environment SOUTHLAND
REGIONAL COUNCIL
Te Taiao Tonga

# Waituna Lagoon 2017/18 monitoring update

Prepared 18 June 2018

## Lagoon water level

The lagoon was closed for 506 days (starting around 9 January 2017). There has been one event (since our records began in 1972) where the lagoon was closed for longer (1992-1994) when the lagoon remained closed for 619 days.

The level of the lagoon got over two metres in July, but dropped off at a steady rate, demonstrating that left to its natural processes, the lagoon drains at a moderate rate, provided flow conditions do not exceed barrier seepage.

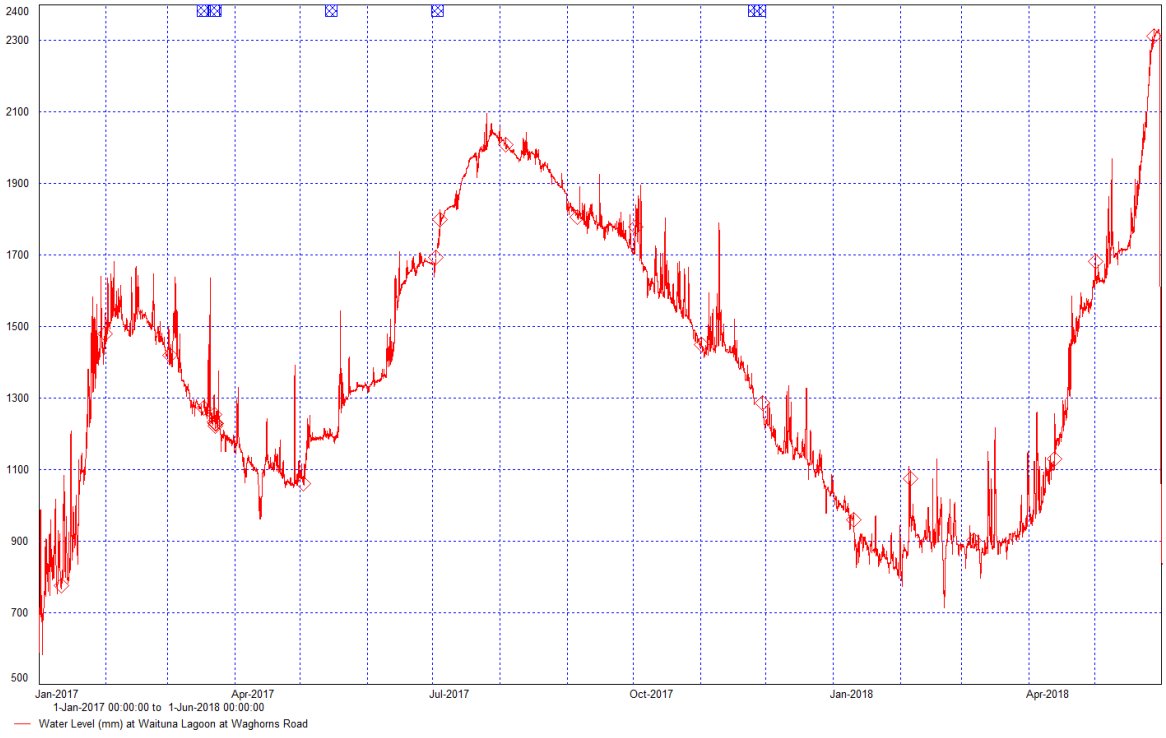


**Figure 1: Water level in Waituna Lagoon at Waghorns Road (January 2017 to June 2018)**

## Rainfall

2017 was a very dry year, with only 79% of the normal annual rainfall being recorded. This year equals 1991 for the lowest annual total since our records began at Woodlands in 1976. October and December 2017 were also extremely dry months and then January 2018 had only

10% of the normal January rainfall. This resulted in very low flows on the Waituna Creek and the other flow inputs into the Lagoon.

## Stream flow

The Waituna Creek got down to a flow of 27 litres per second on 31 January 2018. This is the lowest flow we have recorded since the site went in in 2001. The ARI (annual recurrence interval) for this event has been estimated at 50 years.

## Modelled data

A Waituna model has been developed which used stream flow and rainfall data dating back to 1977 to predict water levels at Waghorns Road. This model suggests that summer levels dropped to the lowest for January for a period where the lagoon was closed. This is a product of the extremely dry conditions. Please note that the following graph has lower values in the envelope graph, but these are mainly due to the days just following the Lagoon being closed. Also note that this is modelled data and not actual data. This allows us to compare past events using the Waihopai River as a proxy for the Waituna Creek.

