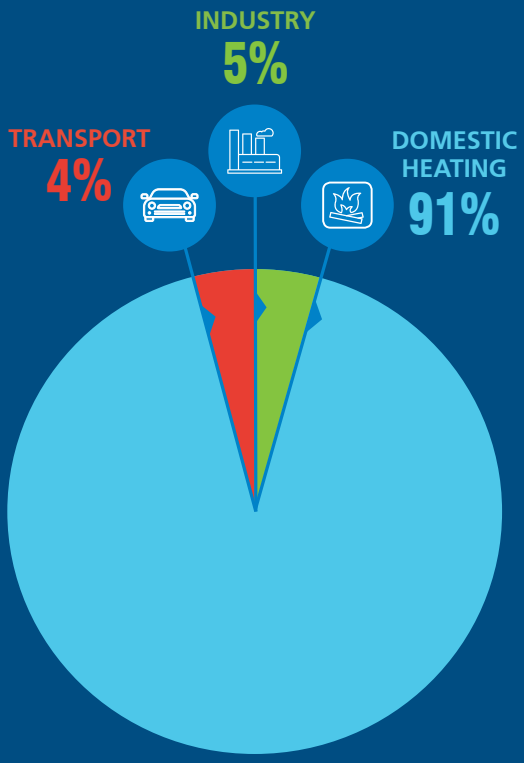
SOURCES OF AIR POLLUTION

Council undertakes an emission inventory every five years to determine the sources of air pollution in each airshed. This involves analysis of domestic home heating surveys and emissions factors for burners, census data, industrial discharge consents, and vehicle emission data.

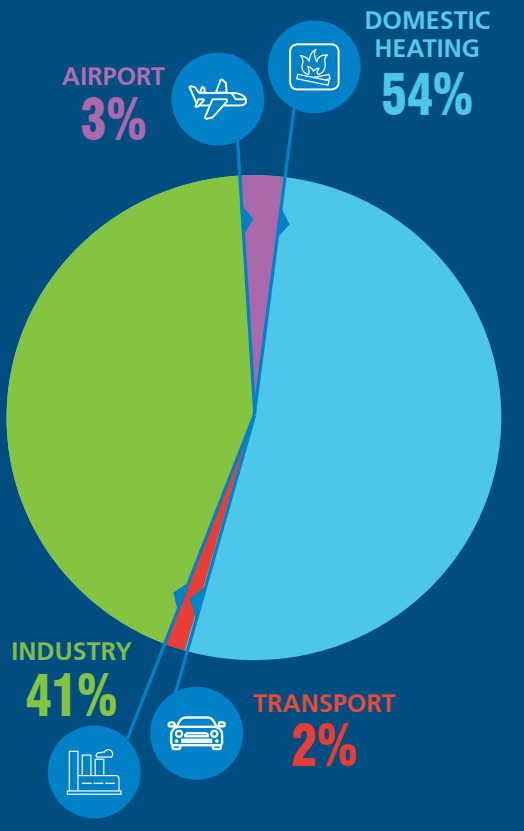
Research undertaken in 2014 show the sources of emissions vary by airshed (refer to graphs on right).

Domestic woodburners are the largest contributor across all air sheds over winter months. It is important to note that the emissions output from a fire varies according to the model of burner, the fuel burnt and the techniques used to light and load the fire. Generally the hotter the fire burns the less smoke it produces. Open fires and outdoor burning tend to produce the most smoke (per piece of wood) and modern wood burners and pellet fires the least.

AIRSHED A (NELSON SOUTH)



AIRSHED B1 (TAHUNANUI)



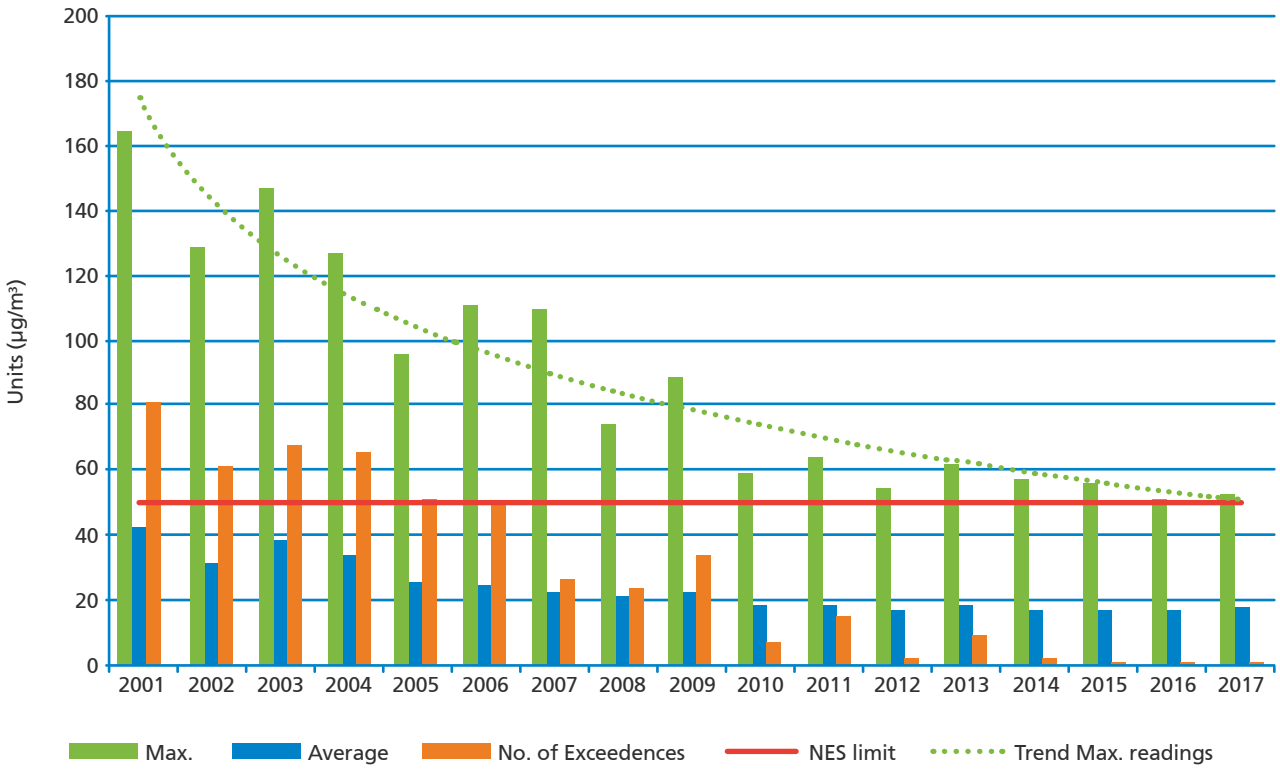
KEY RESULTS FOR 2017

Airshed A

There was one NESAQ exceedance in the Nelson South area in 2017. This compares to 81 in 2001. The maximum PM_{10} concentration recorded was 53 µg/m³ and the annual average concentration was 17 µg/m³.

AIRSHED A - YEARLY PM_{10} DATA

(monitoring site: St Vincent Street)



Dry wood is essential for clean burning.

