

A PLAN FOR THE MANAGEMENT OF PEAT LAKES AND ASSOCIATED RESERVES ADMINISTERED BY THE WAIPA DISTRICT COUNCIL



Lake Serpentine

A Reserve Management Plan prepared in accordance with the requirements of the Reserves Act 1977

This Plan sets out the policies and objectives for the management of:
The Recreation Reserves at Lakes Cameron (Kareaotahi), Mangakaware, Serpentine
(Pikopiko) and Ruatuna; and,
The Local Purpose and Esplanade Reserves, and all other Council-administered public land
adjoining any of the Peat Lakes located in the Waipa District.
This Plan supersedes all existing management plans prepared under the Reserves Act 1977
in relation to the reserves and other land specified above.

Note: Lake Ngaroto Recreation Reserve is subject to a separate reserve management plan.

April 2007

Table of Contents

Part One

1.0	INTRODUCTION	1
2.0	PURPOSE OF THIS DOCUMENT.....	1
2.1	Statutory Purpose.....	1
2.2	Implementation.....	2
2.3	Scope of the Document.....	3
2.4	The Statutory Process.....	3
3.0	WAIPA PEAT LAKE RESOURCE.....	4
3.1	Formation and History	4
3.2	Types of Peat	6
3.3	The Peat Lakes Today	7
3.3.1	In Lake Characteristics.....	7
3.3.2	Open Water and Lake Bed	8
3.3.3	Plant Communities.....	8
3.3.4	Fauna of Peat Lakes.....	9
3.3.5	Freshwater Fish	9
4.0	STATUS AND ADMINISTRATION OF PEAT LAKES	10
4.1	Legal Status	10
4.2	Council Administered Reserves	10
	Table One: Lake Status and Administering Authority.....	10
	Table Two: Esplanade Reserves Adjoining DOC Administered Lakes	11
5.0	STATUTORY AND OTHER CONTROLS.....	11
5.1	Reserves Act 1977	11
5.2	Resource Management Act 1991 (RMA).....	12
5.3	Local Government Act 1974 and 2002 Amendment.....	12
5.4	Queen Elizabeth II Trust Act 1987.....	12
6.0	LINKAGES WITH OTHER PLANS AND DOCUMENTATION	13
6.1	Long Term Council Community Plan.....	13
6.2	Waipa District Plan	13
6.3	Heritage Policy and Implementation Strategy.....	13
6.4	Community Leisure Plan	13

6.5	Regional Policy Statement (RPS).....	14
6.6	Regional Plan	14
7.0	EXISTING MANAGEMENT AND MANAGEMENT ISSUES	14
7.1	Waipa Peat Lakes and Wetlands Accord	14
7.2	Management Plans and Related Literature	15
7.2.1	Lake Serpentine and Serpentine Recreation Reserve	15
7.2.2	Lake Rotomanuka	15
7.2.3	Management of the Waipa Peat Lakes.....	15
7.2.4	Lake Ruatuna Recreation Reserve.....	15
7.2.5	Esplanade Reserve Recommendations.....	16
7.2.6	Waipa District Lakes Study	16
7.3	Adopting Generic Plans for Reserves.....	16
8.0	THREATS TO PEAT LAKES.....	17
8.1	Land Use and Development	17
8.2	Drainage and Peat Settlement	17
8.3	Contaminants	18
8.4	Sedimentation	18
8.5	Introduced Pest Plants and Animals.....	18
8.5.1	Pest Plants (weeds).....	19
8.5.2	Pest Fish	19
8.5.3	Pest Mammals	19
8.6	Public Use	20
9.0	MANAGEMENT AIMS AND OBJECTIVES	20
10.0	GENERAL POLICY FOR THE WAIPA PEAT LAKES AND LAND ADJOINING THESE LAKES.....	20
10.1	Policy One: Adjoining Land Use and Development.....	20
10.2	Policy Two: Managing Levels, Drainage and Peat Settlement .	21
10.3	Policy Three: Managing Contaminants and Sedimentation	22
10.4	Policy Four: Managing Introduced Pests (Plants and Animals)	22
10.5	Policy Five: Fostering Community Involvement.....	23
10.6	Policy Six: Promoting and Managing Use.....	23
10.7	Policy Seven: Managing Ecological Values.....	24
10.8	Policy Eight: Managing the Lake Landscapes	25
10.9	Policy Nine: Managing Historic and Cultural Heritage	26

10.10	Policy Ten: Grazing.....	27
10.11	Policy Eleven: Leases and Licenses and Commercial Use ..	27
10.12	Policy Twelve: Reserve Classification.....	28
10.13	Policy Thirteen: Policy Review	28
11.0	SCHEDULE OF LAND ADMINISTERED BY COUNCIL	29
11.1	Lake Koromatua	29
11.2	Lake Cameron.....	31
11.3	Lake Rotomanuka	33
11.4	Lake Serpentine	35
11.5	Lake Ruatuna	37
11.6	Lake Mangakaware	39
	REFERENCES:.....	41

PART TWO	42
MANAGEMENT PLAN FOR LAKE MANGAKAWARE RECREATION RESERVE	42
1.0 LOCATION AND ACCESS	42
2.0 LEGAL DESCRIPTION AND CLASSIFICATION	42
2.1 History of Administration.....	42
3.0 PHYSICAL DESCRIPTION	42
3.1 Catchment Use and Vegetation.....	43
3.2 Water Levels	43
3.3 In Lake Conditions.....	44
4.0 WILDLIFE AND FISHERIES	45
4.1 Wildlife.....	45
4.2 Fish.....	45
4.3 Mammal and Animal Pests.....	45
5.0 ARCHAEOLOGICAL SITES	46
6.0 AGRICULTURAL USE OF THE RESERVE LAND	46
7.0 RECREATION AND PUBLIC USE	47
8.0 MANAGEMENT OBJECTIVES	47
8.1 Buffer Margins around the Lake	47
8.2 Minimum Lake Levels and Drainage	47
8.3 Inflows of Sediments and Contaminants	47
8.4 Introduced Pests	47
8.5 Recreational Use.....	48
8.6 Enhancing Habitats	48
8.7 Historic Sites and Features	48
8.8 Grazing.....	48
APPENDIX ONE: RESERVE PLAN	49
APPENDIX TWO: WILDLIFE RECORDED WITHIN THE LAKE RESERVE	50
APPENDIX THREE: FISH AND MAMMALS RECORDED WITHIN THE LAKE RESERVE .	51
APPENDIX FOUR: SEASONAL WATER LEVEL FLUCTUATIONS	52
REFERENCES	53

PART THREE	54
MANAGEMENT PLAN FOR LAKE CAMERON (KAREAOTAHU) RECREATION RESERVE	54
1.0 LOCATION AND ACCESS	54
2.0 LEGAL DESCRIPTION AND CLASSIFICATION	54
2.1 History of Administration.....	54
3.0 PHYSICAL DESCRIPTION	55
3.1 Catchment Use and Vegetation.....	55
3.2 Water Levels	55
3.3 In Lake Conditions.....	56
Table One: Physical statistics for Lake Cameron taken from most recent literature available (EW 2005).....	56
4.0 WILDLIFE AND FISHERIES	57
4.1 Wildlife.....	57
4.2 Fish.....	57
4.3 Mammals and Animal Pests	57
5.0 HISTORY OF THE RESERVE MANAGEMENT	57
6.0 RECREATIONAL AND PUBLIC USE	58
7.0 MANAGEMENT OBJECTIVES	58
7.1 Establish and Maintain Buffer Margins around the Lake	58
7.2 Set Minimum Levels and Control Drainage	59
7.3 Controlling Inflows of Sediments and Contaminants	59
7.4 Managing Introduced Pests.....	59
7.5 Promoting Recreation and Public Use.....	59
7.6 Enhancing Habitat.....	60
7.7 Managing Historic Sites and Features.....	60
7.8 Grazing.....	60
APPENDIX ONE: RESERVE PLAN	61
APPENDIX TWO: WILDLIFE RECORDED WITHIN THE LAKE CAMERON RESERVE	62
APPENDIX THREE: MAMMALS FOUNDS WITHIN THE LAKE CAMERON RECREATION RESERVE	63
REFERENCES	64

1.0 INTRODUCTION

The Waipa District is known for its flat to low rolling, high producing agricultural land, but it is also rich in water. Two major rivers the Waikato (including the Karapiro and Arapuni hydro impoundments) and the Waipa, pass through the Waipa District and there are nineteen smaller lakes, ranging from one to ninety hectares in size. Sixteen of these are referred to as “peat lakes”.

The name “peat lake’ is unfortunate as for most people it brings to mind dark and unpleasant associations with bogs and swamps – things that many believe to have little productive value. In reality these lakes are valuable heritage assets, and although they are stained brown as a result of tannin leaching from the surrounding peat substrate, they make a substantial contribution to landscape variety and quality and provide a wide range of recreational opportunities such as sailing, rowing, game bird hunting, fishing, picnicking and ornithology.

There has been a developing appreciation of the ecological significance of these lakes over recent years. This has arisen out of an increasing awareness of the age of these lakes, the distinctive communities of plants and animals that have evolved within them, and their importance as habitats for rare and threatened wildlife.

At the same time there has been increasing awareness that peat lakes are fragile and very sensitive to catchment influences. The clearance of native vegetation and drainage activities for pastoral farming has substantially modified and degraded many lakes. Most are now much smaller and shallower and some have been completely drained. Runoff containing high levels of nutrients has changed water chemistry and plant and algal communities. Most lakes have been invaded by exotic plant pests and connecting drainage schemes has enabled pest fish to colonise.

The Waipa peat lakes are thus changing and unfortunately most of these changes have contributed to a loss in indigenous character, a deterioration in general lake health and wellbeing, and the environmental services they provide to the community at large. These changes are however, a result of human activity, and as such can be controlled and managed.