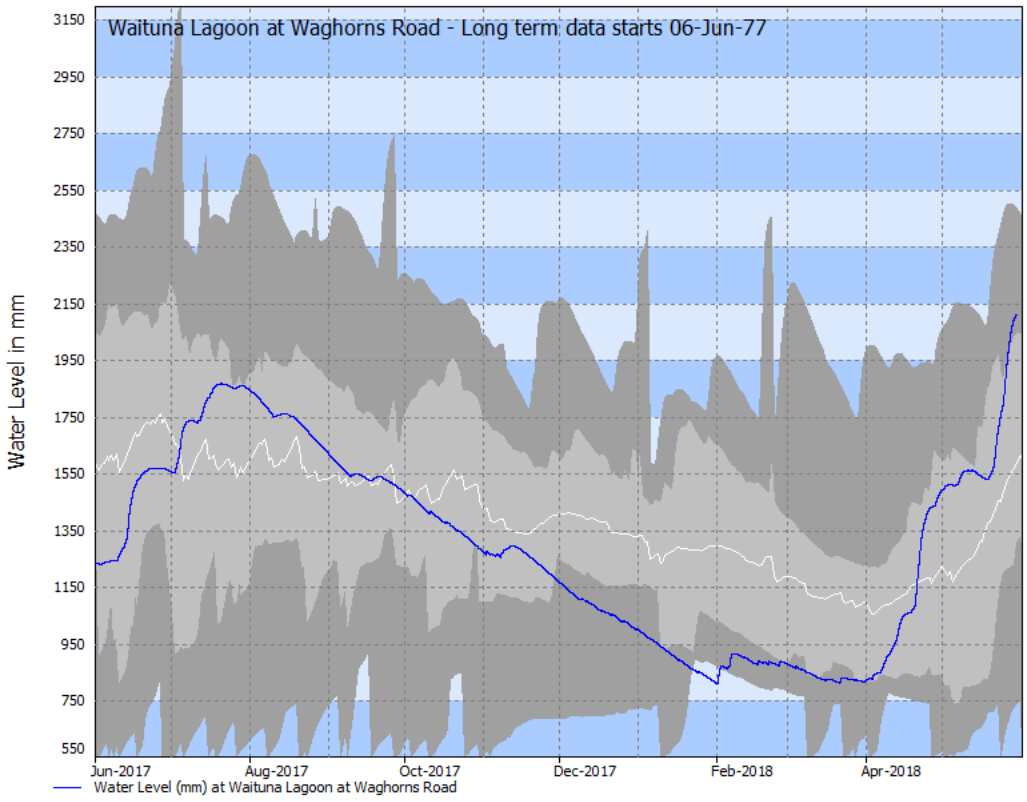


**Figure 2: Envelope plot of modelled water levels for the Waituna Lagoon at Waghorns Road. The blue line shows modelled 2017/18 water levels. The envelope shows the 1977 to 2016 daily median (white line); 75% range (light grey) and minimum and maximum (dark grey) water level.**

**Water quality**

Environment Southland released a report in 2017 which shows state and trends for water quality in the region. This report is available on Environment Southland's website:

http://www.es.govt.nz/Document%20Library/Research%20and%20reports/Various%20reports/Science%20reports/Water%20Quality%20in%20Southland%20-%20Current%20State%20and%20Trends%20-%20April%202017.pdf

Water quality state was analysed using January 2012 to December 2016 (the most recent five years) data and was assessed against the National Objective Framework. The results for the Waituna Lagoon are presented below.

**Table 1: Total nitrogen ($mg/m^3$) statistics and National Objective Framework bandings for the Waituna Lagoon monitoring sites.**

| Site | Status | Minimum | Maximum | Median | Number of samples | Band |
|---|---|---|---|---|---|---|
| **East** | Closed | 300 | 2,500 | 730 | 44 | **C** |
| | Open | 150 | 2,100 | 590 | 37 | **C** |
| **West** | Closed | 330 | 3,100 | 810 | 46 | **D** |
| | Open | 150 | 3,100 | 360 | 38 | **C** |
| **Centre** | Closed | 500 | 2,700 | 820 | 46 | **D** |
| | Open | 137 | 2,800 | 315 | 36 | **B** |
| **South** | Closed | 240 | 2,700 | 710 | 46 | **C** |
| | Open | 91 | 2,600 | 200 | 37 | **B** |

**Table 2: Total phosphorus ($mg/m^3$) statistics and National Objective Framework bandings for the Waituna Lagoon monitoring sites**

| Site | Status | Minimum | Maximum | Median | Number of samples | Band |
|---|---|---|---|---|---|---|
| **East** | Closed | 12 | 74 | 26.5 | 44 | **C** |
| | Open | 12 | 139 | 27 | 37 | **C** |
| **West** | Closed | 17 | 130 | 36.5 | 46 | **C** |
| | Open | 7 | 130 | 24 | 38 | **C** |
| **Centre** | Closed | 19 | 64 | 30 | 46 | **C** |
| | Open | 9 | 101 | 18 | 37 | **B** |
| **South** | Closed | 15 | 64 | 26 | 46 | **C** |
| | Open | 8 | 92 | 20 | 37 | **B** |