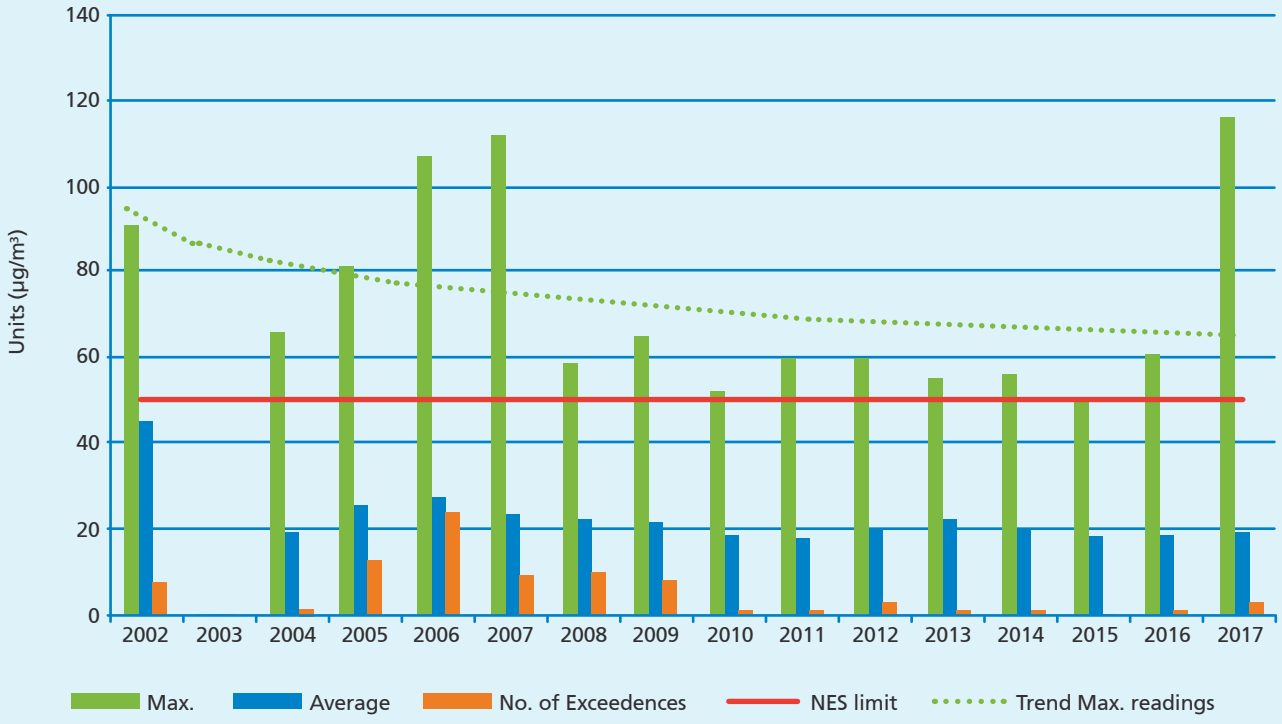
Airshed B1

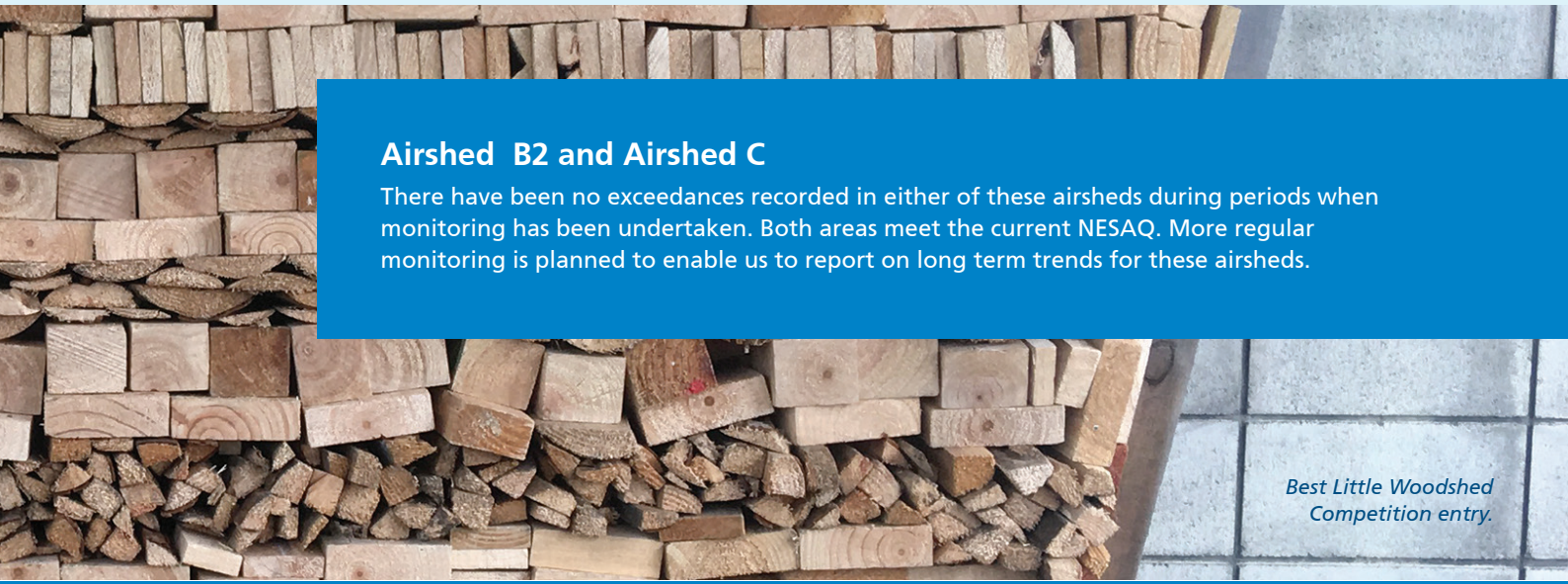
There were three NESAQ exceedances in the Tahunanui area in 2017. The maximum recorded PM_{10} concentration was 116 µg/m³ in March, and the annual average concentration was 19 µg/m³.

The trend for Airshed B1 shows a general reduction in both smoke concentrations and number of days the Standards were breached. Each of the exceedances occurred on hot dry days with strong southwest winds (<20km/hr) with PM_{10} peaks in the middle of the day. They are likely to be due to increased dust levels rather than industrial or residential burning.

AIRSHED B1 - YEARLY PM_{10} DATA

(composite of monitoring sites: Roto Street, Vivian Place & Blackwood Street)





Airshed B2 and Airshed C

There have been no exceedances recorded in either of these airsheds during periods when monitoring has been undertaken. Both areas meet the current NESAQ. More regular monitoring is planned to enable us to report on long term trends for these airsheds.

Best Little Woodshed Competition entry.

WHAT ARE WE DOING ABOUT IT?

NELSON AIR QUALITY PLAN

Council has an operative Air Quality Plan which places controls on activities affecting air pollution.