2.0 PURPOSE OF THIS DOCUMENT

2.1 Statutory Purpose

Reserve Management Plans are required under section 41 of the Reserves Act 1977. Specifically the Act states:

“The management plan shall provide for and ensure the use, enjoyment, maintenance, protection, and preservation, as the case may require, and, to the extent the administering body’s resources permit, the development, as appropriate, of the reserve for the purposes for which it is classified, and shall incorporate and ensure compliance with the principles set out in sections 17, 18, 19, 20, 21, 22, and 23, as the case may be, of this Act for a reserve of that classification.”

- For either recreation or esplanade purposes, the Management Plans key purpose is to ensure that the use and management of the Reserve is consistent with the purpose for which the reserve has been classified. The majority of reserves identified in this management plan are classified.
- Management Plans must be regularly updated. Section 41(4) of the Reserves Act 1977 states:

“the administering body of any reserve shall keep its management plan under continuous review, so that, subject to subsection (3) of this section, the plan is adapted to changing circumstances or in accordance with increased knowledge..”.

2.2 Implementation

This document describes the peat lake resource; identifies the issues and threats that need to be addressed to retain or restore the lakes; provides policy that will enable Council to achieve the heritage goals desired; and will achieve the management planning requirements under the Reserves Act 1977.

Most important, is to develop a long term management strategy that encapsulates the community’s desire to conserve the peat lake and wetland resources as many of the impacts, from intensive agricultural land use, expanding urbanisation and changing hydrology, can take many years to materialise.

Further, there are a number of agencies with statutory roles and responsibilities that must work collaboratively if remedies are to be successfully applied.

The plan will apply to all peat lake Reserves and associated land parcels administered by Council, but the policy developed could also be applied to land around privately owned lakes.

Council is committed to assisting land owners to protect and conserve lakes on private land.

The process of confirming the management plan will:

- establish a common purpose and understanding around the conservation of the Waipa peat lakes;
- encourage discussion of the management and development options for the lakes;
- seek informed feedback on existing and proposed management;
- clarify issues over the management of the lakes and surrounding land; and,
- explain the roles and responsibilities of the various agencies involved.

2.3 Scope of the Management Plan

The Plan addresses several legislative and advocacy needs. It focuses on all Council-administered land associated with peat lakes, including peat lake recreation reserves and other reserve/public land adjoining peat lakes.

- Section 41 of the Reserves Act 1977 requires Council to prepare management plans for **Recreation Reserves** under its control, management or administration. This Plan recognises these requirements and its provisions apply to two peat lakes, the Lake Mangakaware and Lake Cameron (Kareotahi) Recreation Reserves, and the Serpentine and Ruatuna Recreation Reserves, which adjoin peat lake reserves administered by the Department of Conservation.

Lake Ngaroto, the largest of the Waipa peat lake Recreation Reserves, has a current Management Plan. The significance of Ngaroto means Council will continue to manage the reserve by way of a separate management plan.

- There are a number of **Esplanade Reserves** that have been created through sub-division and these are now vested with Council. They adjoin the Lake Serpentine (Rotopiko), Rotomanuka, Ruatuna, Cameron (Kareaotahi) and Koromatua Government Purpose (Wildlife Management) Reserves, all of which are administered by the Department of Conservation.

Esplanade Reserves are deemed to be reserves for local purposes and, while the management plan provisions of the Reserves Act 1977 do not apply, it is desirable to develop policies for these reserves that are consistent with conserving and protecting the lakes. A similar situation arises for Council administered unformed paper roads, access reserves and access strips.

- Many of the conservation initiatives proposed for Council administered land could also be applied to peat lakes on private land, as the threats and issues are the same. The proposed policies place emphasis on engaging landowners in restorative measures, and encouraging the adoption of land use practices that will help degraded lakes to recover. Council will work with the landowners and other interested groups to implement conservation measures appropriate for privately owned lakes.

2.4 The Statutory Process

Section 41 of the Reserve Act 1977 prescribes the process by which a reserve management plan shall be prepared. This process is summarised in the following Figure1 (Reserve Management Plan Preparation Procedure).

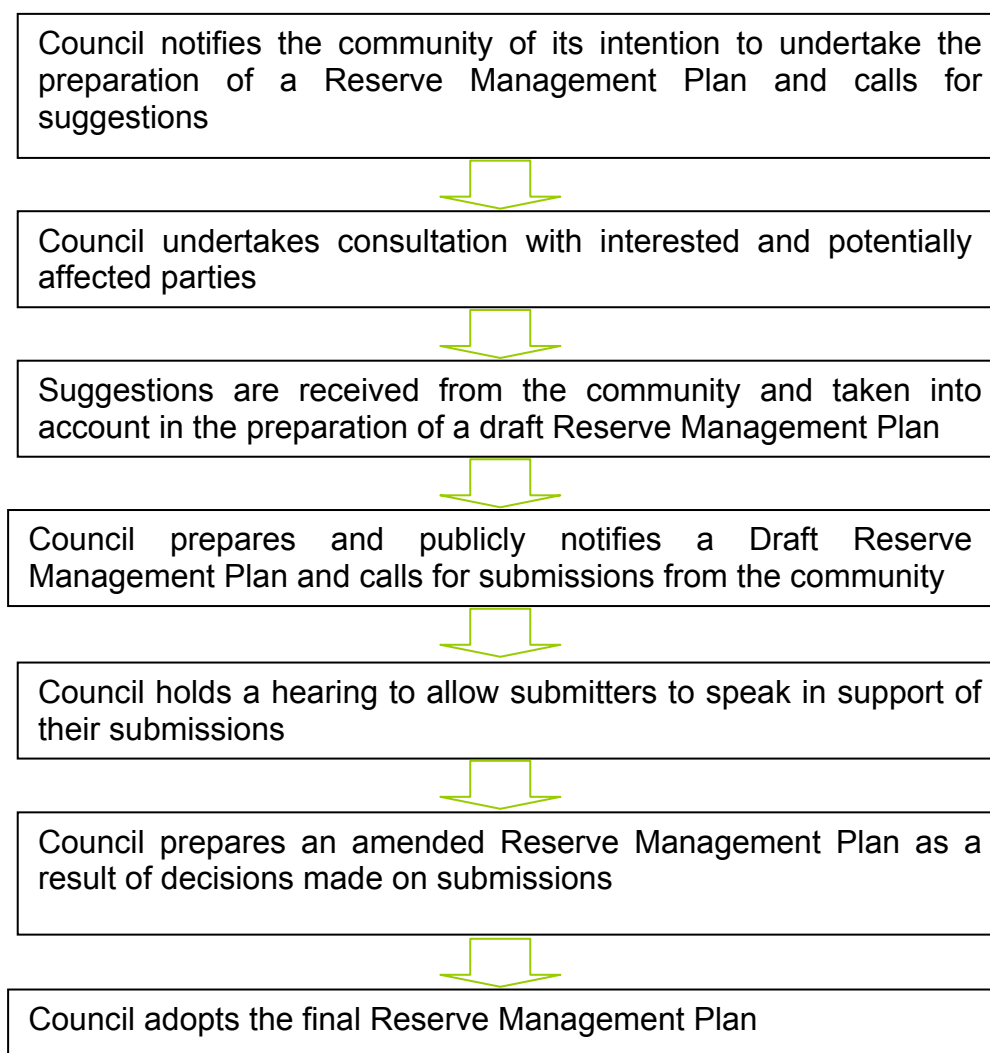


Figure 1: Reserve Management Plan Preparation Procedure

3.0 WAIPA PEAT LAKE RESOURCE

3.1 Formation and History

Studying cores taken from sediments and peat surrounding the lakes, has shown the history of most is a long and varied one, dating back to well before recorded human settlement.

The formation of peat in the lower Waikato basin began about 19,000 years ago when the Waikato River abandoned its course west through the Hinuera Valley to the Firth of Thames and entered the Hamilton basin. The river at that time was more a braided river system, much like some of the present day South Island rivers such as the Waitaki and Rakaia. The change mobilised vast quantities of alluvial sands and gravels and deposited this material in a broad fan, up to 80m thick in places, from the Karapiro Gorge northwards to beyond where Hamilton city is today. The

deposition of alluvial material blocked the mouths of valleys in the older hilly landscapes and small lakes formed in the valleys behind these gravel bars.

At this stage there was no peat or swamp around the edges of these lakes and the water in all of them was clear. The climate was still quite cold, following the last glaciation, and the vegetation around the lakes was similar to that found in the alpine areas of New Zealand today. As the climate warmed (<14,700 years ago) a dense forest established over the landscape and probably around the lakes. This forest was quite similar to the conifer broadleaved forest growing at Pureora in the central King Country today.

Around 10,000 years ago, a wetter and warmer climate promoted the growth of peat forming vegetation on the surface of the alluvial plains and around the lakes. This process raised ground water levels destroying and eventually burying the forests growing near the lakes. The stumps that emerge from the peat during drainage operations are the remnants of these ancient forests.

Over the next 3,000 years, peat rapidly deepened and spread outwards to form the Rukuhia (6,400ha) and Moanatuatua (8,500ha) peat domes/deposits we know today.

The lakes near the edge of these peat bogs, like Rotomanuka and Ngaroto, were never greatly influenced by the later peat formation and remained unchanged. But as the peat grew other lakes were affected. These lakes deepened, became acidic and turned dark brown from the humic material leaching from the peat. Such lakes as Maratoto, Cameron (Kareaotahi), Pataka, Mangahia, and "Milicich" pond, are true peat lakes and exhibit these characteristic today.

One rather surprising aspect of the development of Lake Maratoto, the most studied of the lakes, is that as the peat grew it did not encroach on and reduce the lake's surface area, as is known to happen elsewhere in the world. Maratoto has remained much the same size throughout its history.

