Lakes and wetlands

Lakes and wetlands support a diverse array of plants and animals, some of them rare and threatened. In Taranaki, lakes such as Rotokare, Rotomanu and Mangamahoe are popular spots for picnicking, fishing, swimming and boating. Highly valued by Māori, lakes and wetlands also provide traditional food sources – known as mahinga kai.

Lakes can be classified by how they are formed (geomorphic lake types) and by the mixing pattern of the water and how they are connected to the sea. Of the 37 named lakes and lagoons in Taranaki, eight are artificial, being the product of either quarrying or damming. The remainder have formed through natural processes and include a number of coastal dune lakes, along with volcanic, riverine and landslide lakes. The majority of these natural lakes are in South Taranaki.

Lake Rotorangi is the largest lake in the region, and at 46km is New Zealand's longest man-made lake. Formed in 1984 through the damming of the Pātea River for hydroelectricity generation, the lake is popular for boating, swimming and waterskiing, particularly in the summer. The lake has been monitored since 1984, more recently for state of the environment and recreational water quality purposes, but primarily to ensure Trustpower meets the requirements of its resource consents associated with the Pātea Hydroelectric Power Scheme.

Wetlands, including swamps, marshes, and bogs, are the meeting place of land and freshwater. As well as being important for biodiversity, wetlands benefit land management by acting as the 'kidneys' of the land, filtering water that flows into them and trapping sediment. They store water during rainfall, helping to reduce flood levels. In dry periods, they release water to help maintain flows.

Approximately **5,000** wetlands have been identified and mapped

87% of monitored wetlands are in **good or better condition**

100 wetlands have been **restored or protected** during the last five years

Only **8.4%** of Taranaki's **wetland habitat remains**

What we know

Lakes

Lake health can be measured in a range of ways however a common way is the trophic lake index (TLI). Trophic state is calculated from a range of key water quality indicators such as nutrients, water clarity and algae, and provides an overall picture of lake health. Generally, the lower the levels of nutrients and the clearer the water, the better the health of the lake.

Microtrophic and oligotrophic lakes are typically low in nutrients and algae, mesotrophic lakes have moderate levels of nutrients and algae, while eutrophic and supertrophic lakes exhibit excessive nutrient levels and high amounts of algae, and are often associated with poor water clarity. Because of this, eutrophic or supertrophic lakes are generally unsuitable for swimming and contact recreation.

TLI Score	Description	Classification
0 - 2	Microtrophic: The lake is very clean with very low levels of nutrients and algae. The lake can have snow or glacial sources.	Very good
>2 - 3	Oligotrophic: The lake is clear and blue, with low levels of nutrients and algae	Good
>3 - 4	Mesotrophic: The lake has moderate levels of nutrients and algae.	Fair
>4 - 5	Eutrophic: The lake is murky, with high amounts of nutrients and algae.	Poor
>5	Supertrophic: The lake has very high amounts of phosphorus and nitrogen, and can be overly fertile and often associated with poor water clarity. Excessive algae growth can occur. Suitability for recreational purposes is often poor.	Very Poor

Lake trophic index (TLI) scores range from very good (microtrophic) through to very poor (supertrophic).

Nutrients such as nitrogen and phosphorus readily accumulate in lakes, and increased concentrations tend to result in excess plant growth. Lake Rotorangi, the only regularly monitored lake in Taranaki, is classed as eutrophic. This status is influenced mainly by nutrients and water clarity however, the lake has less algae than is typical of eutrophic lakes. This is due to inflows from the Pātea River, which provides a continuous source of freshwater. Being a very long lake, conditions closer to the head of the lake can be quite different to those at the lower end.

When compared to criteria set out in the National Objectives Framework (NOF), Lake Rotorangi falls within band B for measures of total phosphorus, ammonia and chlorophyll-a. Total nitrogen concentrations fall within band C, while dissolved oxygen concentrations place the lake in band D and below national minimum standards overall. There is not yet enough data to assess the state of the lake against NOF measures for native and invasive submerged plants (measures of ecosystem health) or *E. coli* and cyanobacteria as measures of suitability for human contact. However, available data suggests that during summer the lake is usually suitable for recreational use.