Plan rules prohibit outdoor burning in urban areas, the use of open fires and the installation of enclosed burners in houses that do not already have an enclosed burner, with the exception of Airsheds B2 and C, where a limited number of Ultra Low Emission Burners (ULEB) are permitted.

A plan change in 2016 provided for ULEBs to be installed in up to 1000 homes without solid fuel burners in Stoke (Airshed B2) and up to 600 homes in Airshed C.

A full review of the Nelson Air Quality Plan is currently taking place as part of the draft Whakamahere Whakatū Nelson Plan development. It is also worth noting the Government is reviewing the NESAQ.

Council has contributed to the Nelson Tasman Marlborough Healthy Homes Scheme that seeks to install insulation into homes where residents have high health needs. 1204 Nelson homes have been insulated under this scheme to date.

INDUSTRIAL EMISSIONS

Council is working with industry to reduce its contribution to air pollution through the resource consents process.

Improvements have been made with many industrial emitters installing emission reduction and capture technology.

EDUCATION

Council runs a behaviour change programme, educating people on how to burn wood cleanly and improve the operation of their woodburners.

Even low emission burners contribute to air pollution when poor fuel is used, operated incorrectly or not maintained.

Burning wet wood produces more smoke, burning treated timber can release arsenic, and burning plastic produces dioxins.

Council established the Good Wood scheme to encourage people to buy and burn dry, untreated fire wood. There are currently five wood merchants registered with the Good Wood scheme.

Council's Eco Design Advisor provides a free service giving advice on heating options and how to keep your homes warm.

STAY UP TO DATE

You can now check Nelson's real time air quality information through the national Land, Air, Water Aotearoa (LAWA) environmental database which is available through the Council's website nelson.govt.nz, search = LAWA.

Best Little Woodshed Competition entry.

Best Little Woodshed Competition winner.

CLIMATE CHANGE

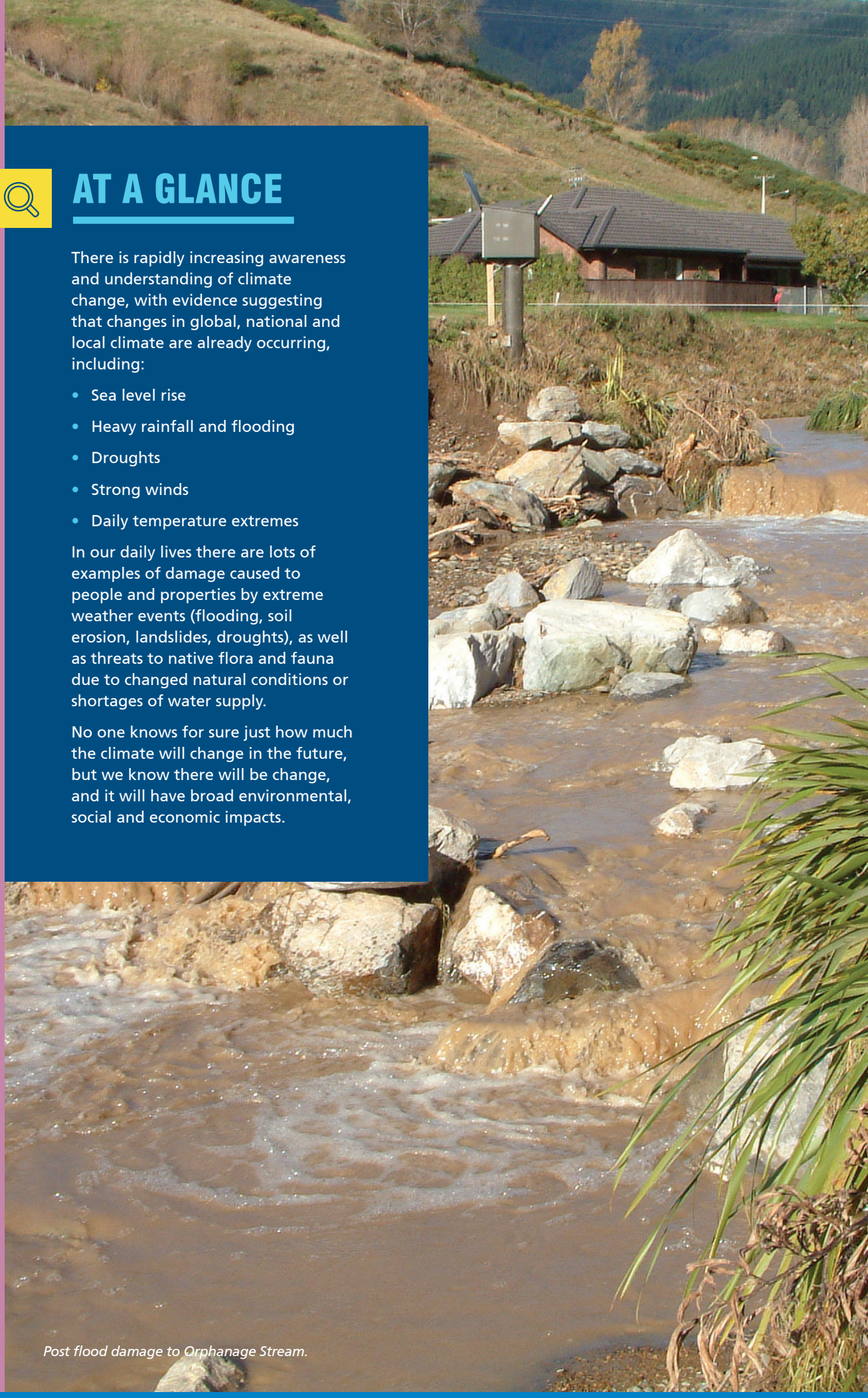
AT A GLANCE

There is rapidly increasing awareness and understanding of climate change, with evidence suggesting that changes in global, national and local climate are already occurring, including:

- Sea level rise
- Heavy rainfall and flooding
- Droughts
- Strong winds
- Daily temperature extremes

In our daily lives there are lots of examples of damage caused to people and properties by extreme weather events (flooding, soil erosion, landslides, droughts), as well as threats to native flora and fauna due to changed natural conditions or shortages of water supply.

No one knows for sure just how much the climate will change in the future, but we know there will be change, and it will have broad environmental, social and economic impacts.



Post flood damage to Orphanage Stream.

WHY DOES IT MATTER?

The earth's atmosphere is made up of oxygen, a large amount of nitrogen and a small percentage of greenhouse gases, such as carbon dioxide and methane.

Greenhouse gases act like a blanket around earth. When the balance is right they trap warmth from the sun and make life on earth possible. However, increasing the concentration of greenhouse gases in the atmosphere traps too much heat and causes the climate to change.

Average temperatures of earth's atmosphere and oceans have increased dramatically over the last 100 years, a time during which greenhouse gas production as a result of human activities such as industry, agriculture and transportation have risen substantially.

WHAT CAN WE DO ABOUT IT?

Climate change is a challenge that everyone needs to address, all the way from government through to individuals – with business, science, research, government, non-governmental organisations and communities all playing a part.