The probable reason for this is that peat growth was so slow (estimated at 0.1cm/year in depth) that physical erosion through wave action at the lake edge and bacterial break down of peat particles in the water, was able to keep pace with the growth of peat.

The change from shallow clear water to deeper acid brown water had considerable effects on the plants and animals living in the lakes. Not all organisms can live in peat water. Most of the large aquatic plants disappeared as light had increasing difficulty penetrating the brown stained waters. Those that remained were 'emergent' rushes and reeds growing around the lake margins. The variety of animals also became less and some of those remaining were unusual and adapted to living in peaty conditions.

During the last 7,000 years, the climate of Waipa became drier and cooler, although there have been occasional wetter and warmer spells. These variations in climate have produced alternating periods of peat growth and recession, and thus also variations in lake depth and growth of trees around the edge of the bogs and near the lakes. There have also been influences from the more recent Taupo eruptions

(1,800 years ago) which again changed the landscape, felling and burying forest in volcanic ash and pumice and changing drainage patterns, particularly in the central and northern Waikato basin. But the Waikato river soon cut a channel through the soft landscape and became confined to its now deep channel (Green J.D. 1988)

In more recent times human usage on and around the lakes initiated further change. Maori foraged around the lakes and constructed Pa on their margins. Anecdotal comment suggests lake levels may also have been manipulated (raised) to create 'Pa Islands' making them more easily defended. Several of these Swamp Pa, like those on the shores of Lakes Mangakaware and Ngaroto are now recognised as very important historical sites and regarded by archaeologists as being perhaps the best preserved open air neolithic settlements in the world (Gumbley, John and Law 2005).

3.2 Types of Peat

Peat is formed from the consolidated remains of wetland plants in wet environments. High water tables prevent rapid break-down of the dead plant foliage, stems and roots by decomposing organisms – fungi and bacteria - causing the surface to rise vertically. The term 'peat' is generally used when the organic content is 50% or more and the term 'peat land' is applied to all land having a peat substrate, irrespective of whether the land is wet or well drained.

Peat can be divided into two broad types, based on the source of the water. It should be noted however with changes in hydrology through drainage activity, a degree of mineralisation will be occurring in the oligotrophic peat bogs.

Eutrophic Peats form when the main source is ground water and nutrients from adjacent mineral soils are limited. The water table is generally close to or just below the peat surface and is usually constant. Peat builds up in these wet hollows or small lake basins, until the basin is filled or the upper limit of the ground water is reached. The resulting wetland is flat or even slightly concave on top. These eutrophic peats are often described as 'fen peats' and support vegetation like rushes, sedges and scrub manuka.

Oligotrophic Peats form when rainwater is the only source of water. Because rainwater does contain many nutrients, oligotrophic peats have a low fertility and are more acidic than fen peats. They generally support low growing plants tolerant of low fertility such as endemic mosses, cushion plants, ferns and rushes and will often have a domed (or raised) surface resulting in greatest peat growth in the most poorly drained central part .

Of the original 14,900ha of 'fen' and 'bog' peat present in 1840 prior to intensive agricultural development, little remains today. The only bog remnant is the Moanatuatua Scientific Reserve east of Ohaupo, a rectangular 114ha "Island" in a sea of pasture. This Reserve supports a natural cover of peat forming *restiad* vegetation, including the giant cane rush (*Sporadanthus ferrugineus*) - one of three sites where this endemic plant occurs in NZ - wire rush (*Empodisma minus*, tangle fern (*Gleichenia dicarpa*) and *Sphagnum* mosses.

Other examples are generally 'fen peat' and are associated with the margins of the peat lakes. These margins vary in width from a few meters to tens of meters and from less than one meter to over six meters in depth.

3.3 The Peat Lakes Today

The catchments of the lakes are generally flat to gently undulating, with the water body either sandwiched between a peat bog and low hills/ridges, or residing in a basin of deep bog peat (true peat lakes). The former lakes and the peat around their margins have been influenced by the eroding soils - Hamilton clay loams and Ohaupo silt loams – producing peaty loams.

An inevitable consequence of developing peat for pasture is shrinkage and surface settlement. This is evident with the appearance of previously covered stumps and old forest remnants, and the now raised root systems of many kahikatea standing within grazed pastureland. The rate of surface settlement will vary according to land use adopted and the amount of tillage and fertilizer used, although an estimate of between one and five centimetres annually may not be far wrong (Thompson & Greenwood 1997).

In pre-European times most lakes were rain fed, with no surface water inlets or outlets, and levels varied according to seasonal climate changes and evaporation. Today, water still leaches into the lake via the bogs as shown by the dark tannin staining, but an increasing contribution comes from catchment runoff via extensive drainage infrastructure.

This increase in water has caused greater variation in lake levels, particularly maximum levels over short durations. Maintaining gravity drainage becomes increasingly difficult as drainage activities cause the peat surface to subside. This has led to the deepening of drains and the excavation of lake outlets. Water levels in all lakes have been lowered, some by several metres and in extreme cases, lakes have been drained completely. Examples include an un-named lake north of Lake Ngारoto-iti and Round Lake to the south east of Lake Rotomanuka.

3.3.1 In Lake Characteristics

Peat lakes generally share similar attributes. They have acidic waters with a pH generally less than 5 (range 4.6 – 5.5); the water is stained by the leaching of tannins from surrounding decomposing vegetable matter (a notable exception is Rotomanuka North which receives water artificially diverted from catchments to the south and east); they can become thermally stratified during warm calm spells as the sun warms the particulate material in the upper water column; and they are low in fertility. Although most are becoming more eutrophic and less dystrophic with drain and surface inflows from intensively managed land.

The beds of some lakes are covered by 2 - 4m of fine lake sediments and organic matter that has settled from the water column over the years. These sediments include at least 28 thin layers of well preserved volcanic ash, wind blown from eruptions that occurred in the central North Island. These sediment layers provides

a very useful reference to the long and varied history of the lakes and their surrounds.

3.3.2 Open Water and Lake Bed

The lakes are productive systems and support complex biological communities. The greatest diversity of plants and animals is found in the lakes with relatively clear water and higher pH. However those with dark peat stained waters also support interesting species like whirligig beetles (*Gyrinus convexiusculus*), water mites (*Limnochara*) - recorded for the first time in NZ from Lake Maratoto; freshwater jellyfish (*Craspedacusta sowerbyi*) and leeches. Life on the lake bottoms is similarly diverse, especially in the shallow zone to 1m in depth. The dominant types are worms and midge larvae - which graze on bacteria coated sediment particles, algae and dead organic material; filter feeding pea mussels *Spaerium* and *Pisidium*, and the common freshwater mussel *Hyridella menziesi*.

The open water is dominated by microscopic planktonic plants (phytoplankton) and animals (zooplankton) which drift freely at the mercy of water currents. The phytoplankton communities contain a variety of species, some of which may be very abundant. During the summer the more enriched lakes produce blooms of blue-green algae. If the weather is calm these may float to the surface and will form a green scum. Zooplankton, *cladocerans*, copepods and rotifers, are also abundant and of interest scientifically.

Lake Rotomanuka (North and South) Serpentine and Mangakaware are some of the very few lakes in NZ known to have two species of *calanoid* copepod co-existing in their zooplankton, and Lake Mangahia is the only lake in NZ known to have *Boeckella delicata* as its sole *calanoid*. More recent studies on Lake Mangakaware have revealed a new species of *Ceriodaphnia* (*C. pulchella*) not previously recorded in NZ (Green J.D. 1988: Chapman, M.A. Boubée, J.A.T. 1978)

3.3.3 Plant Communities

Most lakes, except the most tannin stained like Maratoto, Cameron, Pataka and Mangahia, supported beds of submerged aquatic plants although the original native communities have largely been replaced by introduced species. Lake Serpentine (Rotopiko) is the only lake that supports intact beds of native plants.

The submerged communities are/were dominated by hornwort (*Ceratophyllum demersum*) and oxygen weeds (*Egeria densa* and *Elodeia canadensis*) which themselves appear prone to effects from increased nutrient levels, reduced water clarity and light penetration, and browsing by wildfowl and fish. Such communities in lakes Ngaroto and Rotomanuka have collapsed in recent years.

At the edges of the open water grow tall emergent reeds like tall spike rush (*Eleocharus sphacelata*), and raupo (*Typha orientalis*), behind which are floating mats of rushes, sedges, grasses, ferns and mosses. Typically the lakes were fringed by bog-forming species like tangle fern, wire rush, *sphagnum* mosses and other peat tolerant woody trees and shrubs.

Some of the rare and more unusual peat plants include insectivorous species like sundews (*Drosera spp*), floating bladderworts (*Utricularia spp*) and the world's smallest vascular plant *Wolffia australiana* (a type of duck weed).

Hydrological changes, particularly the lowering of the lake levels, cause drying of the lake's peaty margins and consequently changes in vegetation. Many of the original indigenous peat forming plants have been unable to tolerate the drying conditions and in some cases excessive grazing and trampling, and are being replaced by woody natives and invading exotics like introduced grasses, willow, pasture weeds, gorse and blackberry.

Lakecare groups and the administering agencies have been controlling pest plants and planting a range of native trees like kahikatea, cabbage tree, manuka (*Leptospermum scoparium*), *Coprosma sp.* and flax (*Phormium tenax*) on the drier margins of several lakes, notably Ngaroto, Serpentine (Pikopiko), Cameron (Kareatahi) and Koromatua.

3.3.4 Fauna of Peat Lakes

The lakes provide habitat for a variety of resident and frequenting native water birds. Grey duck (*Anus superciliosa*), grey teal (*A. gracilis*), shoveler duck (*A. rhynchosotis*), black swan (*Cygnus atratus*), little black shag (*Phalacrocorax sulcirostris*), large black shag (*P. carbo*); occasional NZ scaup (*Aythya novaeseelandiae*) and NZ dabchick (*Podiceps cristatus*) frequent the open water areas.