Attribute	Unit	Attribute band	Description
Ecosystem health			
Phytoplankton (trophic state)	Annual median (mg chl-*a*/m2)	B	Lake ecological communities are slightly impacted by additional algal and/or plant growth arising from nutrient levels that are elevated above natural reference conditions
	Annual maximum (mg chl-*a*/m2)	B	
Submerged plants (natives	Lake submerged plant (Native Condition Index % of Maximum potential score)	NA	Insufficient data to assess this attribute
Submerged plants (invasive species)	Lake submerged plant (Invasive Impact Index % of maximum potential score)	NA	Insufficient data to assess this attribute however, available information suggests this may not achieve the national bottom line due to the presence of invasive species
Ecosystem health (water quality)			
Total nitrogen (trophic state)	Annual median (mg/m^3)	C	Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrient levels that are elevated well above natural reference conditions
Total phosphorus (trophic state)	Annual median (mg/m^3)	C	Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrient levels that are elevated well above natural reference conditions
Ammonia (toxicity)	Annual median (mg NH_4-N/L)	A	99% species protection level: No observed effects on any species tested
	Annual maximum (mg NH_4-N/L)	B	99% species protection level: Starts impacting occasionally on the 5% most sensitive species
Lake-bottom dissolved oxygen	Measured or estimated annual minimum (mm/L)	D	Likelihood from lake-bottom dissolved oxygen of biogeochemical conditions resulting in nutrient release from sediments
Mid-hypolimnetic dissolved oxygen	Measured or estimated annual minimum (mm/L)	D	Significant stress on a range of fish species seeking thermal refuge in the hypolimnion. Likelihood of local extinctions of fish species and loss of ecological integrity.

The current state of Lake Rotorangi as measured against National Objectives Framework attributes for water quality and ecosystem health.

From monitoring carried out over the past 25 years, we know conditions within Lake Rotorangi continue to change. Total nitrogen concentrations have improved over the past 25 years, while total phosphorus and algae (measured by chlorophyll-a concentrations) have degraded over the last 25 years, but have improved over the last 10 years.

Turbidity has also degraded over the longer term. The total phosphorus and turbidity changes are likely due to sediment entering the lake from erosion in the hill country upstream of the lake. Despite this change, dissolved phosphorus concentrations remain relatively low, limiting algae growth.

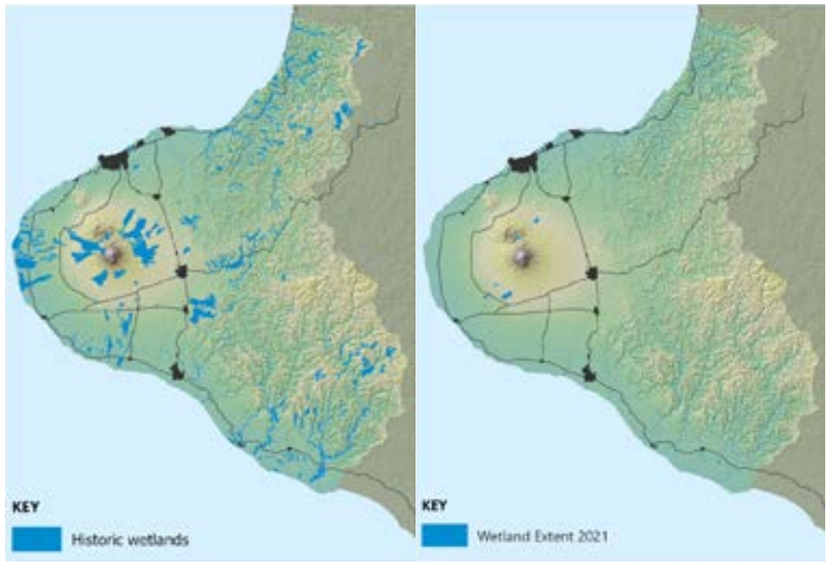
Wetland extent

All wetlands are dynamic, responding to changes in natural and human-induced factors. Changes in climate, land use, groundwater levels and sediment input can all affect wetland extent. In New Zealand, the vast majority of wetland habitat has disappeared; much of this loss has occurred through drainage for urban or rural development.

In Taranaki around 3,538ha (8%) of wetland habitat remains, compared to the North Island where just 5% of wetland habitat is left. Although small areas of wetland habitat are still being lost, the latest assessments show no major decrease in our region's wetland habitat.

Remaining wetland habitat.

On the ground, identification of swamp forest and urban wetland habitats, in addition to updated modelling of historical wetland extent, has helped improve our wetland extent estimations. During the past five years, 250ha of swamp forest and urban wetland habitat has been identified and added to our wetland extent map. Remote sensing data indicates there may be further areas of remnant swamp forest yet to be classified.

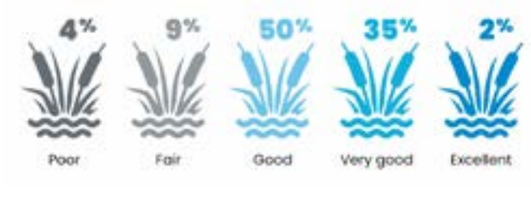


Estimated wetland extent prior to human settlement (left), compared to the current extent (right).