Actions in response to climate change generally fall into two categories:

- Mitigation is about finding ways to reduce greenhouse gas emissions. Examples are the setting of emission reduction targets to limit global warming at international level (e.g. Paris Agreement), national level (e.g. New Zealand's proposed target of net zero carbon emissions by 2050) and local and individual levels (e.g. by measuring and reducing the carbon emissions of organisations and individuals).
- Adaptation deals with the effects of climate change, through responding to impacts such as rising sea levels and coastal hazards. Most adaptation action takes place at a local and community level (e.g. through land use planning) as well as through individuals.

Mitigation and adaptation are closely linked: the more we take action to reduce our carbon emissions, the better the chance that we will have less impacts to adapt to in the future. Some actions we can take contribute to both areas, for example, planting coastal vegetation which absorbs carbon (mitigation), and protects properties at the same time by stabilising coastlines (adaptation).

Rocks Road slip caused by intense rain.

King tide flooding in Wakatu Square Car Park.

WHAT COUNCIL IS DOING

Council is committed to responding to climate change, and growing our community's resilience to the more extreme weather events it will bring is a top priority.

- Reviewing our Resource Management Act policies and plans to produce a new unitary plan – the draft Whakamahere Whakatū Nelson Plan
- Working with the community to better understand and plan for future hazards related to climate change and sea level rise, such as river flooding, coastal erosion and coastal inundation (flooding) using the Adaptive Pathways approach recommended by the Ministry for the Environment
- Enabling teachers and learners to educate and prepare for the future by participating in the Enviroschools programme
- Participating in CEMARS (Certified Emissions Measurement and Reduction Scheme) to measure and reduce emissions related to Council activities
- Reducing carbon emissions through activities such as replacing street lights with energy efficient LEDs and introducing electric vehicles to the Council fleet
- Protecting and building resilience of our natural environment and biodiversity through Nelson Nature and the Healthy Streams programme
- Providing Eco Design advice to residents to help reduce energy usage

WHAT WE ALL CAN DO

- Consider energy efficiency when building and running our homes and businesses. Examples include using the most energy-efficient appliances and lighting, and the installation of solar panels and insulation
- Reduce the amount of waste we create – considering composting, or cutting out single use plastic in favour of reusables
- Look at how we use transport – cycle or walk more, or combine these with better use of public transport and carpooling. Reduce the number of flights you take, when possible, and offset your emissions when you fly. Consider purchasing an electric vehicle or using video conferencing instead of traveling to a meeting
- Plant trees on our own land or get involved in a community forest restoration project, and help New Zealand achieve the government's ambitious target of planting one billion trees over the next ten years

CASE STUDY: COUNCIL INVESTING IN ELECTRIC VEHICLES

Council has replaced two vehicles in its fleet with electric vans. This isn't just about using efficient vehicles fit for purpose, but also because it's important that Council demonstrates how we can all reduce emissions.

Council electric van.

CASE STUDY: COASTAL FLOODING

Nelson and Tasman Council hydrologists support the region's Civil Defence Emergency Management response to flood warnings. Tasman District Council's Hydrologist Martin Doyle describes the climatic factors brought with Ex-Tropical Cyclone Fehi that led to coastal inundation (flooding) in Golden and Tasman Bays.

On 1 February 2018 much of New Zealand experienced significant coastal inundation (flooding) as Ex-Tropical Cyclone Fehi swept across the country. The effects on Nelson and Tasman included flooded roads and homes, evacuations and damage to homes and buildings including prominent Nelson establishments like the Boathouse and the Boatshed Café.

Coastal inundation (flooding), excluding tsunamis, is usually generated by four components: a very high tide, a low atmospheric (barometric) pressure, large waves and a strong onshore wind (further exaggerated if the wind is blowing into a narrowing bay). If the wind is blowing into a narrowing bay, this component is exaggerated further.

TIDE: Sea level due to tidal influence can be measured with a high degree of accuracy at any point in time. The high tide of 4.5 m for 1 February 2018 was expected to peak at 11:22 am. The level of the sea is only above this level for about 0.2% of the time, or 17.5 hours a year on average.

BAROMETRIC PRESSURE: As atmospheric pressure decreases it allows the sea level to rise accordingly. Conversely, a high atmospheric pressure will decrease the sea below the predicted tide level. For every 1 hectopascal (hPa) drop in barometric pressure, the sea will rise about 1 cm in height. Tide levels are calculated on a standard atmospheric pressure of 1013 hPa. On 1 February 2018 the pressure was about 990 hPa, which enabled the sea to rise some 23 cm above normal.

WIND: Ex-Tropical Cyclone Fehi brought gale force winds as it travelled down the West Coast of New Zealand, resulting in strong northerly winds into Golden and Tasman Bays. These winds peaked at 75 km/hr at the Richmond weather station. This is a notably strong wind for the head of Tasman Bay, the previous strongest being 77 km/hr in 10 years of recording at the Richmond Racecourse. This wind pushed water before it, causing 'wave setup' – or water piling up at the coast. Golden Bay and Tasman Bay both narrow at their heads, creating a funnel which accentuated this 'setup' effect. This was particularly true for the area around Waimea Estuary, including Mapua and Monaco.

WAVES AND SWELLS: Waves are generated locally from the wind, and swells travel in from further away. The centre of Ex-Cyclone Fehi traversed an area west of the North Island - one of few areas that can send swells into the bays at the top of the South Island. It is possible that some of these swells were long period waves and caused the surges in sea level seen on the day. The strong northerly wind created large waves which perhaps had the greatest effect on flooding after the high tide itself. These waves rolled over the shoreline barriers whether they were natural or manmade, causing erosion and ponding.

STORM SURGE: The combination of low barometric pressure and onshore wind is called storm surge. Storm surge can be estimated by calculating how much greater the sea level was than that expected by tidal influence alone. Tasman District Council measures tide at Little Kaiteriteri and Tarakohe. At both these recorders, storm surge peaked about 60 cm, meaning the average level of the tide was 60 cm higher than expected. The storm surge seen on 1 February 2018 was one of the highest recorded in the District at the two recorders since records began 17 years ago. Wave effects and short surges from swells operated on top of this level.

The cumulative effect

We often experience large tides, low pressure or northerly storms. It is the combined cumulative effect of all these components occurring simultaneously ("stacking up") that led to the problems experienced on 1 February 2018. This has not happened on any other occasion in recent times, but might become more frequent due to the impacts of climate change.

Cyclone Fehi storm and coastal flooding of Rocks Road.

