



Lake Pegasus – Response to Questions

This information was supplied by Todd Property and the Waimakariri District Council in response to questions put to them by the Pegasus Residents' Group Inc.

Lake Weed

The weed in Lake Pegasus is a common freshwater weed found in similar lakes and waterways throughout New Zealand and is not preventable. Weed growth in the lake naturally increases during the spring/summer season and slows in winter.

The weed growth absorbs nutrients from the water that would otherwise be available to algae and may assist in preventing the development of an algal bloom.

In recent years, the weed has largely been controlled by the targeted application of an approved non residual herbicide. This application has typically been done in spring and autumn. This weed control has been done for aesthetic purposes.

Last spring water experts suggested that allowing more weed to grow might assist with preventing an algae bloom this summer. On that basis, a decision was made not to undertake the usual spring weed spraying.

The water quality results from testing over this summer will be reviewed in light of this change in practice and decisions based on the assessment of those tests will be included in the ongoing review of the lake management plan.

All options and costs for future weed management will also be considered as part of this process. It is worth noting that we have recently physically removed some weed from certain areas of the lake for aesthetic reasons.

Algae

There is always a risk of algal blooms occurring in waterways. The development of algal blooms is influenced by external elements such as temperature, rainfall and wind which cannot be controlled by the lake owners.

However, Lake Pegasus was designed by experts who incorporated certain features to help minimise the risk of algal blooms developing. For example, at the design stage, particular consideration was given to the side slopes, base lining, water depth, circulation by the waterfall, the water flow through the weirs and the use of Solar Bees.

Solar Bees assist in the prevention and control of harmful blue-green algae blooms. They help reduce invasive aquatic weed growth and surface water stagnation. They can also assist in improving dissolved oxygen and pH levels, water clarity and aesthetics, fish habitats and aquatic biodiversity. The Solar Bees in Lake Pegasus operate as intended and are routinely checked and maintained.

Algal growth is a natural phenomenon in any water body. Its growth is driven by nutrient availability (bioavailable forms of nitrogen and phosphorus for example), water temperature, light and wind conditions. This is why algal growth is prevalent during summer when daylight hours are long and water temperatures are warmer. Nutrients enter water from a variety of sources, for example groundwater, surface water discharges, recycling of nutrients from plant and algal die-off and accumulated lake bed sediments. The primary source of nutrients in Lake Pegasus is from groundwater, which naturally intercepts the lake bed, and recycling of nutrients from the lake bed sediments.

Not all algae is 'bad' or 'harmful'. Not all algal blooms are cyanobacterial blooms.

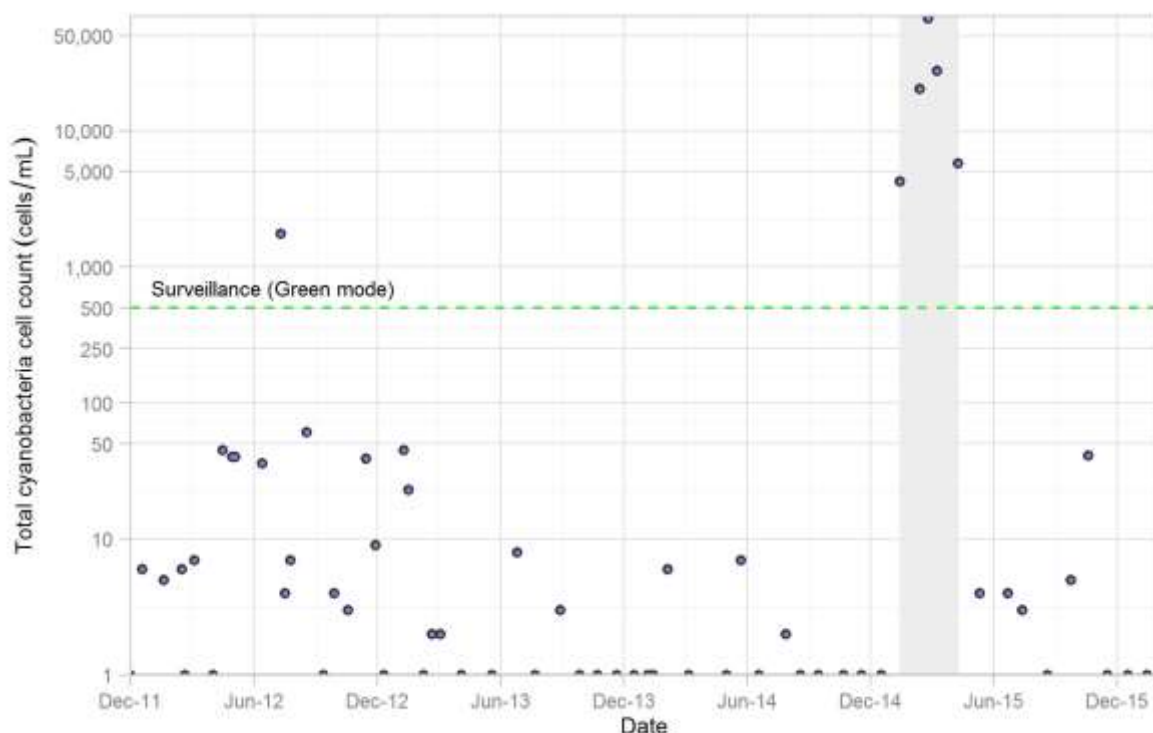
Cyanobacteria -also known as blue-green algae- is an algae of concern because it has the potential to form unsightly blooms which may be toxic to both humans and animals. Human exposure to cyanobacteria toxins may cause symptoms such as skin rashes, nausea, tummy upset and tingling/numbness around the mouth or tips of fingers.