The ubiquitous pukeko (*Porphyrio porphyrio*), white-faced heron (*Ardea novaehollandiae*), pied stilt (*Himantopus himantopus*), and the threatened Australasian bittern (*Botaurus poiciloptilus*), can be found within the swampy margins. More secretive, less visible birds that frequent the lake margins include spotless crake (*Porzana tabuensis*), marsh crake (*Porzana pusilla*) -recorded at Ngaroto the first recording in the Waikato basin for many years - and banded rail (*Pallus philippensis*), which has been recently recorded at Lake Koromatua.

The vegetated margin provides habitat for insectivorous birds like fantail, grey warbler, welcome swallow, North Island fernbird (*Bowdleria punctata*) and numerous introduced passerines.

3.3.5 Freshwater Fish

Originally the peat lakes had no channeled inlets or outlets. Water levels fluctuated according to direct rainfall and sub-surface flows. Only Lake Ngaroto would likely have had a permanent connection to a stream/river system.

Many native fish have a marine phase in their life cycle and either migrate to or from the sea as adults or juveniles. Those species would have had difficulty accessing the lakes. Resident species were likely to have been short finned (*Anguilla australis*) and long finned eel (*A. dieffenbachia*) which have the ability to travel overland through wet/damp vegetation and lake dwelling populations of bullies (*Gobiomorphus sp*), and smelt (*Retropinna retropinna*). Black mud-fish (*Neochanna*

diversus) is a species adapted to seasonal changes in water levels including drying, and has been recorded from a range of sites in the lower Waikato. Although there are no confirmed records for the Waipa lakes it may well be present.

In times of significant rainfall events, when the lakes and their surrounds are flooded, some of the lowland *Galaxiads*, like Inanga (*Galaxias maculatus*) giant kokopu (*G. argenteus*) and banded kokopu (*G. fasciatus*), may have accessed the larger lakes.

4.0 STATUS AND ADMINISTRATION OF PEAT LAKES

4.1 Legal Status

Nine of the peat lakes are reserves, gazetted and classified under the Reserves Act 1977. Table One below shows the status of all lakes and the agencies responsible for administering them.

4.2 Council Administered Reserves

- Lake Mangakaware, with the lake area of 15ha and a surrounding margin of around 32ha, is a Council administered Recreation Reserve. It also has an over-lying Closed Game Area status, gazetted under the Wildlife Act 1953. This status prohibits the hunting and killing of game birds.
- Lake Cameron (Kareaotahi) is a 6.1480ha Recreation Reserve, with three parcels, all public reserves, adjoining the lake. All are administered by Council.
- At the time of writing five Government Purpose (Wildlife Management) Reserves administered by Department of Conservation (DOC), have either Recreation Reserves and/or Esplanade Reserves adjoining them. Refer to 'Table Two'.

Table One: Lake Status and Administering Authority

Name	Status	Administering Agency
Ngaroto	Recreation Reserve	Waipa DC
Mangakaware	Recreation Reserve	Waipa DC
Kareaotahi (Cameron)	Recreation Reserve	Waipa DC
Rotopiko (Serpentine)	Government Purpose (Wildlife Management) Reserve	DOC
Rotomanuka	Government Purpose (Wildlife Management) Reserve	DOC
Ruatuna	Government Purpose (Wildlife Management) Reserve	DOC
Ngaroto-iti	Government Purpose (Wildlife Management) Reserve	DOC
Koromatua	Government Purpose (Wildlife Management) Reserve	DOC
Rotopataka	Government Purpose (Wildlife Management) Reserve	DOC
Pataka (North)	Private	Private

Name	Status	Administering Agency
Pataka (South)	Private	Private
Mangahia	Private	Private
Hendersons Lake	Private	Private
Turnwald Pond	Private	Private
Milicich Lake	Private	Private
Maratoto	Private/QE II Trust	Private/QE II Trust

Table Two: Esplanade Reserves Adjoining DOC Administered Lakes

Lake	Adjoining Reserve Type & No Parcels	Description	Area in hectares
Lake Serpentine	Recreation Reserve x 2	Lot 470, Ngaroto Parish SO 50990	7.7748
		Lot 471, Ngaroto Parish SO 49318	0.0583
Lake Rotomauka	Esplanade Reserve x1 Esplanade Reserve x3	Lot 5, DPS 305162	1.1120
		Lot 3, DPS 80969	0.9040
		Lot 2, DPS 10798	0.1391
		Lot 10, DPS 86961	1.0300
Lake Ruatuna	Recreation Reserve x1 Esplanade Reserve x 4	Pt A lot. 176A, Ngaroto	2.2943
		Lot 4, DPS 69498	1.0350
Lake Cameron	Esplanade Reserve x3	Lot 3, DPS 69498	0.2700
		Lot 4, DPS 87934	0.8640
		Lot 6, DPS 319783	1.4350
		Lot 2, DPS 13741	0.3667
Lake Koromatua	Esplanade Reserve x1 Adjoining land	Lot 3, DPS 91539	1.4850
		Lot 3, DP 315251	0.6100
		Lot 9, DPS 30798	3.84
Lake Ngaroto-iti	Esplanade Reserve	Lot 3 DPS 84651	3.1600
		In prep	Unknown

5.0 STATUTORY AND OTHER CONTROLS

5.1 Reserves Act 1977

The Reserves Act 1977 is the primary statute governing the reservation, classification and day to day management of peat lakes (and their margins) gazetted as Reserves. This Act, together with the Conservation Act 1987 and the National Parks Act 1980 are the primary statutes used to establish the national network of protected areas.

The Reserves Act 1977 promotes the protection of natural heritage and provides for public use, management and development to meet the Reserve's primary purpose.

Section 41 of the Act requires the administering body to prepare management plans for all Reserves, other than those deemed to be for Local Purposes. Further, the administering body of any reserve is required to "..... keep its management plan under continuous review, so that the plan is adapted to changing circumstances or in accordance with increased knowledge ...".

5.2 Resource Management Act 1991 (RMA)

The 'allocation and use' of natural resources is managed under the RMA. This is particularly important when considering the management of wetlands and riparian margins.

The RMA is the statute empowering Regional Councils and Local Authorities to plan for and manage activities associated with digging drains, managing lakes and water courses for flood purposes, and it also provides for the setting of lake levels, maintaining water quality and managing bio-security risks and threats.

A key feature of the RMA is the ability to create an Esplanade Reserve or an Esplanade Strip on sub-division, where a "... sub-division encompasses or adjoins a river greater than 3m (average) in width; a lake 8ha or larger; or the sea; or, has the purpose of protecting, maintaining or enhancing the quality of the freshwater or marine environment ...". This instrument has been used to establish 'buffer margins' around several of the peat lakes.

It also established the framework for Regional and District Plans. Plans contain the objectives, policies and rules that govern the control of effects resulting from the use and development of terrestrial and aquatic resources.

5.3 Local Government Act 1974 and 2002 Amendment

The Local Government Act (LGA) requires Councils to prepare an Annual Plan which signals capital and operating expenditure. The annual plan will incorporate expenditure identified in policies and objectives in Management Plans.

The LGA also introduced a requirement for Councils to prepare a Long Term Council Community Plan (LTCCP). This plan provides direction Councils will take to meet community expectations and forecasts expenditure for the next 10 year period.

The LGA provides Councils with power to manage drains and drainage infrastructure that benefit communities and prevent property damage and health risks.

5.4 Queen Elizabeth II Trust Act 1987

The QE II Trust provides opportunities for landowners to covenant heritage features on their land. A covenant is a legally binding, voluntary agreement between the land owner and the Trust and is registered on the title. It provides, subject to agreed conditions, for the protection, restoration and management of the heritage asset.

Two lakes in the Waipa District are subject to a covenant under the QE II Trust Act. They are Lakes Maratoto and Rotongata. The former is regarded as the least modified and most pristine of the peat lakes, while the latter, within the Arohea District, is not regarded as a peat lake.

6.0 LINKAGES WITH OTHER PLANS AND DOCUMENTATION

6.1 Long Term Council Community Plan

Council's Long Term Council Community Plan was adopted in June 2006. Public submissions to the plan recognised the contribution natural heritage - including the peat lakes - and reserves make towards environmental and community health and well-being. Council has in turn recognised that the protection of the peat lakes together with outstanding landscapes, waterways and indigenous forests, is important and has dedicated funding for a five year restorative programme. This will focus on five priority peat lakes - Lakes Maratoto, Serpentine (Rotopiko), Rotomanuka, Mangakaware and Ngaroto.

6.2 Waipa District Plan

The District Plan was adopted in December 1997. The Plan is a requirement of the Resource Management Act 1991 and outlines the controls necessary to regulate and manage the development of land and any associated environmental effects. The Plan identifies policies and rules necessary to achieve a range of environmental objectives, including policies relating specifically to peat lakes.

Policy RU38 states: To prepare management plans for each of the protected areas (particularly the lakes within the District), to ensure that their unique qualities are protected.

6.3 Heritage Policy and Implementation Strategy

This Policy was adopted in 2004 and has as a goal to:

- Safeguard and enhance the heritage of the Waipa District

Supporting this goal are a number of Objectives. Those that relate to peat lakes are:

- To regulate and protect heritage values;
- To promote heritage advocacy and education;
- To develop heritage advocacy and protection initiatives;
- To develop and maintain heritage partnerships; and
- To promote responsible ownership of heritage values.

6.4 Community Leisure Plan

Waipa's Community Leisure Plan was adopted in May 2002. It is the guiding strategic document for the provision and development of the District's recreational facilities.

The Community Leisure Plan articulates the following Vision:

“Waipa is a District with vibrant and diverse leisure opportunities based on its natural environment, quality infrastructure, strong tradition and partnerships, and timely innovation”.