HOUSING

AT A GLANCE

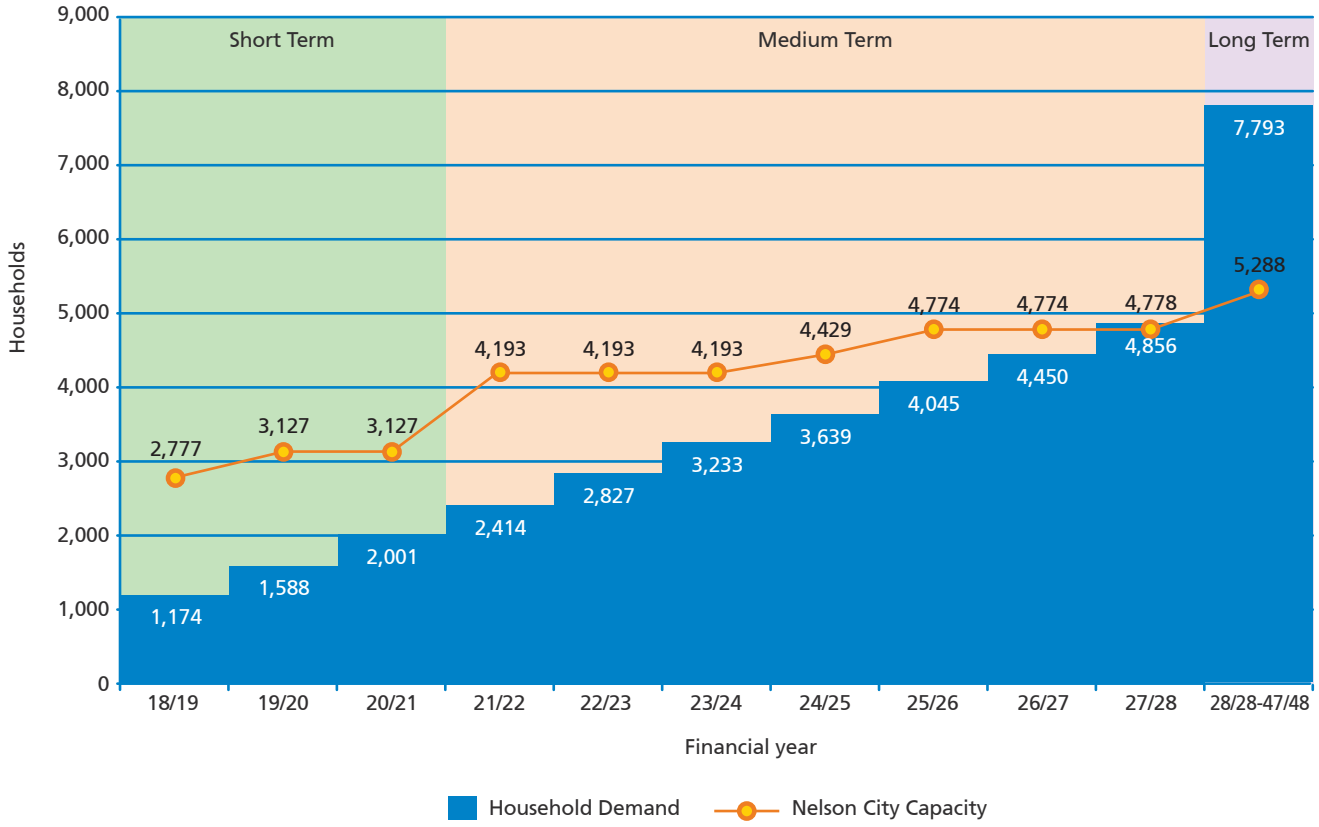
The housing environment in Nelson can be summarised as follows:

- There is adequate residential capacity in the short term but a shortage beyond year nine.
- Demand for smaller homes is expected to increase in response to the ageing Nelson population.
- House prices are too high for approximately 70% of residents not living in their own home to be able to participate in the housing market.

CAPACITY

There is insufficient residential housing capacity in Nelson in the medium term (from year 9) and this extends into the long term (years 11 to 30). Projected demand outstrips capacity by 2,505 households from years nine to 30. Recommendations include undertaking a Future Development Strategy which will assess options for rezoning expansion areas and increased infrastructure investment, along with analysis of feasible infill development of existing urban areas to explore how it can be plan enabled. The graph below shows the projected demand for dwellings over time and the corresponding capacity.

HOUSEHOLD DEMAND AND CAPACITY - NELSON CITY



DWELLING SIZES

Population projections indicate that the population of Nelson is ageing and will continue to do so for at least 30 years. As a result of the large increase in the older population there is expected to be a corresponding increase in demand for one and two bedroom dwellings. Council currently has no ability to control the size of dwellings in the market and while the Nelson Resource Management Plan enables a range of dwelling sizes, the feasibility of those in relation to land value and site size does not favour smaller dwellings. Further work is required to better understand the community's preferences for dwelling size and how that relates to price points in Nelson.

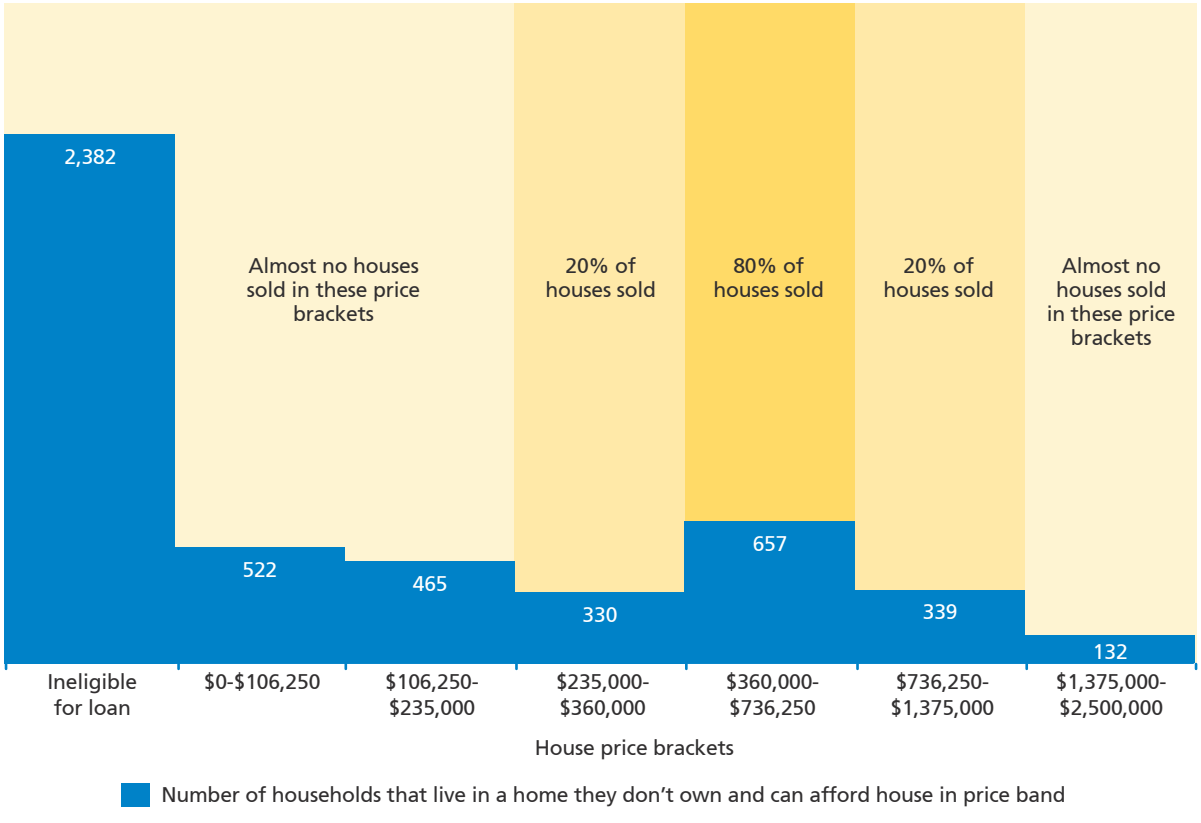
AFFORDABILITY

Households that can afford between $0-$106,250 and $106,250-$235,000 are able to borrow money from the bank but not enough to afford any houses sold in the current market in Nelson. For the remaining price brackets, the house sales profile broadly follows the demand profile. This indicates that around 70% of people who do not live in their own home are unlikely to be able to participate in the Nelson housing market due to inadequate income or, conversely, too high property prices.