The toxins can have a particularly harmful and, in some cases, deadly effect on animals, including dogs.

The following graph shows the total numbers of cyanobacteria in Lake Pegasus compared to the threshold that requires a public health alert. Please note the shaded bank marks the bloom that occurred last summer and so some data points are beyond the scale of this graph.

Total Cyanobacteria numbers in Pegasus Lake

Alert threshold is 500 cells/ml



Some facts about cyanobacteria and cyanobacteria in Lake Pegasus:

- Cyanobacteria are naturally occurring and have been present in the lake (albeit in mostly very low numbers) since soon after the lake was filled.
- There are two main types of cyanobacterial blooms: benthic (mat forming - typically a black slimy mat on stones or stream/lake bed) or planktonic (suspended in the water column and characterised by the presence of a scum, often luminous green in colour).
- Lake conditions can change from 'normal' to 'bloom' in a very short timeframe (over the course of days), if conditions (i.e., nutrients and climate) are right.
- Not all cyanobacteria produce toxins.
- Of the cyanobacteria that do produce toxins, they do not necessarily produce toxins all the time.
- Ministry for the Environment guidelines dictate that all cyanobacterial blooms are managed as if they were toxic blooms to ensure public safety.

In the event a bloom is identified (either through visual inspection or laboratory analysis), the lake will be closed, public warning signs will be erected by the Waimakariri District Council and a media release will be sent out by Canterbury District Health Board's Community and Public Health service to alert the public.

If a bloom occurs there is a rigorous sampling and reporting process to follow until such time as Environment Canterbury is satisfied that the bloom has resolved and instructs Community and Public Health to lift the lake closure.

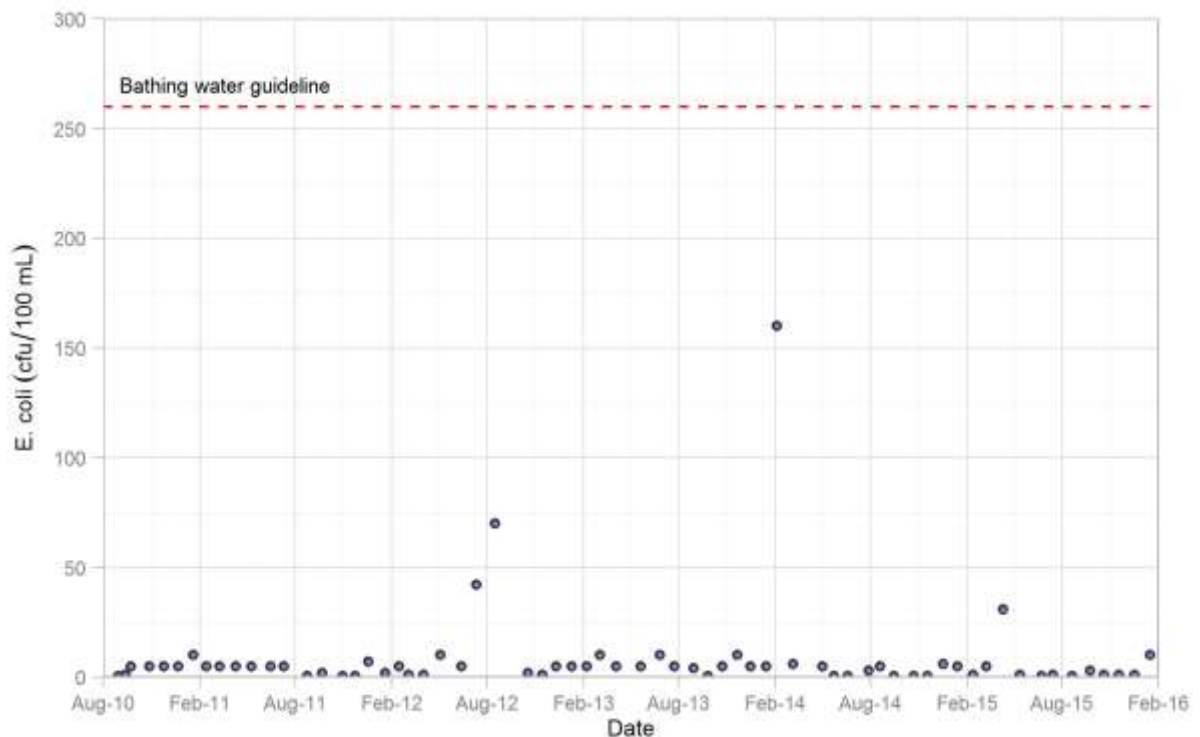
The managers of Lake Pegasus participate in a twice-yearly workshop (spring and autumn) with councils and the Community and Public Health service to review the process identified above. Algal growth in Lake Pegasus is monitored in a number of ways:

- Chlorophyll-a (the green colour in algae) is analysed fortnightly in summer and monthly at other times of the year by an external analytical laboratory.
- Algal species counts are done fortnightly in summer by NIWA; these results identify any cyanobacterial species and the numbers/concentrations are compared to the Ministry for the Environment guidelines to determine whether a bloom is occurring.

E. coli

E. coli presence can be a health hazard and high levels of E. coli would result in lake closure the same as for a toxic algal bloom.

The lake has had consistently low levels of E. coli. The figure below shows the levels of E. coli in the lake compared to the bathing guideline.



Eels

Eels have very little influence on the health of the lake. Smaller eels prey on insect larvae, worms, snails etc., while larger eels feed on fish and larger invertebrates. Other fish species can stir up bottom sediments and may cause the lake to become turbid; however, this does not occur with eels. Eels are simply part of the natural food web of Lake Pegasus.

Eels are a very long-lived species and their populations are considered to be in decline in New Zealand. Eels do not spawn until the end of their lives, which can span between 40 and 100 years. In the interests of conservation and to avoid the risk of harm caused to lake users by fish hooks left in the lake we do not support fishing.

Eels are most active at night when people are unlikely to be using the lake and there have been no cases of bites reported to Todd Property. We do not have any information that suggests eel numbers should be reduced.

Dog leg corner

Because of the wind direction and the shape of this part of the lake it tends to hold any debris that blows into it. The shallowness of this area means the water is warmer and calmer than other areas of the lake which tends to promote the growth of algae and weed.

Changing the shape of the lake is not a viable option because of the structural implication for the lake and surrounds. However as part of the ongoing review of the lake management plan we will investigate whether wetland-type planting in this area would be beneficial.

Routine removal of rubbish will also continue to be undertaken.