The Plan states that Waipa District Council will, amongst other things:

- Support the community’s physical well-being by making physical activity opportunities accessible, attractive and affordable.
- Support the community’s mental, social and cultural well-being by providing and promoting programmes, services and facilities that foster creativity, achievement, excitement and involvement, giving residents a strong sense of belonging and pride in their local community and District.

6.5 Regional Policy Statement (RPS)

The RPS, prepared by Environment Waikato (the Waikato Regional Council) has identified ‘peat lakes’ as important ecological sites and has introduced policies that will avoid environmental effects resulting from resource use and development.

6.6 Regional Plan

The Water Module of the Regional Plan proposes policy that will work towards a net improvement in water quality, preservation of ‘natural’ and/or ‘indigenous’ character through the adoption of water classes and standards, controls on effluent discharges within the catchments of sensitive, closed water systems, and the setting of minimum levels for lakes.

7.0 EXISTING MANAGEMENT AND MANAGEMENT ISSUES

Management direction is taken from approved management plans and Council policies and guidelines. Any departure from established protocols or any significant new project, requires approval from Council.

7.1 Waipa Peat Lakes and Wetlands Accord

Council is a signatory to the Waipa Peat Lakes and Wetland Accord. The Accords primary purpose is:

‘ .. to align the activities of management agencies when working with land owners, tangata whenua and interested parties towards the restoration and enhancement of lake and wetlands in the Waipa District’.

The Accord also has a number of objectives designed to:

- promote the sustainable management of lakes and wetlands
- encourage the restoration of degraded lake and wetlands
- maintain assessment and monitoring programmes
- develop and share expertise in lake and wetland management
- raise awareness through education and information

In developing this Management Plan, Council will have regard to the Accord's primary purpose and stated objectives.

7.2 Management Plans and Related Literature

Management Plans and resource inventories have been prepared for a number of Lake Reserves and adjoining Recreation Reserves. These are:

7.2.1 Lake Serpentine (Rotopiko) and Serpentine Recreation Reserve

A draft Plan was prepared in 1978 and addresses both the Government Purpose (Wildlife Management) Reserve administered by DOC and the adjoining Recreation Reserve administered by Council. The intention at that time was for Council to seek control and management of the lake reserve. This initiative never eventuated and the plan was never approved by Council.

7.2.2 Lake Rotomanuka

An inventory and Management Plan was prepared for the Lake Rotomanuna Government Purpose (Wildlife Management) Reserve in 1978, but was never approved.

7.2.3 Management of the Waipa Peat Lakes

In 1978, following the collation of resource material on all lakes within the District by the University of Waikato, a number of practical management recommendations were made to Council with the aim of minimising further deterioration of the lakes. The focus was on reducing enrichment, creating buffers around the lakes, setting minimum lake levels, excluding stock from the lake margins, providing for public use and controlling pest plants and animals. This report provides a very useful reference.

7.2.4 Lake Ruatuna Recreation Reserve

A Management Plan for this Reserve was adopted by Council in November 1981. The Plan promoted the use of the Reserve for recreation and education; the development of service facilities; and planting of suitable vegetation. A storage and ablution block has been built on site to service schools using the lake for school camps.

7.2.5 Esplanade Reserve Recommendations

In 1993 a report was prepared by the Water Research Unit of Waikato University and MAF Quality Management Ruakura Agricultural Centre for the Waipa District Council and the Department of Conservation. The purpose of this report was to identify the width of Esplanade Reserves required around Lakes Serpentine (Rotopiko), Mangahia, Ruatuna and Cameron to protect them from the influences of agriculture and other land use.

7.2.6 Waipa District Lakes Study

In 1997 the Water Research Unit of the University of Waikato made recommendations for the restoration and sustainable management of the Waipa peat lakes. Although now nine years old, the recommendations made are still valid today and will provide very useful guidelines for future management.

7.3 Adopting Generic Plans for Reserves

The Reserves Act 1977 requires management plans to be prepared for all Recreation Reserves vested in Council. Further, management plans must be prepared within five years of vesting and plans for all reserves other than Local Purpose, Government purpose and Recreation Reserves, must be approved by the Minister of Conservation.

Given the large number of Reserves administered by Council and the five year time constraints, Council's Policy Committee endorsed (12 May 2003) a generic approach to renewing management plans, where one plan could cover the management of a number of similar reserves. This approach has been applied to all peat lake-associated reserve land administered by Council, with the exception of Lake Ngaroto. Lake Ngaroto is of sufficient size and importance to warrant its own management plan.

Further, there are a number of land parcels that have yet to be formally reserved, vested in Council and classified under the Reserves Act 1977. There is no impediment in Council managing unclassified land as if it were classified as reserve, so long as that intention is signaled in a draft reserve management plan. Ideally, however, classification should precede the reserve management plan development process. This is reflected in advice received from Land Information, who advise that without the 'clarity of purpose' that formal classification provides, it may be difficult for interested parties or reserve users to understand or interpret the intent of aims and policies in this management plan.

The administrative provisions of the Reserve Act 1977 will be followed and it is proposed that in time an appropriate classification will be adopted for any unclassified land parcels to be used for peat lake reserve purposes. Notwithstanding the classification issue, these parcels will be subject to the provisions of this Plan.

8.0 THREATS TO PEAT LAKES

8.1 Land Use and Development

Development of the Waipa peat land began soon after the land wars (1860's) with the purchase and sub-division of the Rukuhia and Moanatuatua peat domes by colonial settlers. In 1869-70 the first significant drainage channel was dug into the Moanatuatua peat dome via Walker Gully. This drain was reported as "...14 foot wide and 14 foot deep..". (Footprints in History: No 26)

The Waikato Times reported in 1881, that "... development had been pushed ahead vigorously and that the present acreage of grassed surface sown and ploughed was between 3000 and 4000 acres... ...Of this, some 800 acres was drained swamp..". It was reported there were over 80 miles of drains on private property many of which had cost six pounds per chain.

The Rukuhia swamp was also being drained around the same period, initially via an outlet at Melville south of Hamilton known as Excelsior stream. But progress up until 1905 was slow. It wasn't until the original large properties were sub-divided and sold and techniques for draining and managing pastures on peat soils were refined, that development began in earnest.

By the 1970's wetlands were fast disappearing. National surveys concluded less than 10% of wetlands present at the turn of the century remained. The percentage remaining in the Waipa District was much less.

During the 1980's a concerted effort was made by Government agencies and local authorities to protect those wetlands that remained in the Waipa. Most of the Crown administered lake beds not reserved at that time, were reserved and classified under the Reserves Act 1977 as reserves for Government Purpose (Wildlife Management) or Recreation.

Reservation alone however, failed to prevent continued ecological and hydrological change. Many of the Reserve boundaries, which generally followed the water edge at the time the lake was surveyed, did not consider the natural processes that originally formed the lakes or were required to maintain the lake plant and animal communities in a viable state. Re-assessing the boundaries of many existing Reserves and identifying boundaries for those lakes not reserved, will be a requisite to the long-term protection of the Waipa peat lakes.

8.2 Drainage and Peat Settlement

The natural hydrological regime of many lakes has been altered through drainage activities and the inevitable settlement of peat substrates adjoining the lakes. Drains have been excavated into the lakes and lake outlets have been deepened and widened over time to purposefully reduce water levels.

Peat shrinks as it oxidises and the rate of shrinkage accelerates if fertilizers and nutrients are added. Shrinkage rates can vary from 20mm to over 70mm per year. With lime and fertilisers still being applied to maximise production from peat soils, we can expect continued oxidation and surface settlement. Without buffers being established around the lakes to isolate them from the effects of drainage and settlement, they could eventually disappear. At best they will be “perched”, island within a pasture landscape.

8.3 Contaminants

All the lakes have been impacted to a greater or lesser degree by contaminants transported from surrounding land. Development of the lake catchments for agriculture generates materials that contaminate water. Soil disturbance and earthworks release clay and soil particles and often these have phosphorus particles attached. Nitrogen fixing plants, agricultural and horticultural fertilizers and animal excreta produce nitrogen and phosphorus compounds. Animal excreta is also the source of microbes (bacteria and viruses etc), and pesticides and herbicides can end up on the ground surface.

All these materials are generally mobilised by water and washed into the ground or into water ways. In combination these inputs can, when introduced into a closed water system like a lake, irreversibly modify water chemistry, cause algal blooms and harm aquatic communities. This is particularly so with peat lakes, as most are/were naturally low in fertility and support communities that have adapted to such conditions.

8.4 Sedimentation

Under rain fall events sediments exposed through the removal of vegetation cover, earthworks and surface tillage, will become mobilised and washed into water courses and eventually lakes. Excessive sediment will reduce water depth and contribute to reduced water clarity through suspension of inorganic colloidal particles.

All wetlands are undergoing natural process that will, in a geological time frame, eventually turn them into dry land. This eventual loss was compensated for by the creation of new wetlands through river meanderings, land movements and other geological events. Today however, there is a net loss of all wetland types. Flood / river control schemes and land drainage have prevented the forming of natural wetlands and human use of the land is accelerating the infilling processes.

8.5 Introduced Pest Plants and Animals

An inevitable consequence of settlement and international trade is the introduction, either natural or otherwise, of unwanted or undesirable plants and animals. Many of these plants and animals are opportunistic, flexible in their food/habitat requirements and can adapt readily to environmental change. They either compete with, displace, graze or predate native/endemic species. Once established many cannot be eradicated and are difficult to control.

The focus of any pest programmes should be firstly, to eradicate targeted pests where possible and secondly, control pests to acceptable levels to avoid species loss or structural changes to communities. In both cases it is extremely important to ensure an appropriate level of pest surveillance is undertaken to detect new incursions.

8.5.1 Pest Plants (weeds)

The native aquatic flora of NZ has been described as “rather small, both in numbers and stature” (Johnson and Brook 1998) which has enabled a number of aggressive exotic species to become naturalised and widespread.