The Ministry for Business, Innovation and Employment's Housing Affordability Measure (HAM) that is reported on in the National Policy Statement – Urban Development Capacity Quarterly Monitoring Report shows that around 85% of first home buyers are not able to afford a typical 'first-home' which is defined as the lower quartile price point of housing in the Nelson area. This result supports the analysis summarised below.

The graph below shows that of Nelson residents not living in their own home, around half do not earn enough to be eligible for any loan from the bank, as their costs of living day-to-day take up all of what they earn.

RELATIONSHIP BETWEEN HOUSE SALE PRICES AND ABILITY TO PAY FOR ALL HOUSEHOLDS NOT LIVING IN THEIR OWN HOME



AVOIDING THE CREATION OF WASTE

AT A GLANCE

Council has a statutory responsibility to promote effective and efficient waste minimisation, and has created a Joint Waste Management and Minimisation Plan (JWMMP) with Tasman District Council.

OUR VISION IS:

Valuing Resources and Eliminating Waste

OUR THREE GOALS ARE:

- Avoiding the creation of waste
- Improving the efficiency of resource use
- Reducing the harmful effects of waste.

WHAT THE NUMBERS TELL US

For the year ending June 2016, 60,335 tonnes were sent to landfill which equates to 598 kg per person.

This doesn't mean we are all disposing of that much rubbish personally. We also have to take into account waste generated by commercial activities, which is 55% of the waste disposed to landfill.

About 6,500 tonnes of recyclable materials were diverted from landfill through kerbside collection services during 2016. Most of our recycling is made up of glass, mixed paper and cardboard, with smaller amounts of plastics, tin and aluminium.

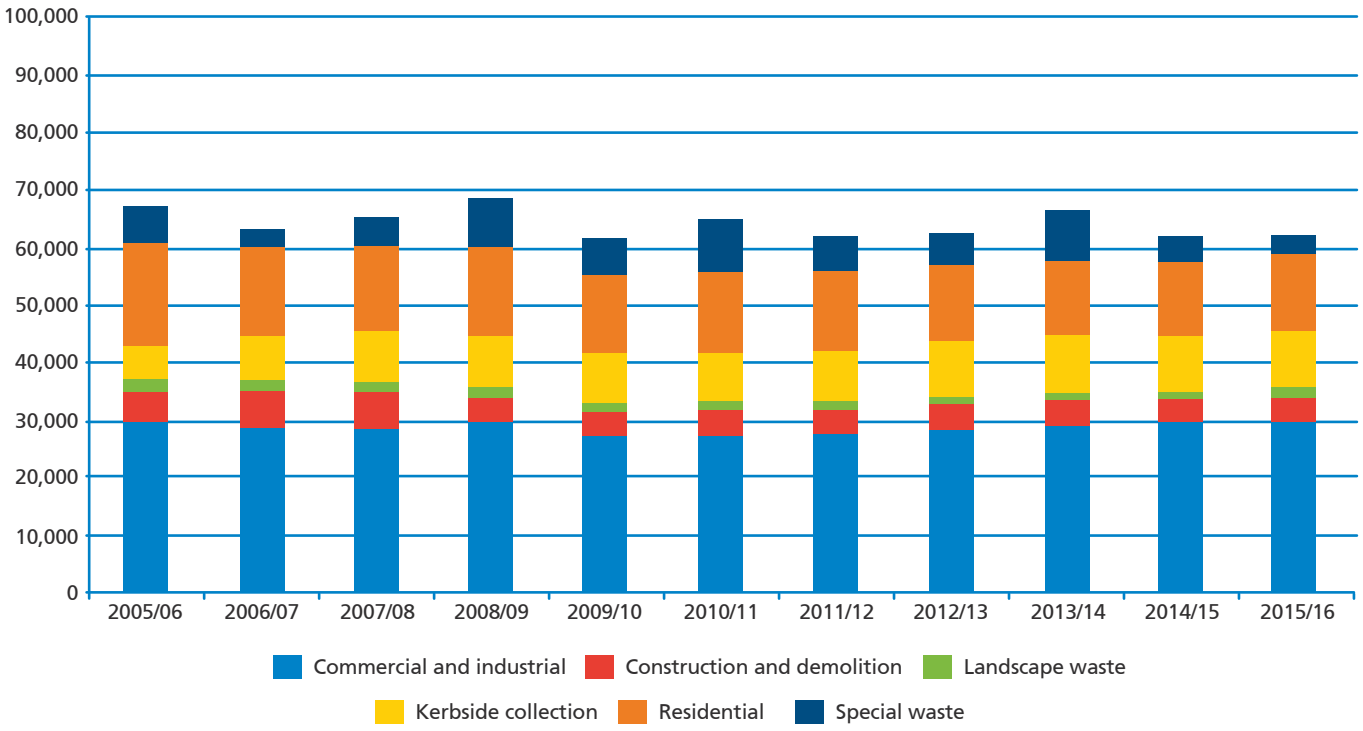
With substantial growth in the region's population, collaborating with the community to reduce the creation of waste is becoming even more important.

Waste disposal at the York Valley landfill.

SOME FACTS AND FIGURES...

Each year approximately 62,000 tonnes of waste, including around 2,000 tonnes from Buller District, is sent to landfill within the Nelson and Tasman Regions. Total waste to landfill peaked in 2008/09 at 68,700 tonnes and since then has varied between 61,400 and 66,600 tonnes per annum.