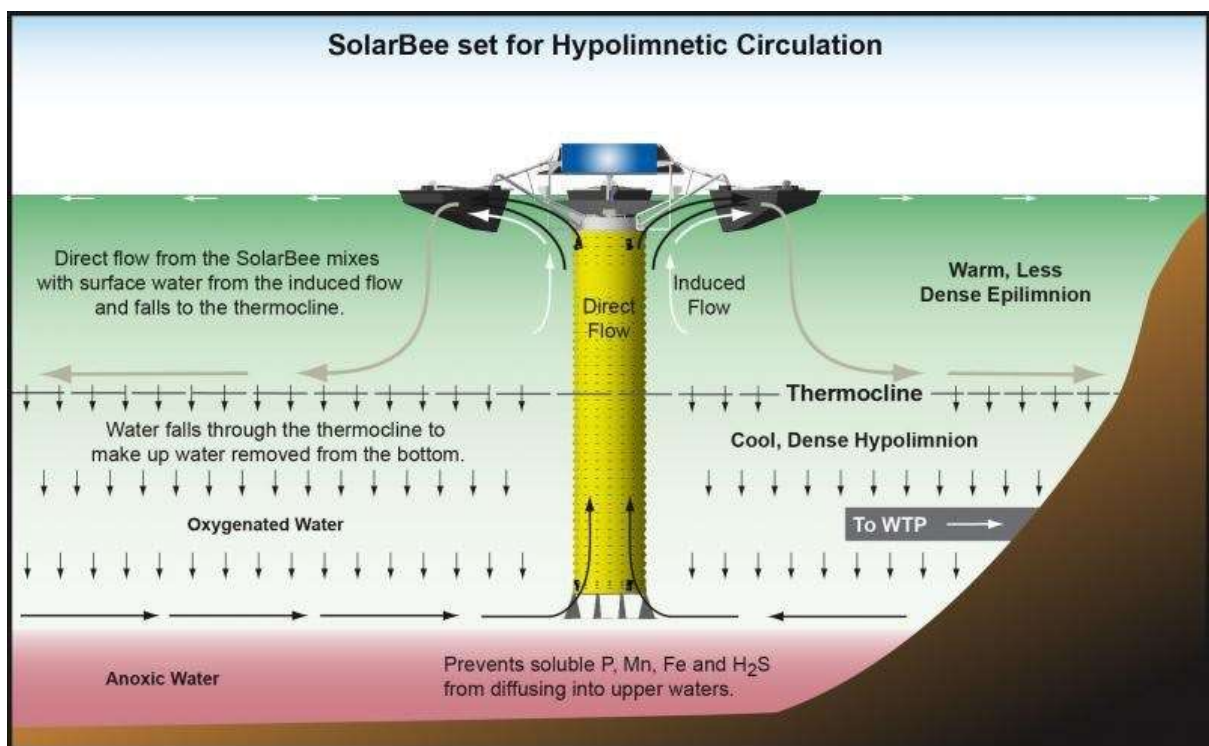
Lake Flow

The lake water is sourced primarily from groundwater. The groundwater input will vary seasonally according to the water table level. Inputs are likely to be highest in spring when groundwater levels are highest as a result of aquifer recharge from alpine snow melt and winter rains. Some water in the lake derives from rain directly into the lake and a small stormwater discharge from the commercial area after being treated by filters.

The lake discharges via two weirs into the ECMA, a natural wetland to the east of the lake. The ECMA has an outlet at its southern end. Water then flows north and discharges into the Ashley River at Waikuku.

The flow through the lake is determined by the natural ground water flow. The two weirs have a small range of adjustability (approximately + or – 100mm) these can be raised or lowered to adjust the standing height of the water. Raising or lowering of the weirs does not provide a long term increase or decrease to the flow of water through the lake.

The SolarBees also assist with the circulation of the lake water and the management of water quality. The SolarBees at Lake Pegasus operate as they were designed and are routinely checked and maintained. Normal operation of the SolarBee mixers is not visible from the surface of the lake as it is 'gentle' mixing process.



Essentially Lake Pegasus is flowing exactly as it was designed to do and there are no sustainable means to alter the flow of the lake

Water Quality

Much of the focus has been on the issue of whether the water quality at Lake Pegasus reaches the “primary” or “secondary” standard.

“Primary” is defined by the Ministry for the Environment as suitable for direct contact where people are fully immersed, for example swimming. “Secondary” is when there is direct contact but swallowing water is unlikely, for example wading, boating or fishing.

The determination of whether a waterway meets “primary” standards and is therefore suitable for swimming is based on the presence of microbiological (faecal) content in the water. The major risk is considered to be ingesting disease-causing micro-organisms through the mouth, nasal passages and ears, including campylobacter, giardia and cryptosporidium.

The assessment of whether a waterway meets the “primary” standard is based solely on the test for E. coli levels. There are no other measures taken into account when differentiating between primary and secondary standards. This process also does not consider algal blooms which are managed through a separate process involving public health services.

Lake Pegasus is consented for secondary contact but currently meets the primary standard.

We believe that the standards described above are very limited in their scope and don't accurately reflect the main focus for residents and visitors to the lake which is the “swimmability” of the lake. There is no absolute measure or rule to determine swimmability – it is subjective and expectations of what constitutes a swimmable body of water will vary from person to person. Clearly that encompasses not only health risks, but the overall experience, such as the water temperature, clarity and presence of weeds.

It is important to accept that it is not possible to guarantee water is suitable for swimming unless you build an entirely artificial construction and use chlorinated water. This is not the case at Pegasus where the lake is man-made but is open to natural processes, fed primarily by ground water, and directly connected to other waterways. This means the lake will change over time like any other water body.

Lake Pegasus is still a very young environment and will change naturally as it ages. These changes include the colour of the water which can transition from green to a darker brown shade and a gradual decrease in clarity. The water clarity will often improve in winter but darken in summer depending on the abundance of algae. It is important to note that the clarity of the water is not related to the primary contact standard. Turbid, algal-rich water may be fine to swim in but also may not be appealing to some people.

We acknowledge that weed growth does impact on the experience of water users and that is why we include weed management within the Lake Management Plan.

Todd Property and the Waimakariri District Council are committed to doing whatever is practicable and affordable to maintain the quality of the water and the experience of water users into the future.

The design of the lake and the lake management plan contribute to our efforts to achieve the best practicable standards. We will also continue to seek advice from water experts and investigate new ways to maintain the lake to a suitable standard.

It must be noted though that we cannot guarantee a toxic algal bloom will not occur in future, resulting in the temporary closure of the lake for public health reasons.

Ownership and timeframes

Todd Property has made an application to the Waimakariri District Council for it to take ownership of the lake. We hope the process will be completed within the year.

Transfer of the lake includes the reserve surrounding the lake and all of the structures such as the bridges and jetties. It also includes the transfer of the consents to the Council, giving it responsibility for monitoring and managing the lake into the future.