

Lake Mokeno

13/02/2026

NRC Lake Number: 356



Ecological Condition: Outstanding

Submerged Plant Indices	Score	NPS-FM Attribute band
Native Condition Index	61%	B
Invasive Impact Index	0%	A

Summary

Overall Rank: Lake Mokeno is a large dune lake with extensive native wetland margins and excellent native macrophyte condition, dominated by widespread *Chara australis* meadows and with no invasive submerged species recorded. This is an improvement from the 2022 assessment, which ranked the lake High.

Threats: Eutrophication and recurrent algal blooms are the primary threats to lake condition. Forestry-related runoff and the large waterfowl population are likely contributors to the nutrient enriched state.

Recommendations: Prioritise reducing nutrient and disturbance pressures. Reducing runoff from forestry through erosion control, drainage management, and riparian protection. Managing pest animals and plant along the shoreline will reduce edge effects. Ongoing monitoring should track macrophyte depth limits, algal biomass, and broader catchment effects to determine whether the current recovered state is stabilising or beginning to deteriorate again.

General description

Lake Mokeno is a large dune lake with a surface area of approximately 148.3 ha and a maximum depth of 6.5 m, located along the southwest coast of the Pouto Peninsula (1695174E, 5977171N). The lake's moderate depth and large surface area are indicative of a system that is influenced by both wind-driven mixing and internal nutrient cycling, while still being sensitive to external catchment inputs.

The lake is situated within a very large 2,845.67 ha catchment, resulting in a high catchment-to-lake area ratio. Land cover within the catchment is dominated by exotic vegetation (82.54%), largely driven by extensive forestry operations within the peninsula. Forestry dominates the eastern portion of the catchment and accounts for 80.61% of the total catchment area, forming a major influence on hydrological pathways, sediment dynamics, and nutrient fluxes, particularly during harvesting and high rainfall events.

Pastoral land use is limited, with only 1.93% of the catchment comprising small, low-producing pastoral parcels scattered throughout the landscape. Native vegetation makes up 17.45% of the catchment and occurs as large, contiguous mānuka/kānuka blocks surrounding much of the lake margin. These native vegetation buffers provide important ecological functions, including stabilisation of soils, interception of overland flow, and attenuation of nutrient and sediment inputs before they reach the lake.

Wetlands comprise 1.57% of the catchment and are primarily associated with the lake margins, with the largest wetland areas occurring along the southern shoreline. These wetlands contribute to shoreline stability, provide habitat diversity, and offer some capacity for nutrient processing and sediment settling. However, their limited areal extent relative to the size of the catchment constrains their overall buffering capacity.

Lake Mokeno has no clearly defined inflowing or outflowing streams. Hydrologically, the lake appears to drain southwards via diffuse subsurface or overland flow paths towards Lakes Otapuiti and Whakaneke, before ultimately discharging to the Kaipara Harbour entrance through an extensive downstream wetland system. This hydrological configuration suggests that the lake functions as part of a broader lake–wetland

complex, with water residence times and connectivity influenced by groundwater and wetland-mediated flows rather than discrete channels.

Overall, the ecological condition of Lake Mokeno reflects the interaction between extensive forestry land use and substantial native vegetation buffering around the lake margin. While the dominance of forestry poses potential risks associated with sediment and nutrient mobilisation, the presence of large contiguous native vegetation blocks and downstream wetland connectivity likely moderates contaminant transfer and enhances the resilience of the lake within the wider Kaipara catchment system.

Wetland vegetation

Tall emergent wetlands border ~95% of the lake margin where they form ~15 – 20 m wide bands that extend past the wetted edge of the lake to ~2 m deep (Video 1). This vegetation transitions into a broader mānuka (*Leptospermum scoparium*)/flax (*Phormium tenax*) wetland zone around much of the lake, with a distinctive south-east wetland dominated by *Carex secta*, *Machaerina arthropphylla* and *Thelypteris confluens* (Video 1).

Key species include *Typha orientalis*, *Eleocharis sphacelata*, *Eleocharis acuta*, *Machaerina articulata*, *Machaerina arthropphylla*, *Machaerina rubiginosa*, *Machaerina juncea*, *Schoenoplectus tabernaemontani*, *Carex secta*, and *Phormium tenax*.

