9 Northland Lakes

9.1 Lakes: Main Points

Pressures

- Aquatic weeds are a major threat to Northland's lakes. Some species pose a significant threat to both the water quality and aquatic biodiversity by choking out native species, in some shallow lakes aquatic weed growth can be over the entire area of the lake.
- Catchment land use is a major determining factor in lake water quality. Unrestricted stock access to foreshore areas, as well as pasture and groundwater inputs have contributed to nutrient enrichment of lakes.

State

- Kai Iwi Lakes have exceptionally high water quality, with high visual clarity and no obvious signs of eutrophication.
- Field inspections of the Pouto dune lakes have shown some variations in water quality. Some of the lakes inspected showed signs of eutrophication.
- Populations of the endangered native fish dwarf inanga are present throughout the Pouto dune lake system; the only place they can be found in New Zealand.
- Variable levels of water quality have also been recorded in the Aupouri dune lake system. Surveys have shown that the lakes having the highest levels of faecal bacteria are lakes to which stock have the greatest access, and are the same lakes which show higher levels of algae and reduced water clarity.
- Lake Omapere has 'flipped' between algal and weed dominated states since 1985. Currently, the oxygen weed *Egeria densa* continues to be a major problem.

Response

- The Revised Proposed Regional Water and Soil Plan contains rules that prohibit the discharge of any sewage and animal effluent into the dune lakes as specified in the plan.
- Recently, 31 lakes in Northland were surveyed for aquatic plants. Aquatic plants were first surveyed in 1986 and by visiting the lakes again, NRC hopes to be able to compare changes in aquatic plant communities.
- The Council continues to monitor Lake Omapere for water quality and weed quantities.
- Education programmes emphasise the importance of clearing boats and trailers of aquatic weeds to prevent weed spread.

9.2 Pressures Affecting the Lakes of Northland

9.2.1 Aquatic Weeds

Aquatic weeds are a major threat to Northland's lakes. Native aquatic plant species are generally low growing, and present no management problems. However, species such as *Egeria densa* (oxygen weed) have spread throughout Northland and present a major threat to both the aquatic biodiversity and water quality of Northland lakes. These type of plants spread rapidly and can create large problems in lakes shallow enough to allow growth over their entire area.

Surface reaching *Egeria densa* weed at Lake Omapere

Thirty one Northland lakes, from Lake Ngakaketa at the top of Ninety Mile Beach to Lake Kahuparere at the bottom of the Poutu Peninsula were surveyed for aquatic vegetation by NIWA between February and May 2001. Twenty-five of these lakes had been previously surveyed in 1986, thus allowing a comparison of lake condition then and now.

Interim results show a variety of trends including the spread of introduced water weeds. In 1986 six lakes were infested with introduced submerged weeds and two more supported the Class A noxious weed *salvinia*. In 2001 both *salvinia* sites and one submerged weed site (Lake Waingata) had been eradicated. However another six lakes contained introduced weeds, three of which could only be spread by human activities. Thus Northland is one of the few regions that still contain many lakes unimpacted by these weeds.

Other issues identified were:

- The spread of introduced pest fish and their possible impact on several lakes.
- Changes in lake clarity, as indicated by increased or decreased depth records for native aquatic plants. Significant improvement was found in five lakes possibly due to improved catchment management.

- The rediscovery of three rare plants species and a population of the rare fish dwarf inanga.

9.2.2 Eutrophication of Lakes

Eutrophication is the enrichment or pollution of water bodies by nutrients – usually nitrogen and phosphorus. These nutrients cause excessive growth of aquatic plants and algae. Excessive growths become a problem when:

- Aquatic plants impede users of the water.
- One plant grows excessively and excludes other plants.
- Aquatic organisms are damaged by dissolved oxygen depletion when large weed beds collapse and rot.
- Toxic algal species proliferate in large numbers.
- Waters become highly turbid.

Eutrophication of lakes is major problem through out the world. Fifty four percent of lakes in the Asia Pacific region are eutrophic. Europe, Africa, North America and South America have 53%; 28%; 48%; 41% of their lake degraded by nutrient pollution respectively (Chorus and Bartam, 1999).

Northland's lakes are particularly vulnerable to eutrophication, as they tend to be small, shallow and often have farming activities within their catchments that contribute significant phosphorus and nitrogen pollution. Assessing and monitoring the rate of nutrient pollution and the degradation of lakes is therefore very important.