**Table 3: Phytoplankton (chl-*a* mg/m$^3$) statistics and National Objective Framework bandings for the Waituna Lagoon monitoring sites**

| Site | Status | Minimum | Maximum | Median | Number of samples | Band |
|---|---|---|---|---|---|---|
| **East** | Closed | 0.3 | 29 | 1.5 | 72 | **C** |
| | Open | 0.2 | 14 | 1 | 28 | **B** |
| **West** | Closed | 0.5 | 39 | 2.45 | 44 | **C** |
| | Open | 0.1 | 4.9 | 0.7 | 28 | **A** |
| **Centre** | Closed | 0.2 | 31 | 2.2 | 46 | **C** |
| | Open | 0.2 | 14.6 | 0.9 | 37 | **B** |
| **South** | Closed | 0.1 | 26 | 2.25 | 44 | **C** |
| | Open | 0.1 | 5.3 | 0.8 | 28 | **A** |

**Index for National Objective Framework bandings for phytoplankton ecosystem health (tropic state) in lakes**

| Band | Narrative Attribute State |
|---|---|
| **A** | Lake ecological communities are healthy and resilient, similar to natural conditions |
| **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 |
| **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<br>***National Bottom Line*** |
| **D** | Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state (without native macrophyte/seagrass cover) due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes. |

**Algal blooms**

An algal bloom occurs when there is a rapid accumulation of algae and is often characterised by a change in water colour and appearance. Freshwater algal blooms are caused by excess nutrients and/or favourable weather conditions. Algae blooms can be naturally occurring but are often exacerbated or caused by excessive nutrients; especially when climatic conditions are favourable.

Some species of algae are toxin producing. These toxins have a variety of adverse effects on other species, such as developmental, immunological, neurological, reproductive capabilities or mortality (death). These toxins can also be harmful to humans through direct exposure or by eating fish and shellfish.

*Green algae bloom (non-toxin producing)*

31 October 2016 – during the annual *Ruppia* survey it was noticed that extensive blooms (non-toxic) were present.

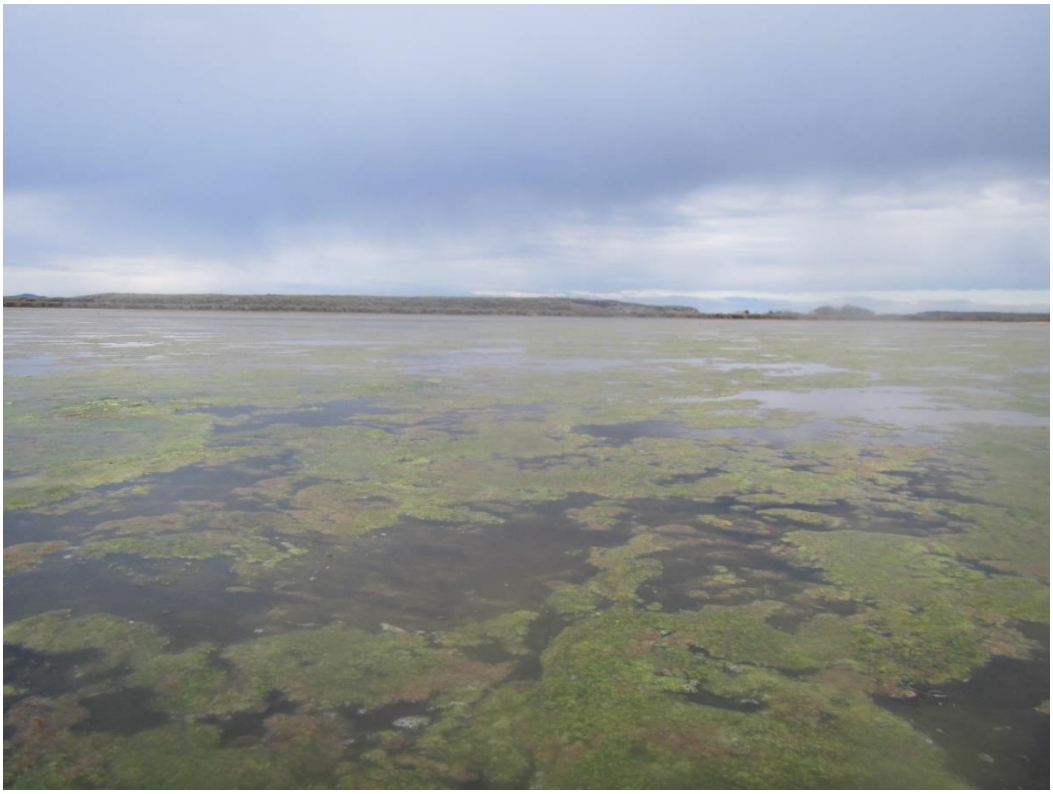

**Figure 3: Extensive algal bloom 31 October 2016**

7 November 2016 – further visits showed the algal bloom to be extensive in the western arm of the lagoon. The lack of wind, warmer temperature around this time and localised delivery of nutrients by Waituna Creek has probably contributed to this accumulation of non-toxin producing algae.