The invasive royal fern (*Osmunda regalis*) has been identified in several locations around the lake and poses an ongoing threat to the surrounding wetlands across the peninsula. The overall wetland condition is very high with management requirements driven primarily by the risk of *Osmunda regalis* reinvasion/spread.



Video 1: Intact riparian margins and wetland features.

Submerged vegetation

Lake Mokeno is currently in an excellent native macrophyte dominated condition, with no invasive species recorded. The 2026 submerged plant community is primarily composed of dense, near-continuous meadows of *Chara australis* that extend across the lake (Video 2). Covers are typically very high (76 – 100%) with beds reaching a maximum height of ~1.30 m. These robust, high-biomass meadows provide substrate stabilisation, habitat provision, and nutrient sequestration.



Video 2: Extensive charophytes meadows.

Chara globularis occurs as a secondary charophyte species that forms generally low covers (1 – 25%) amongst the *Chara australis* meadows. Native vascular macrophytes

contribute to the overall diversity but are not as prominent as the charophytes. *Potamogeton ochreatus* was the most common pondweed and formed stands amongst the charophyte meadows as well as a defined band along the lower macrophyte extent where it reached covers of 76 – 95%. *Potamogeton cheesemanii* and *Myriophyllum triphyllum* were also present and occurred as isolated stems and small stands but were generally sparse (1 – 5% cover).

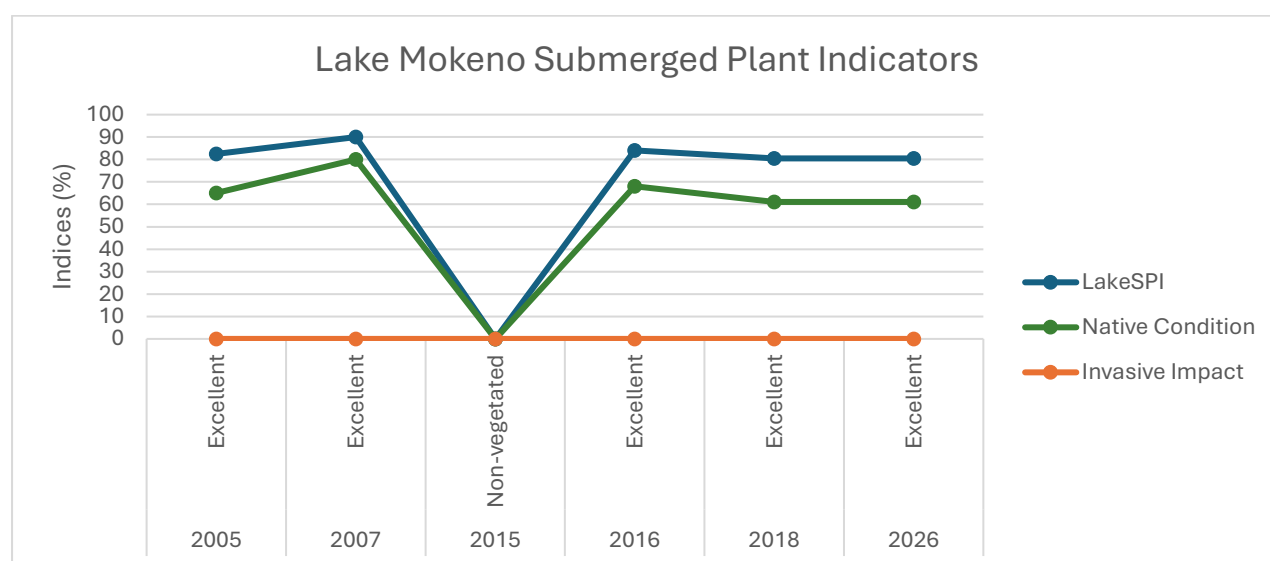
The macrophyte extent is primarily governed by photic depth and bathymetry. The broad shallow bays support charophyte meadows that extend >300 m offshore, while the steeper western margins compress the macrophyte band to ~20 m wide.