Azolla weed growing on Lake Omapere

The Ministry for the Environment has released a document recommending that a Trophic Level Index system (TLI) be used to assess the trophic status of a lake. The TLI system works by combining data for four water quality variables to get a single figure that expresses the state of the lake. The Ministry for the Environment recommends that these indices can be used to compare the state of lakes nationally, and to quantify changes in particular lake over time.

As the Ministry for the Environments TLI system relies on water quality data it is not appropriate for Northland lakes. In our small shallow lakes, nutrients are rapidly exchanged between weed, water, algae and sediment. All of these parts of the system must therefore be monitored if we are to fully understand the extent of nutrient pollution.

9.3 The State of the Lakes of Northland

9.3.1 Dune Lakes

Northland has a large number of small shallow lakes. Most of these have been formed between stabilised sand dunes along the West Coast. The dune lakes are grouped on the **Aupouri**, **Karikari** and **Pouto** Peninsulas. They vary in size, with the majority being between 5 and 35 hectares in area and generally less than 15 metres deep. Lake Taharoa of the Kai Iwi Group is one of the largest and deepest dune lakes in the country, covering an area of 237 hectares and being up to 37 metres deep.

Maps 15 and 16 show the location of lakes on the **Aupouri**, **Karikari** and **Pouto** Peninsulas.

Typical Northland dune lake

Kai Iwi Lakes

Historical studies have shown that these lakes have exceptionally high water quality characteristics (Northland Regional Council, 1991). Bathing water quality surveys conducted during 2000-01 confirmed the high water quality of **Lake Taharoa** in relation to bathing water quality standards.

In addition, historical studies have shown that:

- The waters were very clear and not polluted with organic material. Phytoplankton levels were low with no obvious signs of eutrophication.

- Thermal stratification occurs in all three lakes especially the deeper **Lakes Taharoa** and **Waikare**. This can give rise to temperature layering and deoxygenation of overlying waters.

- Lake levels fluctuate over a range of generally less than 1m in response to rainfall patterns. The lakes have little or no surface inflows or outflows, but receive groundwater seepage and lose water via leakage to groundwater.

- The lakes are home to a variety of native and exotic wildlife. The dwarf inanga is considered New Zealand's rarest native fish and the freshwater crab is relatively rare. Both are under some pressure from trout in the lakes.

- Two exotic fish – Rudd and Mosquito fish, have been illegally introduced into the lakes. There is doubt that Rudd have established but Mosquito fish are common. Mosquito fish are a prolific breeder and are known to attack native fish, they are also known to alter zooplankton populations.

- The plant communities present in the lakes are unusual in that the non-vascular charophytes dominate and there are few exotic species present. The generally low growing native species present no management problems. No surface growing exotic oxygen weeds have been recorded in the lakes. Water analysis and growth trials have indicated that such weeds are unlikely to establish because of the low alkalinity. Present conditions of low alkalinity need to be maintained as a means of excluding such weeds.

Pouto Dune Lakes

No comprehensive water quality investigations have been carried out on the Pouto Dune Lakes. However, conclusions from historical studies (Northland Regional Council, 1991) can be summarised below:

- Field inspections of lakes have indicated some water quality variations between lakes. Some of the lakes show signs of eutrophication, for example **Lakes Waingata** and **Rototuna**, and to a lesser extent **Lakes Parawanui**, **Swan** and **Kahuparere**.

Lake Mokeno, Pouto Peninsula

- The Pouto dune lakes contain aquatic and plant communities which in some cases are unique to both Northland and New Zealand. Three lakes in particular, **Lakes Kahuparere**, **Kanono**, and **Humuhumu** contain good populations of dwarf inanga. The number of species of native fish in the lakes is small as many native fish require a marine phase to their life cycle which is not possible in lakes with no outlets to the sea. Native aquatic plants, the charophytes, are the predominant bottom vegetation.

Aupouri Dune Lakes

Findings from historical studies (Northland Regional Council, 1991) of the Aupouri dune lakes are summarised below:

Faecal Bacteria

- Generally, shore locations have higher levels of faecal bacteria than open water sites. This is related to the greater use made of the shoreline by domestic stock and waterfowl. Periodic high levels of bacterial contamination have been observed during recent surveys of **Lake Ngatu** for bathing water quality, although these sites are suitable for swimming most of the time. Faecal bacteria results are consistent with the surrounding land use, reflecting varying levels of faecal contamination related to input mainly from domestic stock.