ANNUAL TONNES OF WASTE SENT TO LANDFILL IN THE NELSON AND TASMAN REGIONS



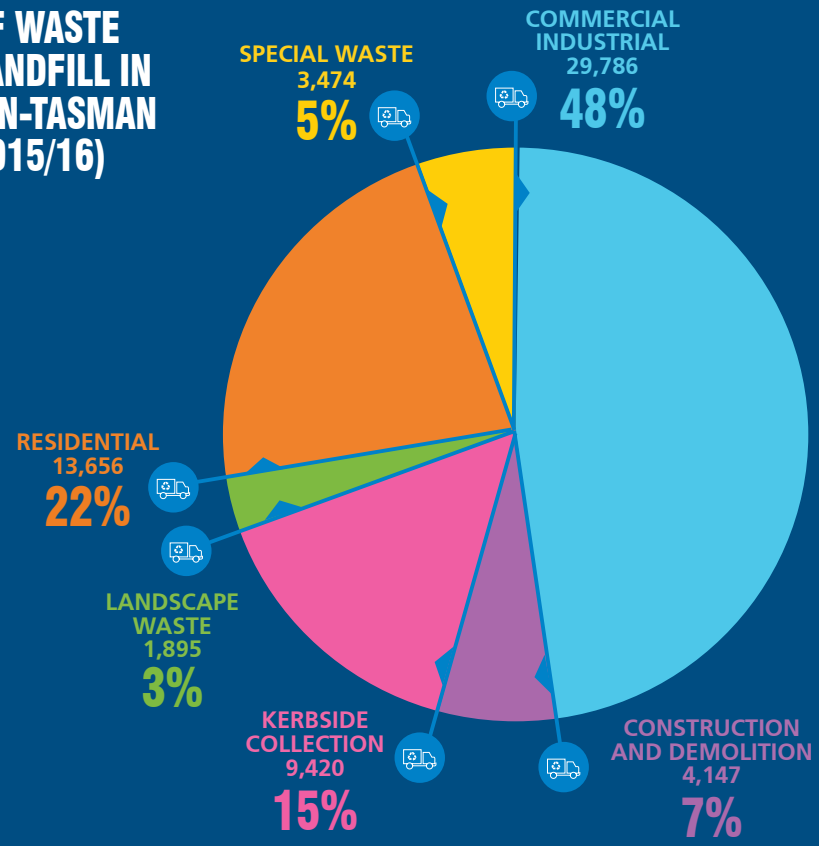
WHY DOES IT MATTER?

According to a study by the Ellen MacArthur Foundation, in a business-as-usual scenario there may be more plastic by weight in the ocean than fish by 2050. Local government is also facing significant challenges in areas such as sustainable markets for recycling.

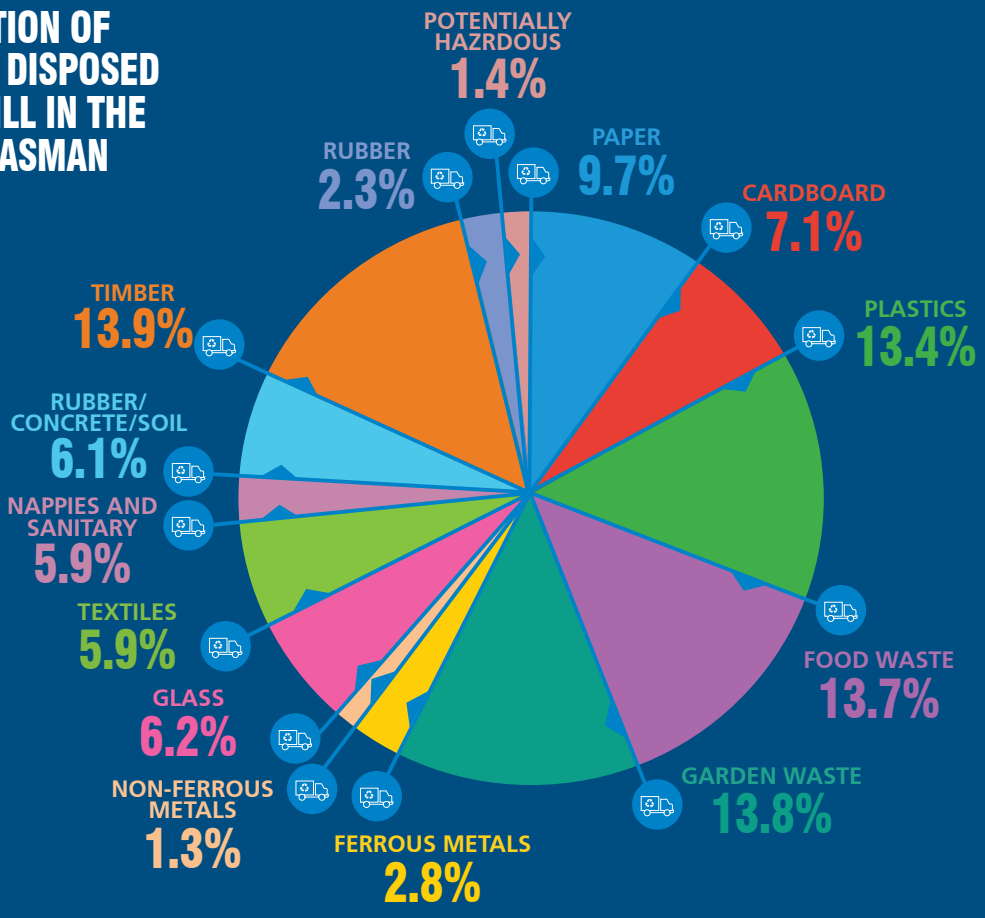
Waste is something which affects all of us, and which we all have the ability to influence - whether it's doing better at diverting recoverable materials from landfill, keeping harmful materials out of our environment or lightening our carbon footprint through consuming less. We're also wasting valuable resources such as food – and Council has a role to play in enabling our community to create change.

Sorting of recycling materials.

SOURCE OF WASTE SENT TO LANDFILL IN THE NELSON-TASMAN REGION (2015/16)



COMPOSITION OF MATERIAL DISPOSED TO LANDFILL IN THE NELSON–TASMAN REGION



WHAT ARE WE DOING ABOUT IT?

WHAT COUNCIL IS DOING:

In the hierarchy of waste - avoid, reduce and reuse are the preferred actions. Council's role is to collaborate with the community to make this easier.

To do this we use a range of tools, including:

- Advocacy for national programmes such as product stewardship programmes including container deposit schemes and reducing the use of single use plastics
- Subsidies to increase access to products and services that help reduce waste. Examples include the subsidy for compost bins, worm farms and bokashi, and for electronic waste recycling
- Engagement and support for activities such as composting to turn food waste into a valuable resource for growing food, and supporting schools through Enviroschools
- Encouraging re-use in the community through initiatives such as SecondHand Sunday
- Providing advice and support for the wider community, including working with event organisers to reduce waste at events
- Supporting resource recovery through residential kerbside collections, as well as public and commercial drop off of materials at transfer stations

WHAT WE ALL CAN DO?

- Lead by example by avoiding single use items such as plastic bags and straws
- Compost your food waste – not only does it not need to be in landfill, but it's a great resource which can save you money
- Make conscious choices about what you buy – ask yourself how long an item will last and is it fit for purpose?
- Where you can, choose to reduce or reuse, before you need to recycle

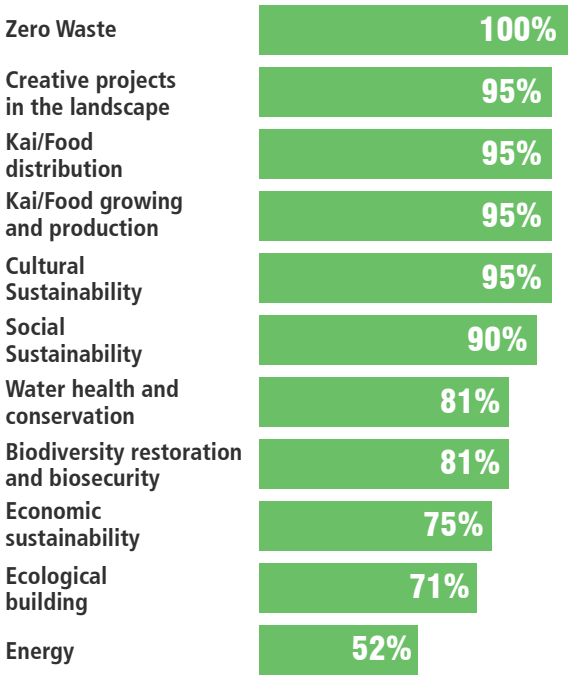
Reducing waste through organic composting .