Species that have had a pronounced effect on the Waipa Lakes include: oxygen weeds (*Elodea*, *Lagarosiphon* and *Egeria*) brought into NZ as aquarium plants or as packing for fish ova; curled pond weed (*Potamogeton crispus*) and hornwort (*Ceratophyllum demersum*) all of which occupy the open water area. Alligator weed (*Alternanthera philoxeroides*) which arrived in the 1880's in ballast water discharged from ships, reed sweet grass (*Glyceria maxima*) planted as stock food and primrose willow (*Ludwigia peploides*) now occupy open water margins; and the moist soils have been colonised by crack willow (*Salix fragilis*), grey alder (*Alnus glutinosa*), yellow flag (*Iris pseudacorus*), and in the more peaty areas, by grey willow (*S. cinerea*).

Exotic plants generally out-compete native species for space, are more tolerant of hydrological modifications and taller plants can reduce plant diversity and abundance through shading.

8.5.2 Pest Fish

The recent ‘connection’ through drainage of many lakes to larger streams and rivers, has also enabled introduced fish species like European/koi carp (*Cyprinus carpio*); rudd (*Scardinius erythrophthalmus*); mosquito fish (*Gambusia affinis*); bullhead catfish (*Ictalurus nebulosus*) and goldfish (*Carassius auratus*) to colonise. Introduced fish, now common in many of the larger lakes, survive well in changed environments and out-compete most native fish for habitat and food. Species like koi have also been implicated in changing water quality by mobilising materials as they grub through bottom sediments for food and uproot submerged plant communities.

8.5.3 Pest Mammals

Wetlands are favoured habitats for introduced mammalian predators like the brown rat (*Rattus norvegicus*); Mustelids - stoat (*Mustela erminea*), ferret (*M. furo*) and weasel (*M. nivalis vulgaris*) - introduced into NZ for rabbit control; brush tailed possum (*Trichosurus vulpecula*) which is both a opportunistic predator and browser; house cat (*Felis catus*) and European hedgehog (*Erinaceus europaeus occidentalis*).

Introduced predators are likely to be the reason for the reduced distribution and low numbers of most native wetland birds today.

8.6 Public Use

Those lakes Reserved under the Reserve Act 1977, are available for public recreation, although several Reserves do not have formed public access.

Use of most reserves is passive in nature apart from the game bird hunting during the annual season (May to August). Recreational or customary harvest of tuna (two native and one Australian species) is permitted within Reserves, but harvest limits apply. It is illegal under the Reserves Act 1977 to commercially harvest any indigenous species.

9.0 MANAGEMENT AIMS AND OBJECTIVES

The Heritage Policy and Implementation Strategy together with additional policy adopted by Council in October 2006, signaled the general direction management will take for peat lake reserves and other adjoining land administered by Council.

Management of these reserves aims to:

- focus resources on those lakes that are most representative of the Waipa peat lakes, have the greatest potential for restoration and can be secured against known threats longer term;
- work collaboratively with all agencies that have statutory responsibilities to manage lakes in public ownership, land owners and interest groups;
- to ensure the primary purpose for those lake gazetted and classified under the Reserves Act 1977, are met;
- promote the protection and management of peat lakes on private land and encourage land owner involvement through incentives: and,
- to promote wetlands as sites that can offer recreation, exercise and health benefits to the general public.

10.0 GENERAL POLICY FOR THE WAIPA PEAT LAKES AND LAND ADJOINING THESE LAKES

The following policies have been developed specifically to address the threats/pressures on the peat lakes and their margins and to manage future development and public use.

10.1 Policy One: Adjoining Land Use and Development

Justification

Inappropriate use of land adjoining peat lakes poses the greatest threat to their long term viability. To separate the physical and biological processes associated with the

lake from inappropriate adjoining land use, it is desirable to create a physical barrier or buffer between the two.

Council will:

- actively pursue the creation of buffer zones around all crown administered/reserved peat lakes, either through vesting of land on subdivision (Reserve Strip and Esplanade Reserves); the use of Environment or Heritage Protection Lot provisions in the District Plan; or through land purchase;
- manage any buffer zone created in a manner that will reduce detrimental impacts on both physical and biological processes operating within the lake environs and compliment the primary purposes of the Reserve or lake; and,
- work with Peat Lake Accord members and other state agencies in achieving these outcomes.

10.2 Policy Two: Managing Levels, Drainage and Peat Settlement

Justification

Maintaining minimum lake levels and in turn, appropriate ground water levels around the lake margins, is a prerequisite to ensuring the plant communities associated with these margins are sustained over time and the lake is contained within a 'peat dam'.

Council will:

- seek appropriate minimum lake levels for Council administered peat lakes and support the setting of minimum levels of other lakes;
- prohibit new drainage activity within Reserves or land administered by Council which may impact on lake levels or ground water levels;
- reroute, wherever possible, drains on Council administered land and modify these drains to encourage filtering through wetland vegetation prior to discharge into a Lake Reserve;
- seek new Rules and actively support existing Rules in the Regional Plan that require a resource consent to excavate and maintain drains within 200m of an existing Lake Reserve and to maintain minimum ground water levels; and,
- promote controls on the use of land within a 200m margin of a peat lake reserve to promote sustainable land use practices and to avoid excessive peat settlement and peat loss.

10.3 Policy Three: Managing Contaminants and Sedimentation

Justification

Inflowing contaminants and sediments change water chemistry, biological communities and physical processes and, ultimately contribute to a loss of indigenous biodiversity, environmental health and restrict human recreational opportunities.

Council will:

- control the use of fertilizers on Reserve and other land administered by Council to avoid excess nutrients entering peat lakes and work with Environment Waikato to reduce the use of fertilizers within peat lake catchments;
- restrict the grazing of stock on all Reserve land to protect riparian vegetation, avoid land pugging/damage to soil structure and contamination of soils;
- promote land use practices within lake catchments that will reduce or eliminate sediment flowing into lake reserves;
- manage exposed surfaces to avoid sediment mobilisation on reserve or other land administered by Council; and,
- promote controls on land use through the District Plan to reduce or eliminate contaminants and sediments draining from adjoining land.

10.4 Policy Four: Managing Introduced Pests (Plants and Animals)

Justification

Pest plants and animals threaten indigenous species and communities, and erode natural character and landscape variety by removing palatable plants and vulnerable animals and insects.

Council will:

- meet its obligations for the control and management of pest plants and animals required by the Regional Pest Management Strategy 2007 – 2012 and Bio-security Act 1993;
- ensure all contractors employed to undertake pest control operations are suitably qualified and certified for handling and applying pest control chemicals and adhere to approved methods for storage, handling and delivery of such chemicals;

- undertake regular surveillance on Reserves or other land administered by Council and target plant pests that pose the greatest threat to the viability of indigenous species and communities; and,
- support pest eradication and control initiatives undertaken by EW and DOC on and around lake reserves.

10.5 Policy Five: Fostering Community Involvement

Justification

Wetlands are catchment “sinks” and their condition reflects the type of land use within catchments, but more importantly how well the land is managed. It is therefore essential for managers of wetlands to engage adjoining landowners and interested parties, and seek their support and co-operation whenever possible in realising wetland conservation goals.

Council will:

- encourage landowner and community involvement in the preparation of management plans for reserves and other land administered by Council;
- work with Environment Waikato, Department of Conservation, Iwi, Auckland Waikato Fish & Game, Queen Elizabeth II Trust, Landcare Groups and other interested parties to promote changes in land use practices that will reduce environmental impacts on lake environments; and,
- provide advice and wherever possible incentives to landowners, community and user groups to encourage the implementation of sound land use practices that will reduce or eliminate environmental impacts on lake environments.

10.6 Policy Six: Promoting and Managing Use

Justification

Use of the peat lakes was traditionally limited to gathering food for personal use or trade, game bird hunting and recreational boating (on the larger lakes). Today, people are seeking to balance their busy lifestyles, particularly those in urban communities, with a range of outdoor experiences. Wetlands are now recognised as interesting, biologically diverse places that contribute to water quality and environmental health and offer opportunities for education, research and recreation. Wetlands can offer both passive and active experiences that compliment the more traditional sports and outdoor activities. There is a growing awareness and desire by communities to invest in the restoration of wetlands for recreational and aesthetic purposes as demonstrated by the increasing number of Land and Lake Care Groups throughout the Waikato Region.

Council will:

Manage use by:

- providing access through Council administered land and promote recreational opportunities where such use is appropriate and consistent with the primary purpose of the reserve and any adjoining reserve;
- ensure infrastructure supports public use and is of a standard of construction that complies with provisions of the Building Act 2004 (SNZ HB. 8630:2004), District Plan and Reserves Act 1977. This includes: car parks, picnic tables, paths, walkways flat-forms and the like;
- authorising the construction of buildings where those buildings directly support a permitted recreational use; are required for management purposes; and, meet the provisions of the Building Act 2004, District Plan and the Reserves Act 1977;
- permitting dog access to the Council administered Reserves and land, for exercise and game bird hunting purposes, provided the provisions of Council's Dog Control Bylaw 2004 are met;
- ensuring compliance of Section 50 of the Reserves Act 1977 which prohibits the taking of any indigenous fauna for commercial purposes; and,
- ensuring all health and safety risks are well understood by recreational users.

Enhance people's experiences and understanding of peat lakes by:

- providing interesting and informative interpretation at key locations, and where appropriate and in conjunction with the Department of Conservation, develop "show case" sites where a range of quality wetland experiences are available to visitors; and,
- maintaining these sites and interpretative aids to a high standard.

10.7 Policy Seven: Managing Ecological Values

Justification

A primary objective in the management of peat lakes, is to improve/maintain ecological integrity. Robust, naturally functioning systems support viable and interacting communities. They also provide the greatest opportunities for human appreciation and interaction.