Phytoplankton – Algal Blooms

- Aupouri dune lakes varied from having little or no algae in them to being highly turbid due to the presence of significant amounts of algae. Species observed were common species. Higher levels of algae have been recorded in **Lakes Waiparera**, **Rotokawau**, and **Heather**. Those lakes surrounded by land use other than pasture were generally found to be low in algal content.

Water Clarity

- Surveys have shown that the lakes having elevated faecal bacteria levels are lakes to which stock have the greatest access, and are the same lakes which show higher levels of planktonic algae and reduced water clarity. This suggests that these lakes are becoming enriched with nutrients from farming operations, most likely from direct dung and urine input, and runoff or groundwater from pasture containing nutrient from dung, urine and fertiliser.

9.3.2 Geothermal Lakes

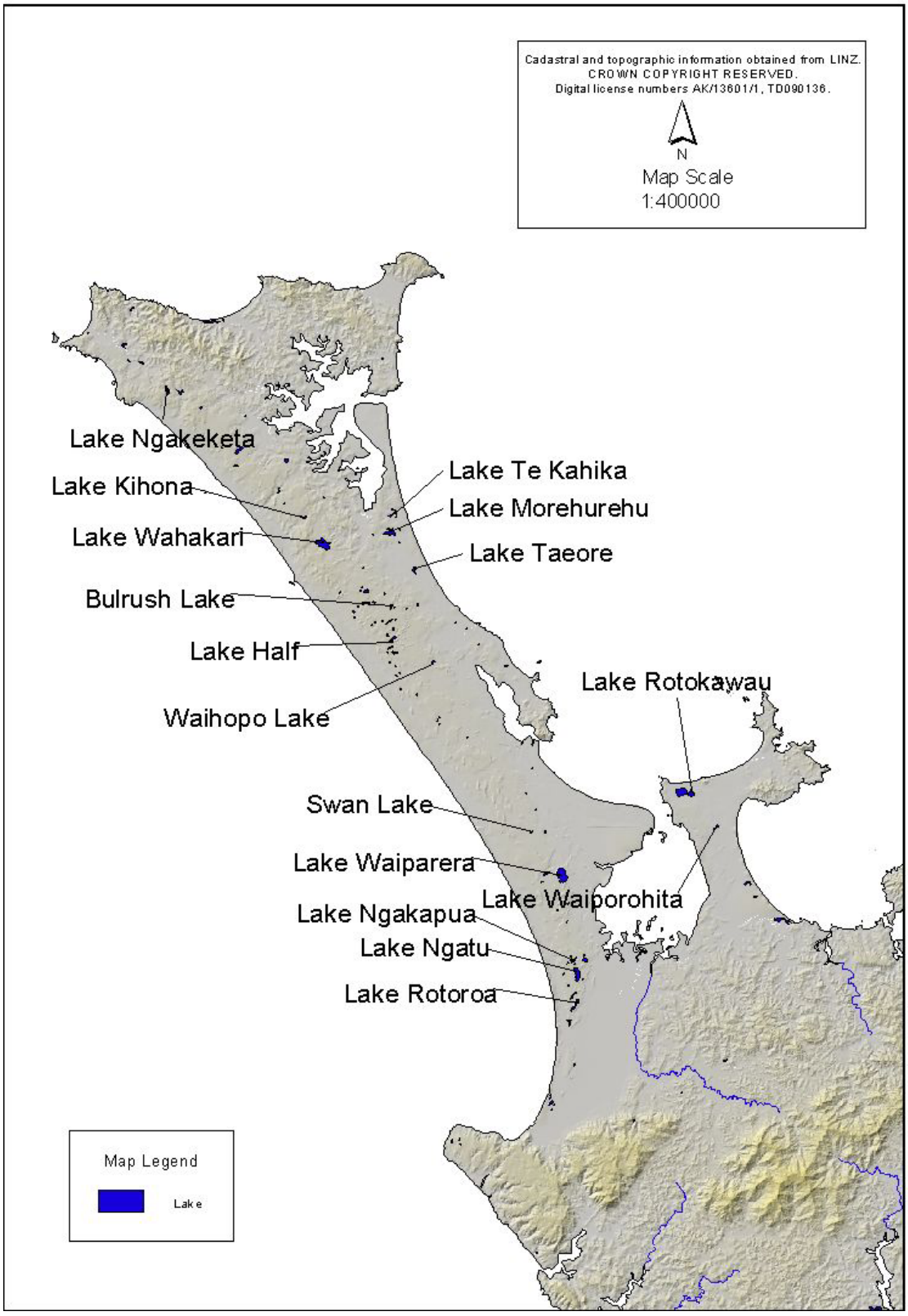
Two small geothermal lakes exist in Northland at Ngawha. Northland Regional Council officers monitored these lakes for the first time in October 1998 – **Lake Ngamokaikai** and **Lake Waiparaheka**. Both lakes were acid with a pH range of 3-3.5. Dissolved oxygen in waters of both lakes was below 1 g/m^3 at 3m depth. Both lakes provide "extreme" environments for aquatic life. These are unique lake environments in Northland.