Wetland condition

The Council's biodiversity, predator and weed control, fencing, and enhancement planting programmes all contribute toward protecting and restoring Taranaki wetland ecosystems. To assess the basic ecological condition of wetlands, our scientists examine indigenous vegetation and fauna. We also assess pressures acting on wetlands, including stock access and presence of other animals, invasive plants, artificial drainage and catchment use.

Wetland condition assessments over the past five years show that 85% of wetlands monitored in Taranaki are in good or very good condition. Around 9% are in fair condition and 4% are in poor condition. Just 2% of wetlands are in excellent condition.



Condition of wetlands in Taranaki.

Since formal monitoring began in 2010, the Council has assessed 67 unique wetlands. Between 2015 and 2020, 21 were assessed for the first time, with a further 32 wetlands reassessed five years after their initial assessment. Based on five-year reassessment data, 74% of wetlands have shown improvement in their ecological condition, while 3% have unchanged ecological condition, and 23% have degraded in condition. Our repeat assessments show measures of indigenous vegetation, invasive species prevalence and stock exclusion have improved in the majority of wetlands over the five-year period.

Ten-year repeat wetland assessments are also underway. Preliminary results show that the majority (64%) of wetlands have improved in condition from their initial assessment in 2010. However, four wetlands have shown a decline in condition suggesting restoration works may need to be revisited.

The Council also monitors rare wetland bird species, such as the Australasian bittern (Botaurus poiciloptilus). Classified as 'Threatened-Nationally Critical' in New Zealand, bittern are a highly mobile, threatened, wetland specialist bird. We have records of bittern from 39 locations across the region, and are continuing to identify potential habitat and breeding locations.

What we're doing

A new regional lakes monitoring programme

Lake monitoring and reporting is a requirement of the National Policy Statement for Freshwater Management 2020 (NPS-FM). As a result, the Council is introducing a new regional monitoring programme to include a wider range of lakes throughout the region.

We have identified 17 natural lakes as potentially suitable for long-term monitoring. From 2023, we aim to include around a third of these in our regional lake water quality monitoring programme, while more will also be assessed for ecological health.

We recently undertook baseline water quality sampling of 15 of these proposed lakes. Preliminary results suggest they range in trophic condition from mesotrophic to supertrophic, meaning there will likely be significant requirements to address water quality issues under the NPS-FM, where these lakes are impacted by land use and other activities.

We also recently commissioned NIWA to carry out LakeSPI (Submerged Plant Indicator) surveys in Lakes Rotokare, Kaikura and Mangawhio. LakeSPI is a method of characterising the ecological health of lakes based on the proportion of native and invasive plants growing in them. The surveys found the lakes to be in moderate (Rotokare and Mangawhio) or high condition (Kaikura), with LakeSPI indices between 21% and 66%. The native condition scores of the lakes range from 28% to 52%, while the invasive impact scores ranged from 19% to 79%. For the LakeSPI index and the native condition score, higher scores represent better ecological health whilst for the invasive impact assessment the reverse is true. In time, further surveys will provide an overall picture of the ecological health of Taranaki lakes.

The 17 lakes, comprising four geomorphic types, that have been identified as possible candidates for inclusion in future long-term monitoring.

Preserving and restoring Taranaki wetlands

Although wetland loss has slowed in Taranaki, there is still a big job ahead to protect, restore, improve and maintain our region's wetlands. With the introduction of new national policy and regulations, wetlands have become a national focus for preservation and restoration.

Council officers are working on the ground identifying and mapping wetlands, confirming swamp forests, and encouraging and supporting landowners to fence, protect and restore wetland habitats.

Between 2015 and 2020, more than $525,000 has been spent through our land management and biodiversity programmes on restoring and protecting more than 100 wetlands. This funding has enabled stock exclusion fencing, enhancement planting, invasive weed and animal control, and track maintenance in and around wetlands. Because of this mahi, more than half of these wetlands (covering around 43ha) are now legally protected.

The Council actively works with landowners who want to protect and restore wetlands, and supports this via three wetland restoration funding pathways. The Environment Enhancement Grants Fund primarily supports the enhancement of wetlands of regional significance. The Wetland Contestable Fund is a Council initiative used to promote the restoration of wetlands regardless of size and condition. Finally, our Key Native Ecosystem (KNE) programme focuses on protecting the 'jewels in our biodiversity crown', those remnant wetlands that have significant indigenous biodiversity value. Read more about our KNE programme in the Biodiversity & Biosecurity section.

Constructed wetland vision comes to fruition

The constructed wetland at Awatuna with Taranaki Maunga in the background.

A constructed wetland is not only improving water quality on and around a South Taranaki dairy farm but is also helping educate others in the region.

Donna and Philip Cram began their environmental journey 15 years ago, when they stopped cows crossing through streams on their property. It's something all farmers must do now - but in those days it was common to graze cows to the water's edge.