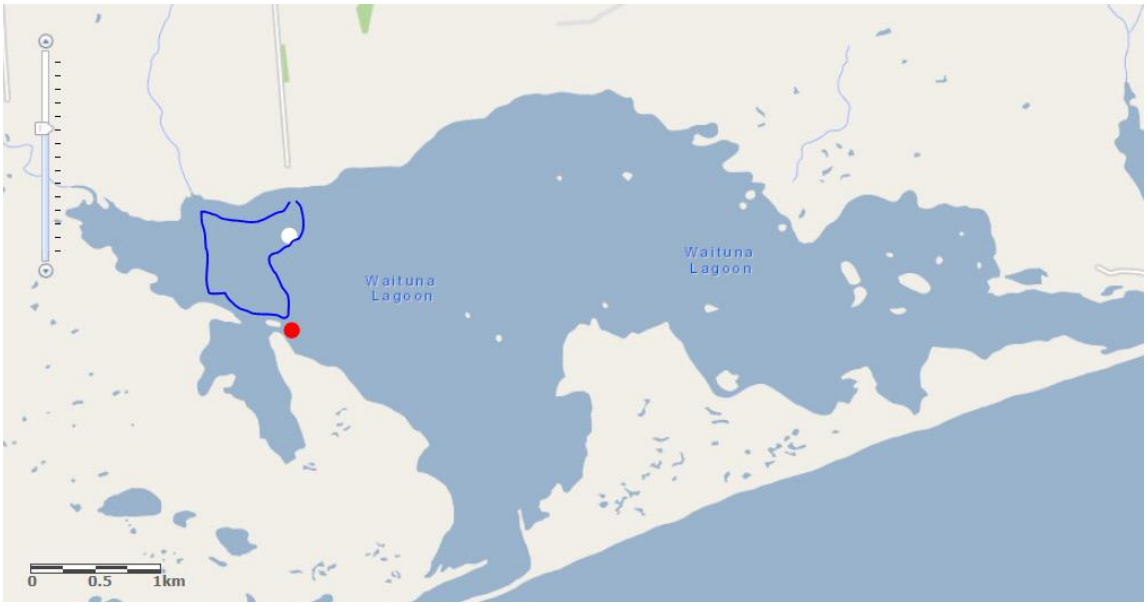


**Figure 4: Extent of blooms by 7 November 2016**

Environment Southland received no further reports of algal blooms until early 2018 (discussed below).

*Cyanobacteria bloom (toxic producing)*

22 March 2018 – Sampling results triggered public warnings (using the standards in the interim New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters). A series of additional samples were taken to verify the results and determine the status of the public health warning in place. Extra consideration was given to the Waituna Lagoon at this time due to the imminent opening of the duck shooting season. The sampling history is shown in the table below.

**Table 4: Results of samples taken in Waituna Lagoon from March to May 2018 (site: Waituna Lagoon centre)**

| | 22 March 2018 | 16 April 2018 | 23 April 2018 | 3 May 2018 | 15 May 2018 | 29 May 2018 |
|---|---|---|---|---|---|---|
| Dominant species | * | * | * | * | * | * |
| Toxin producing | Yes | Yes | Yes | Yes | Yes | Yes |

**Dolichospermum cf. lemmermannii (Toxin producing)*

**Figure 5: Photos of cyanobacteria blooms from 22 March to 29 May 2018**

The cyanobacteria bloom came following a period of unusually dry and warm conditions during which a drought was declared for Southland and subsequently received some considerable rainfall. This dry period will have had contaminant and nutrient build up on and in the land which was then mobilised and delivered to water bodies with the rainfall. This, along with the weather conditions at the time created ideal conditions for algal and cyanobacteria growth.

The Waituna Lagoon was opened on the 30 May 2018.

*Summary*

With weather events which deliver very strong winds or heavy rainfall the situation may be alleviated by removing the ideal growing conditions for algae and cyanobacteria.

Opening the system may well also avoid this situation in the short term due to increased salinity and flushing. Though there is the potential for salt tolerant species to also bloom (including toxin producing).

Further stressing of the system through nutrient supply and climatic stress (increasing with climate change) will see this system manifesting these responses more often and likely more dramatically.