9.3.3 Volcanic Lakes

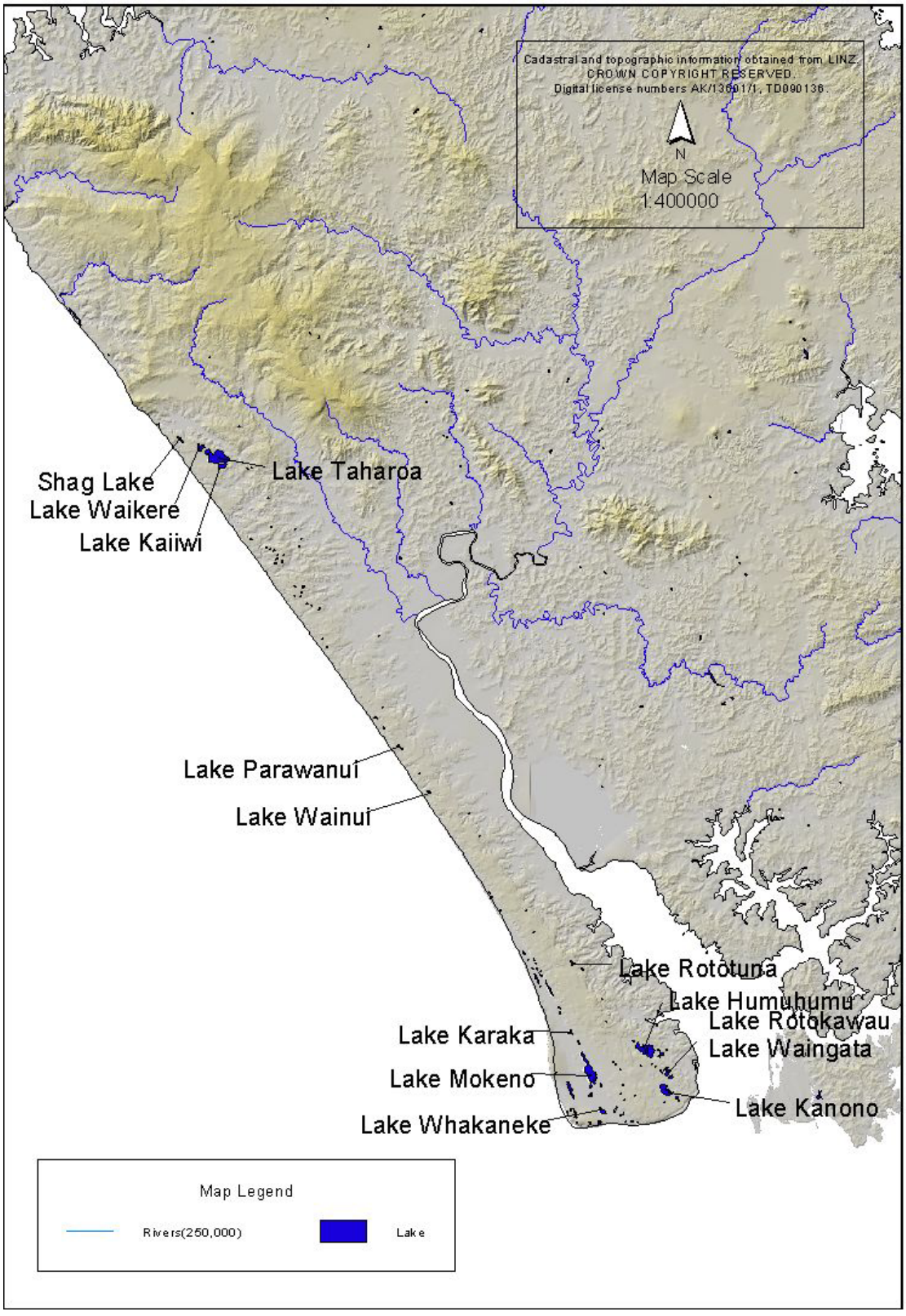
Lake Omapere is the largest lake formed by volcanic activity in Northland. Although not an explosion crater itself, the lake was formed many thousands of years ago by a lava flow which now forms the northern shoreline. While water now flows to the west