This current condition represents a recovery and stabilisation following a period of pronounced degradation and intermittency in submerged vegetation extent between 2012 – 2022 (Figure 1). In 2005 and 2007, Lake Mokeno was in clear-water equilibrium and was 100% vegetated with charophyte meadows reaching ~6 m deep (Figure 1). By 2012, water clarity had deteriorated markedly during a dense algal bloom, with deep charophytes reported as rotting in situ, signalling a system under severe light stress and at risk of regime shift. That shift was evident in 2015, when submerged vegetation contracted to a narrow fringe along the emergent reeds with average covers of <10% (Figure 1). Partial recovery occurred in 2016 with vegetation extending to ~4.2 m and an increase in species diversity (Figure 1). In 2018, LakeSPI scores remained in an excellent condition but the macrophyte growth was more spatially variable, charophyte meadows were present in fewer profiles than in previous surveys and the maximum vegetated depth had reduced to ~3.1 m (Figure 1).

The 2022 assessment indicated that Lake Mokeno can still experience acute non-vegetated episodes due to algal bloom driven macrophyte collapse. The cyanobacteria bloom during the 2022 survey resulted in poor water clarity (<0.3 m) and no macrophytes were recorded on the five LakeSPI transects. However, macrophytes were occasionally sampled away from transects (including *M. triphyllum*, *C. australis*, *P. ochreatus*, *P. cheesemanii*), implying the system retained a reasonable vegetated biomass even under bloom conditions. The 2026 LakeSPI results yielded an overall score of 80.5% and tightly clustered high transect scores indicating that the lake has returned to a widespread charophyte meadow state (Figure 1). However, the maximum vegetated depth was still

3.4 m indicating a likely permanent departure from the 2005 – 2007 state where vegetation extended to ~6 m.

Lake Mokeno is likely to remain in an excellent condition due to the extensive *Chara australis* beds that help maintain clear-water conditions through sediment stabilisation and nutrient sequestration. The principal risk remains episodic algal bloom events similar to those observed in 2012 and 2022, which could rapidly reduce the macrophyte zone and induce short-term collapse. Management priorities should focus on maintaining water clarity and invasive species prevention.



Survey Date	Status	LakeSPI %	Native Condition %	Invasive Impact %
February 2026	Excellent	80.5	61	0
September 2018	Excellent	80.5	61	0
April 2016	Excellent	84	68	0
May 2015	Non-vegetated	0	0	0
April 2007	Excellent	90	80	0
March 2005	Excellent	82.5	65	0

Figure 1: Lake Mokeno LakeSPI scores as a percentage of the maximum Potential LakeSPI score, Native Condition Index, and Invasive Impact Index.

Wetland birds

Lake Mokeno is the largest of the assessed Poutō lakes and sits within a large, connected lake–wetland system that drains south toward the Kaipara Harbour. The 2026 survey

recorded 11 species and ~216 individuals, dominated by black swan (*Cygnus atratus*, 78), New Zealand scaup (*Aythya novaeseelandiae*, ~50), and dabchick (*Poliocephalus rufopectus*, 47), with additional paradise shelduck (*Tadorna variegata*, 18) and mallard/mallard-hybrids (*Anas platyrhynchos*, 13). The abundance of diving birds suggests productive open water environments with reliable prey and suitable habitat structure.

Threatened and at-risk values are high due to the number of threatened species and the habitat complexity. Spotless crake (*Zapornia tabuensis tabuensis*; At Risk – Declining) was detected in 2026, and previous assessments reported Australasian bittern (*Botaurus poiciloptilus*) and other threatened wetland birds including banded rail (*Hypotaenidia philippensis*) and brown teal (*Anas chlorotis*).

The extensive wetlands and habitat heterogeneity created by tall emergent vegetation borders around ~95% of the shoreline, transitioning into broader mānuka/flax wetlands with diverse reed-sedge communities (e.g., raupō and *Eleocharis/ Machaerina* spp.) create regionally significant habitat values. A key risk is invasive royal fern (*Osmunda regalis*), which could impact habitat quality if reinvasion/expansion occurs.