Council will:

In protecting and restoring habitats / ecosystems on Council administered land;

- lead the restoration of under represented flora and fauna like *restiad* and *sphagnum* plant communities, and actively support such initiatives on Reserve and other Council administered land;
- use Council administered land to retain connectivity between habitats and biological communities;
- support initiatives taken by community groups and agencies to reintroduce species lost from a site through human or pest pressures;
- ensure plants selected to restore sites are functional, provide for specie needs and are from appropriate genetic stock; and,
- provide access for migratory native fish.

Protect and enhance biodiversity by:

- ensuring rare and threatened species, as determined by the Department of Conservation, are a priority for protection and management, and participating in species recovery programmes where Council administered land can play an important role; and,
- ensuring habitat and species diversity at sites is retained and promoted.

10.8 Policy Eight: Managing the Lake Landscapes

Justification

Peat lakes are very much a feature of the rural landscape of the Waipa District. An open water body fringed by vegetation within an landscape of lush pasture and tree stands, offers Waipa residents and visitors aesthetically pleasing views from State Highway 3 between Hamilton and Te Awamutu and from other roads. Protecting this diverse, vibrant rural setting will help retain Waipa's identity and generate a 'sense of place', to which local communities can relate.

Council will:

Imitate "nature" where appropriate by:

- restoring natural indigenous communities on Council administered land; and
- retaining and promoting natural patterning, colours and textures.

Enhance local identity by:

- protecting natural features that make a significant contribution to landscape features;
- providing services, using building materials and styles consistent with that commonly used in the area;
- using artworks, design and interpretative materials that aid understanding of the locality; and,
- ensuring key features like peat lakes and their environs remain visible from transport corridors and townships.

10.9 Policy Nine: Managing Historic and Cultural Heritage

Justification

Peat lakes played an important role in the lives of Maori providing food, materials for habitation and security from attack. Evidence of 'kaianga' and Pa can be found on many of the lakes, but particularly Maratoto, Ngaroto and Mangakaware. Early European settlers also exploited the lakes for food, taking waterfowl and fish.

Swamp Pa associated with the Waipa Peat Lakes, like those on the shores of Lake Mangakaware and Ngaroto, are recognised as nationally important historic and archaeological sites.

Council will :

Preserve historic and archaeological heritage assets and features by:

- identifying archaeological and cultural sites on Council administered land;
- consulting with Historic Places Trust and tangata whenua on the protection and management of such assets and features;
- preparing conservation plans for historic and archaeological sites where recreational or other use of that land may conflict with the protection of those assets and features;
- promoting appropriate and informative interpretation of sites/assets where use is likely to be high; and,
- ensuring statutory obligations under the Historic Places Act are met.

10.10 Policy Ten: Grazing

Justification

Under the right circumstances, grazing may be seen as a legitimate use of Reserve and Council administered land if those lands are under utilised or not required for recreation or conservation purposes. Controls will be necessary to ensure any grazing undertaken will not compromise future use of the land for recreation or conservation purposes.

- Where Reserve land is not immediately required for recreation or conservation purposes, it may be fenced and grazed as a method of maintenance and or weed control, subject to Section 74 of the Reserves Act 1977, and provisions under the Regional Plan that control stock access to wetlands; and,
- Where Reserve land is not required longer term and is suitable for grazing, this land can be offered for grazing. The area to be grazed will be clearly identified and subject to a grazing plan which will stipulate all conditions, controls and inputs, deemed necessary to manage the land. Any person taking up the grazing opportunity must comply with the grazing plan.

10.11 Policy Eleven: Leases and Licenses and Commercial Use

Justification

It is recognised that, in the right circumstances, leasing of land can be beneficial to both Council and Community Groups. The lease functions as a contractual agreement to ensure that Council property is appropriately managed and maintained to an agreed standard. At the same time it is recognised that lease agreements are necessary to enable continuity and forward planning for lessees. Currently Council has two types of leases for land subject to this Plan. These are grazing leases and community leases.

- At the discretion of Council, leases are typically for a period of 10 years. In accordance with the specifics of the lease documentation, they may be altered or terminated with due notice by either party; and,
- Lease applications will be assessed in accordance with the compatibility of the proposed activity with the primary purposes of the Reserve and taking into account the Planning Principles identified in the Waipa District Council's Community Leisure Plan and Heritage Policy and Implementation Strategy; and,
- The Peat Lake Reserves shall not be used to house commerce or industry which is unrelated to or not connected with the primary use of the Reserve.

10.12 Policy Twelve: Reserve Classification

Justification

Not all land purchased by or vested in Council for the purposes of protecting or managing a peat lake reserve, has been formally reserved and classified. Those parcels awaiting reservation and classification will be formally processed as a priority. As reservation is a prerequisite to management planning, management of those land parcels will be guided by and in general accordance with, this Plan.

Council will:

- as a matter of priority, ensure the reservation and classification of Council administered land deemed important in managing and conserving peat lake reserves

10.13 Policy Thirteen: Policy Review

Justification

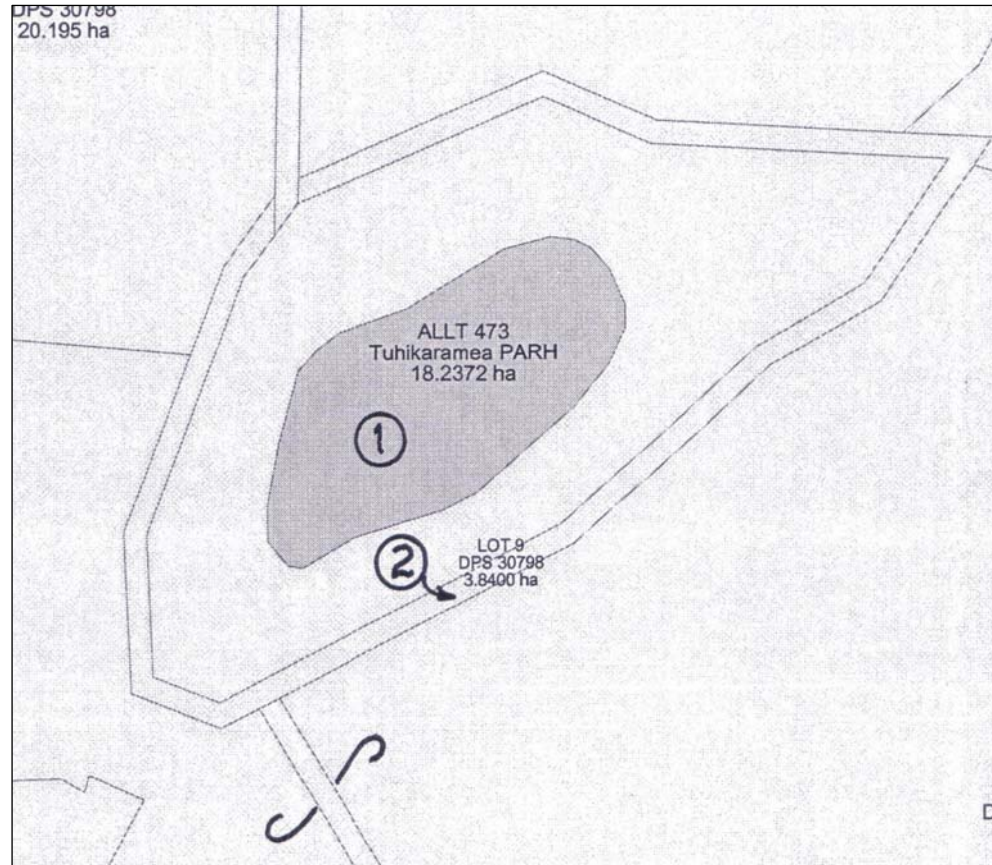
The Reserves Act 1977 requires that reserve management plans are periodically reviewed. With an expected growth in population and more intensive use of land, pressures on and use of reserves associated with peat lakes is likely to increase. Policies may need to change to adequately manage these changes.

- The policies outlined in the reserve management plan will be reviewed every 5 years, or as changing circumstances dictate;
- If the review entails major changes to the reserve management plan, Council will undertake full public consultation in accordance with the requirements of the Reserve Act 1977. A periodic review entailing minor updates will not require full public consultation.