into the Hokianga Harbour, drainage prior to the lake forming took water eastward down the Waitangi River to the Bay of Islands. **Lake Owhareiti** (west of Moerewa township) was formed in a similar fashion.

Updated information on the state of **Lake Omapere** can be found at http://www.nrc.govt.nz/about.us/special.events/lake.omapere/index.shtml



Map 15: Location of some of the major lakes of the Aupouri and Karikari Peninsulas



Map 16: Location of some of the major lakes of the Pouto Peninsula

9.4 Responses to Issues Affecting the Lakes of Northland

9.4.1 Regional Council

Policies and Plans

The **Regional Policy Statement** provides an overview of resource management issues in Northland, including those with regard to lake water quality and quantity. It contains objectives, policies and methods to achieve the integrated management of Northland's environment.

The objectives of the Regional Policy Statement seek to maintain or enhance water quality of Northland lakes for the purposes of aquatic ecosystems, contact recreation, water supplies and cultural and aesthetic purposes.

The **Revised Proposed Regional Water and Soil Plan** contains rules that prohibit the discharge of any sewage and animal effluent into the dune lakes as specified in the plan. Closed systems such as dune lakes are more sensitive to the adverse effects of effluent discharges. Dune lakes have been recognised as having high recreational and aesthetic qualities and are an important tourist feature of Northland. Discharges into any of the dune lakes would threaten those qualities.

Monitoring

In April of 2001 the Northland Regional Council contracted aquatic plant specialists from NIWA to survey twenty-six of the Northland Lakes. Aquatic plants were first survey in 1986 and by visiting the lakes again, NRC hopes to be able to compare changes in aquatic plant communities.

Aquatic plants can be an indicator of overall lake health and many Northland Lakes are vulnerable to aquatic weed invasion. These surveys will help the Council to identify invasions of weeds and to take steps to control them if necessary. The results will also reveal how the lake communities are changing over time. The results of this survey should be available during 2002.

Weed surveys of **Lake Omapere** are expected to continue as long as *Egeria* remains a problem in this lake. More information on the state of **Lake Omapere** can be found at http://www.nrc.govt.nz/about.us/special.events/lake.omapere/index.shtml

Egeria spreads vegetatively by plant fragments being transferred between lakes. Fragments on boats and trailers are a primary mode of dispersal. Northland Regional Council undertakes education and has erected signage at major lakes about the importance of clearing boats and trailers of aquatic weeds.

Clearing boats and trailers of weed is important to prevent the spread of aquatic weeds

The Northland Regional Council has set up an Environmental Fund of currently $100,000 per year to help people improve and protect Northland's natural environment. The fund will provide up to 50% of the costs of projects protecting indigenous vegetation and habitats by fencing out stock, allowing regeneration of native plants, and replanting streamsides and lake margins with appropriate native plants.

9.4.2 Other Responses

The Department of Conservation has completed a dwarf inanga recovery plan. Dwarf inanga are a rare landlocked whitebait, found only in a few dune lakes on the Pouto peninsula. The plan refined survey methods and surveys were carried out to confirm lakes still known to contain populations of dwarf inanga.

The Department of Conservation has also been active on the Pouto peninsula, fencing their land where it borders lakes, namely **Lake Waingata**, **Lake Rototuna** (Upper) and **Lake Rototuna** (Lower). Along with predator and weed control on DOC land around these and other lakes in the area, they have carried out surveys of threatened plants.

Agriculture New Zealand, funded largely by a government grant, is undertaking a three year study of a small dune lake on the Pouto Peninsula. The aim is to identify and model nutrient dynamics between the lake and surrounding pastoral land to gain a better understanding of how to maintain agricultural production and at the same time, prevent degradation of the lake environment.