Given its size and connectivity, Mokeno serves as a regionally significant stepping-stone and refuge environment. Management priorities should focus on maintaining wetland condition, biosecurity/weed surveillance, water-quality and macrophyte monitoring, targeted threatened-species surveys and catchment nutrient management.

Fish & invertebrates

Historic records from Lake Mokeno include common bullies (*Gobiomorphus cotidianus*), inanga (*Galaxias maculatus*), smelt (*Retropinna retropinna*), shortfin eels (*Anguilla australis*) and longfin eels (*Anguilla dieffenbachii*), indicating a diverse native fish assemblage. During the 2026 survey, divers recorded large numbers of common bullies and several large shortfin eels which confirms the long-term establishment of these species.

Fyke net surveys caught multiple shortfin eels as well as three At Risk – Declining longfin eels (*Anguilla dieffenbachii*) and 1 redfin bully (*Gobiomorphus huttoni*). eDNA results

from 2026 also detected traces of inanga and freshwater jellyfish (*Craspedacusta sowerbii*), although neither was observed directly by divers. These detections indicate either low-abundance or intermittently detectable taxa and should be interpreted cautiously in the absence of supporting visual records.

Endangered species

Longfin eels (*Anguilla dieffenbachii*; At Risk – Declining) and inanga (*Galaxias maculatus*) have been recorded previously from Lake Mokeno, and the 2026 fyke netting resulted in confirmed counts for longfin eels. Inanga were also detected by eDNA in 2026, supporting continued occurrence even where capture observations are limited. The 2026 threatened bird assemblage comprised New Zealand dabchick (*Poliocephalus rufopectus*; Nationally Increasing), spotless crake (*Zapornia tabuensis tabuensis*; At Risk – Declining), red-billed gull (*Chroicocephalus novaehollandiae scopulinus*; At Risk – Declining), and pied shag (*Phalacrocorax varius varius*; At Risk – Recovering). These records emphasise the importance of maintaining dense emergent margins for cryptic rallids as well as preserving water quality and prey availability for diving and piscivorous species. Marsh fern (*Thelyperis confluens*; At Risk – Declining) are common on the islands and wetland edges.

Lake ecological value

Lake Mokeno is currently classed as an Outstanding lake, with an Ecological Value Score of 12/20. This score is heavily influenced by the extensive habitat size, large lake area (148.3 ha) and moderate maximum depth (6.5 m). Buffering is high due to tall emergent wetlands that border 95% of the shoreline, although native vegetation cover and wetland extent at the catchment scale are only moderate to low. The lake is a significant habitat within the wider Poutō lake-wetland complex and is awarded an extra point for connectivity.

Water quality remains poor because of recurrent cyanobacterial blooms, persistent nutrient enrichment and a history of episodic macrophyte collapse. Aquatic vegetation diversity and integrity is high reflecting the present return to extensive charophyte-

dominated submerged vegetation (2026 LakeSPI score of 80.5%) and no invasive species impacts.

Endangered-species values remain moderate due to several threatened fish and bird records. No live freshwater mussels were recorded in 2026.

The 2026 assessment represents a marked improvement in ecological value from the previous 2022 classification. The 2022 report assigned a High-Moderate status with a score of 9/20, following bloom-driven loss of submerged vegetation. The 2026 recovery of widespread charophyte meadows has enhanced the ranking to Outstanding ecological value, although the system remains vulnerable to renewed bloom-driven decline.

Threats

Lake Mokeno exhibits signs of eutrophication which is likely due to the large population of waterfowls and catchment related nutrient inputs. Regular algal blooms, high epiphyton cover on macrophytes and benthic algal mats below the maximum vegetated depth are indicative of persistent nutrient enrichment. Signs of ungulates and lagomorphs around the margins show continuing disturbance to shoreline vegetation and habitat integrity.

Management recommendations

Management should prioritise reducing runoff from forestry, particularly through erosion control, drainage management and riparian protection. Shoreline pest animal (ungulate and lagomorphs) and plant control, particularly royal fern, would reduce edge disturbance. Managing large waterfowl species should be considered where feasible. Continued monitoring of macrophyte depth limits, algal biomass and catchment effects is important for determining whether pressures are stabilising or intensifying and for guiding restoration effort.