ENVIRONMENTAL EDUCATION

AT A GLANCE

Connecting children with their communities and their environment through environmental education programmes will enable a more sustainable and resilient community to develop. Council has three environmental education programmes currently running – Enviroschools, Waimāori and School Planting.

NELSON ENVIROSCHOOL INVOLVEMENT IN ENVIRONMENTAL ACTION AREAS 2017



ENVIROSCHOOLS

In Nelson there are currently eleven kindergartens, twelve primary/ intermediate schools and four secondary schools registered with Enviroschools. A census undertaken in late 2017, which was contributed to by 91% of participating schools and kindergartens at that time, demonstrated that Enviroschools students are engaged in a variety of environmental action areas.

In the 2017/18 financial year students from Enviroschools engaged with active transport initiatives, biodiversity studies and waste management topics.

WAIMĀORI STREAMCARE

The Waimāori streamcare programme links children and the community with the water, its quality, and the creatures that live within. The programme has a strong focus on freshwater ecology and Māori perspectives, particularly around the concept of kaitiakitanga. Eighty one Waimāori sessions were held in the city in the 2017/18 financial year, including school and community based sessions.

SCHOOL PLANTING

Local primary and intermediate schools take part in school planting activities with approximately 2000 students planting trees each year. The programme has been running for around 20 years and students have planted all over the city. In 2018 the school planting programme was held at Tahunanui Beach to support the recovery of the beach ecosystem after damaging storms earlier in the year.

CASE STUDY:
PENGUIN INQUIRY WITH NELSON CENTRAL ROOM 4

Following a teacher's discovery of penguins nesting under her deck at home (in The Glen), Enviroschools supported the teaching and learning of a term long inquiry topic around the little blue penguin. Students' learning was brought to life as they took action based on their new understandings including building penguin nesting boxes and installing them on site at The Glen.

- Heather Graham, Primary/Secondary Enviroschools Facilitator

Room 4 at Nelson Central School playing the Penguin Pathway game, exploring the human impact on penguin habitat.

ACTIVE VOLUNTEER CONSERVATION GROUPS IN THE NELSON AREA

1. **The Boulder Bank Trapping Group**
   lsolly@doc.govt.nz
2. **Birdlife on Grampians**
   birdlifeongrampians.org.nz
3. **Marsden Valley Trapping Group**
   marsdenvtg@gmail.com
4. **Centre of New Zealand Trapping Group**
   sallyk@nelsonmail.co.nz
5. **Friends of the Maitai**
   friendsofthemaitai.org.nz
6. **Titoki Reserve Native Recovery Group**
   titokireserve@gmail.com
7. **Paremata Flats Restoration Group**
   parematafl ats.co.nz
8. **Nelson Tasman Weedbusters**
   weedbusters.org.nz/get-involved/weedbusters-near-you/nelson-tasman
9. **Pipers Reserve Trapping Group**
   hanchet@slingshot.co.nz
10. **The Brook Waimarama Sanctuary**
    www.brooksanctuary.org
11. **Forest & Bird**
    forestandbird.org.nz/volunteer
12. **Nelson Mountain Bike Club**
    nelsonmtb.club
13. **Battle for the Banded Rail**
    tet.org.nz
14. **Brook Valley Trappers**
    brooktrappers@gmail.com
15. **Birdlife Central**
    martjane@xtra.co.nz

For more information, visit **nelsonnature.nz**

Nelson City Council
te kaunihera o whakatū

MORE INFORMATION

BIODIVERSITY

The Nelson freshwater and estuarine fish distribution map (nelsoncity app):
nelson.govt.nz/fish-sightings

WATER QUANTITY

You can find out more about water quantity in Nelson on the LAWA website and compare to other regions around the country: lawa.org.nz/explore-data/nelson-region/water-quantity/

Find live rainfall and river level data for Nelson and Tasman monitoring sites here:
tasman.govt.nz/my-region/environment/environmental-data/

WATER QUALITY

NATIONAL TARGETS

mfe.govt.nz/fresh-water/what-government-doing/national-targets-swimming-water-quality/national-targets-improving

For further reading the recommended water quality limits to support the NOF and the draft Whakamahere Whakatū Nelson Plan attribute states can be found on the council website - search for "technical documents".

'WAKAPUAKA BURSTING WITH LIFE'

Council's Nelson Nature programme 'Wakapuaka Bursting with Life!' is working with Cawthron and ESR to identify *E. coli* bacteria sources in the Wakapuaka catchment and is working collaboratively with the Landcare Trust and Wakapuaka community to improve water quality. For more details of how you can participate:
nelson.govt.nz/wakapuaka

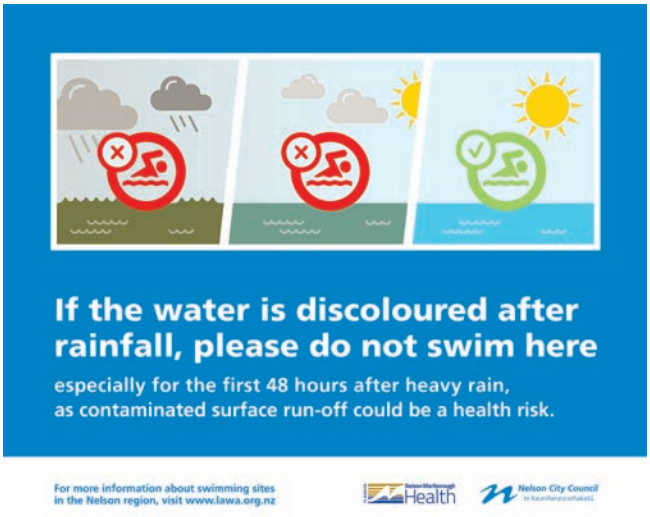
CAN I SWIM HERE - WEEKLY WATER QUALITY RESULTS

The weekly recreation bathing water quality results can be found on the LAWA regional council reporting website - LAWA Can I Swim Here:
lawa.org.nz/explore-data/swimming

SUMMARISED SCHEDULE OF WATER SAMPLES AND ALERTS

The schedule of water sample dates and status alerts are summarised on the Council website:
nelson.govt.nz/bathing

Council has worked with the NMDHB to improve information signs at beaches.



NATIONAL ENVIRONMENTAL MONITORING STANDARDS

For further information on National Environmental Monitoring Standards:
nems.org.nz/about-nems/

AIR QUALITY

WHAT CAN YOU DO TO IMPROVE AIR POLLUTION?

Burn bright pages: nelson.govt.nz/burnbright

Nelson City Council
te kaunihera o whakatū

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