The Crams now lead the way with a range of new sustainable farming practices to improve environmental and water quality, restoring their farm's biodiversity by keeping predators at bay. They are active in the farming community, including establishing a catchment group in the Oeo Catchment.

Working with the Council on a riparian protection scheme, they've fenced all 9.75km of the Oeo Stream tributary flowing through their property. They've built three culverts as "cow crossings" and planted 10,700 native plants over about 10 years on riverbanks and the farm – with help from their children and Opunake High School students.

But it's the wetland that's really catching attention. Years ago Philip identified an area receiving a large amount of water in a catchment area. With help from the Council and NIWA, a former streambed has been re-engineered into a wetland to reduce nutrients, bacteria and sediment leaching into the waterways.

It's now a three-cell 160m long constructed wetland covering 4500m^2 in a setting that reflects Taranaki Maunga. The Crams hope local schools will visit and learn about bird, plant and freshwater ecology and are working with Taranaki Enviroschools and other community groups to share the lessons they have learned.

While the wetland is "a really peaceful place to be with amazing views", Donna says it has a serious purpose. "We will have real data on reduction of nutrients in our run-off. That's very valuable to us and the farmers around us."

Regan Phipps, Council Manager of Science and Technology, says the Council, DairyNZ and NIWA are monitoring and sampling the wetland to assess how efficient it is in reducing nitrogen and phosphorous, *E. coli* and sediment in the catchment.

"Early indications are that the wetland is performing well, and significantly reducing the concentration of nitrate in the water flowing through it. Treatment performance is likely to improve further as the wetland matures."

He says the project is an example of what can be achieved with "a bit of vision, a willingness to work together and some hard graft".

"Not only is the wetland now helping to improve local water quality, it's helping to raise awareness of environmental issues, supporting education and providing a living demonstration of a functioning constructed wetland installation.

"The monitoring data will also provide evidence of constructed wetland performance in a local context, while contributing to the national understanding through our project partners. "

He says the Council has learnt valuable lessons that can be applied in future constructed wetland projects, saving effort, time and money.

"We hope this project will inspire others to consider what they could do to improve water quality in their local area."

The site of the wetland in May 2019, prior to construction.

Where we're heading

Preserving and restoring Taranaki lakes

Lake processes are complex and lake systems unique. In addition to aligning our lakes monitoring programme with the NPS-FM requirements, we need to assess the potential drivers of lake water quality. This will include how natural processes and the actions of people contribute to the health of the region's lakes.

Where waterbodies are not achieving national minimum standards, action must be taken. This may involve setting limits for certain activities or alternatively, lead to the development of an action plan. The Council's riparian and sustainable hill country programmes and the diversion of dairy effluent discharges away from waterways, are examples of elements of an action plan that the NPS-FM might require to reduce levels of inputs of nutrients and sediment to waterbodies. This would also address other pressures such as aquatic pest weed and fish species, bank erosion and stock access.

A significant challenge for Lake Rotorangi – and likely other recreational lakes in the region – is the invasive weed hornwort. First recorded in 2012, this aquatic pest has continued to spread and will eventually dominate the plant community in the lake.

Hornwort is transferred between lakes by contaminated boats and trailers, fishing equipment and eel nets. It can contribute to blockages of waterways and infrastructure and once established, is difficult and expensive to remove. People who see or suspect hornwort should report it to the Council or the Department of Conservation.

The invasive weed hornwort has established in Lake Rotorangi.

Innovative techniques for identifying and mapping wetlands

The introduction of the Resource Management (National Environment Standards for Freshwater) Regulations 2020 (NES-F) has set out clear consenting pathways for activities in and around natural wetlands, while the introduction of the NPS-FM aims to restore wetlands through long-term regional planning provisions.

The Council has responded to these new requirements by expanding our State of the Environment monitoring programme with respect to wetlands. In addition to our current rapid wetland condition assessments, the Council will also be intensively monitoring about 60 wetlands. Additional monitoring will include vegetation mapping and plots to determine indigenous vegetation dominance, and diversity. By expanding monitoring programmes, we will gain a more accurate understanding of wetland types, condition, size and the pressures on them.

With the introduction of the NPS-FM, there is a national push to identify new and more accurate wetland mapping techniques. Using tools such as LiDAR, we are working alongside other regional councils to develop methods that will enable us to meet the national 10 year goal of mapping all wetlands down to an area of 500m^2. Improved wetland mapping will enable us to more accurately determine the extent of our remaining wetlands, and to track changes in these wetlands over time. This in turn will help us develop a better understanding of pressures acting on the region's wetlands, guide policy development, and inform our biodiversity and land management programmes around wetland protection and restoration.