11.0 SCHEDULE OF LAND ADMINISTERED BY COUNCIL

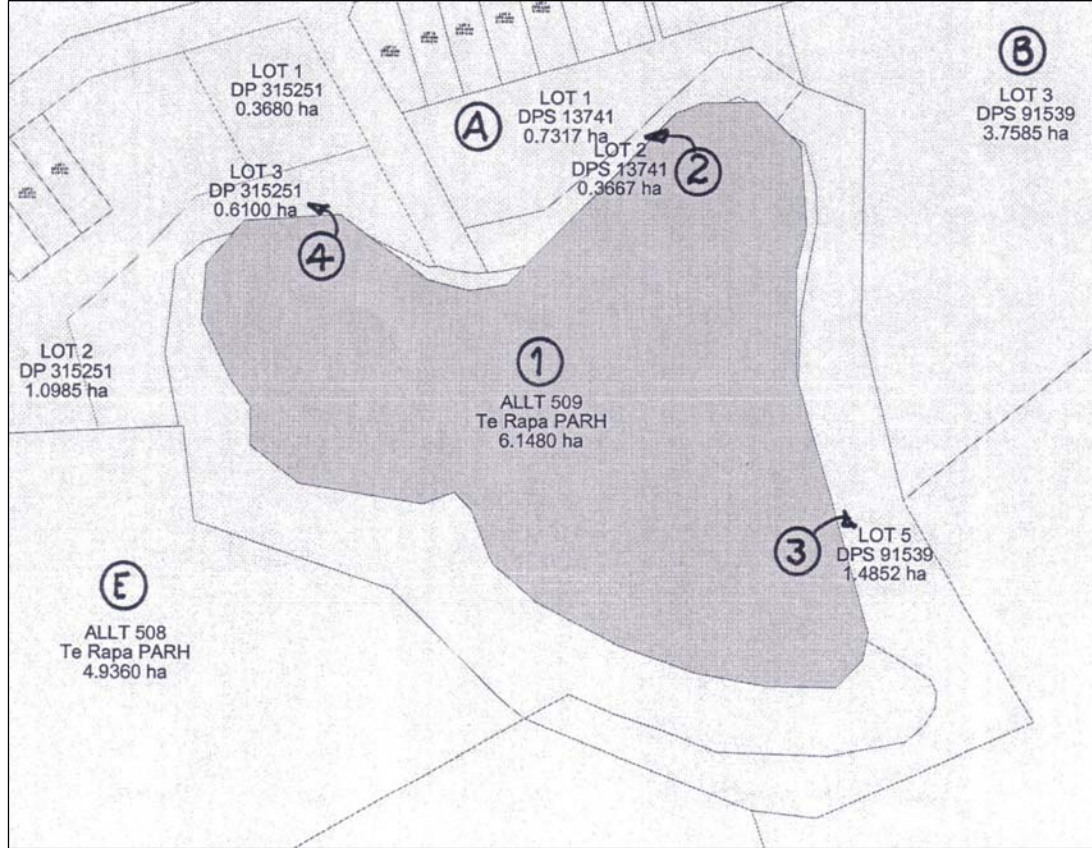
11.1 Lake Koromatua

Parcel No.	Legal Description	Area (Ha)	Title Ref	Acquisition History	Classification
1	Allotment 473, Tuhikaramea Parish [SO 50574]	18.2372	NA [Crown]	Crown land set apart as a Government purpose (wildlife management) reserve by NZ Gazette 1983 p.1559 [Document H.467398].	Classified Government purpose (wildlife management) reserve subject to the Reserves Act 1977 by NZ Gazette 1983 p.2314 [Document H.479054].
2	Lot 9, DPS 30798	3.8400	Required	Local purpose (esplanade) reserve vested in the Waipa County Council in 1986 on subdivision of CT 637/261 and CT 1777/77 under S.306, Local Government Act 1974	Required exercising S.16(2A), Reserves Act 1977.
Total Area		22.0772			



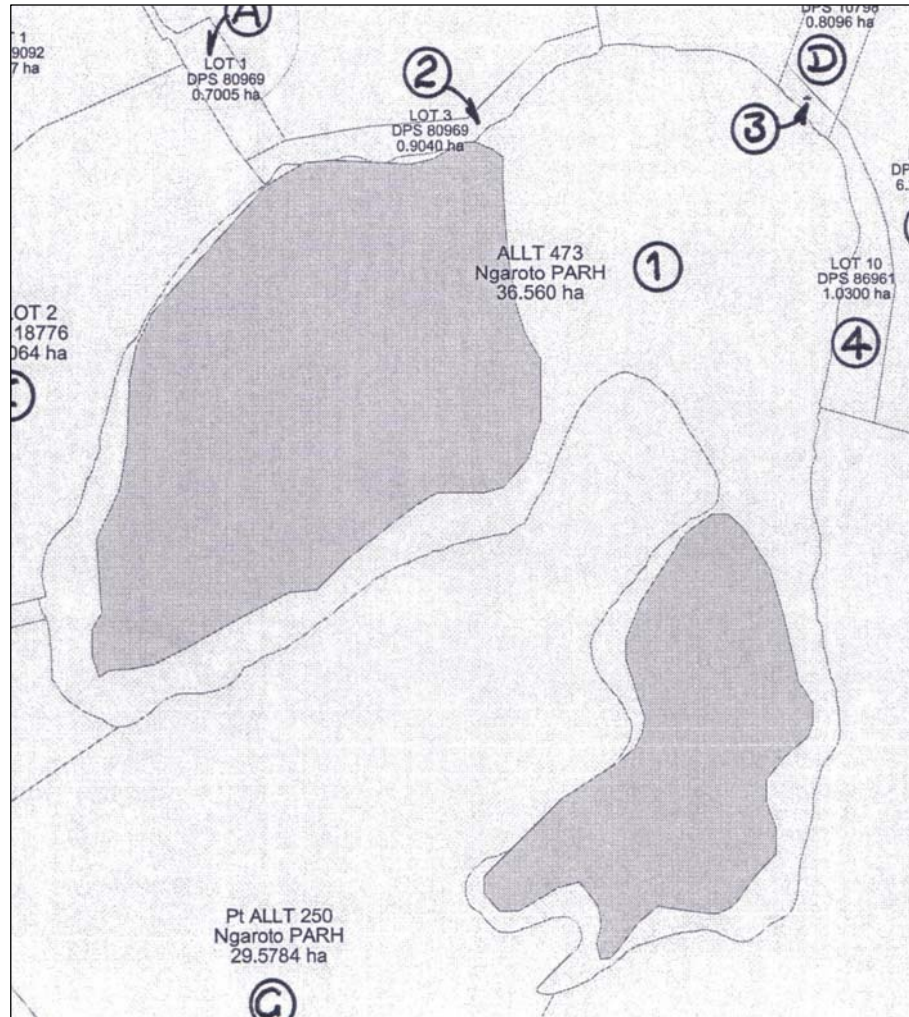
11.2 Lake Cameron (Kareaoahi)

Parcel No.	Legal Description	Area (Ha)	Title Ref	Acquisition History	Classification
1	Allotment 509, Te Rapa Parish [SO 53439]	6.1480	NA [Crown}	Crown land set apart as a recreation reserve by NZ Gazette 1985 p.2088 [Document H.591561]. Waipa County Council appointed to control and manage by NZ Gazette 1985 p.2718 [Document H.599798].	Classified recreation reserve subject to the Reserves Act 1977 by NZ Gazette 1985 p.2718 [Document H.599798].
2	Lot 2, DPS 13741	.3667	Required	Esplanade reserve vested in the Waipa County Council on subdivision of CT 1717/29 in 1970 under S.35, Counties Amendment Act 1961.	Classified local purpose (esplanade) reserve by operation of S.16(11)(b)(iv), Reserves Act 1977.
3	Lot 3, DPS 91539	1.4850	SA72B/834	Vested in Waipa District Council in 2001 as local purpose (esplanade) reserve on subdivision of CT 49B/654 under S.239, Resource Management Act 1991.	Required exercising S.16(2A), Reserves Act 1977.
4	Lot 3, DP 315251	.6100	60130	Vested in Waipa District Council in 2002 as local purpose (esplanade) reserve on subdivision of CT 9D/1179 under S.239, Resource Management Act 1991.	Required exercising S.16(2A), Reserves Act 1977.
Total Area		8.6097			



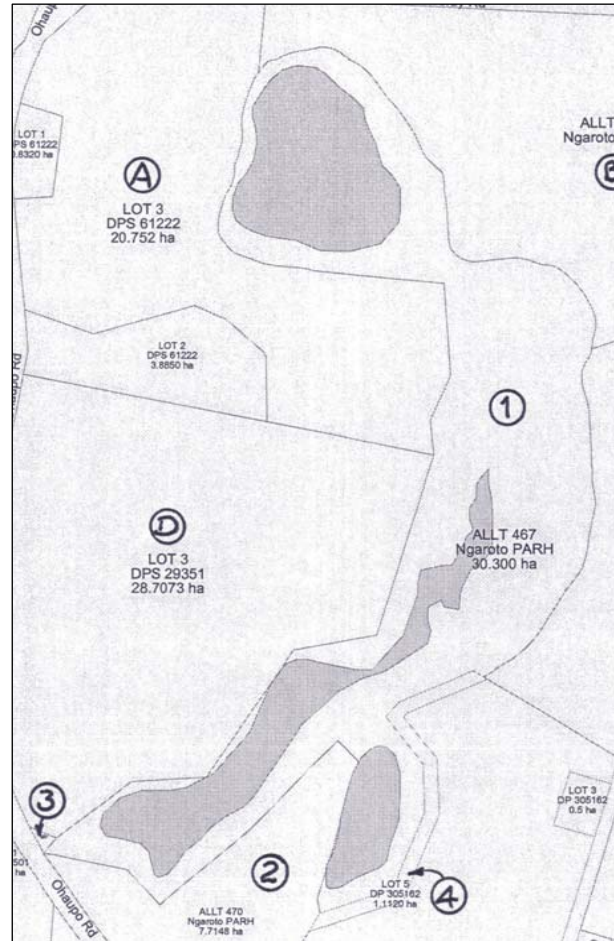
11.3 Lake Rotomanuka

Parcel No.	Legal Description	Area (Ha)	Title Ref	Acquisition History	Classification
1	Allotment 473, Ngaroto Parish [SO 52372]	36.5600	NA [Crown}	Crown land set apart as a Government purpose (wildlife management) by NZ Gazette 1983 p.1558 [Document H.467397].	Classified Government purpose (wildlife management) reserve, subject to the Reserves Act 1977 by NZ Gazette 1983 p.2024 [Document H.475079].
2	Lot 3, DPS 80969	.9040	SA65C/502	Vested in the Waipa District Council in 1998 as local purpose (esplanade) reserve on subdivision of CT 5A/416 under S.239, Resource Management Act 1991.	Required exercising S.16 (2A), Reserves Act 1977.
3	Lot 2, DPS 10798	.1391	Required	Vested in Waipa District Council in 1967 as esplanade reserve on subdivision of CT 788/274 under S.35, Counties Amendment Act 1961.	Classified local purpose (esplanade) reserve by operation of S.16(11)(iv), Reserves Act 1977.
4	Lot 10, DPS 86961	1.0300	SA69A/18	Vested in Waipa District Council in 1998 as local purpose (esplanade) reserve on subdivision of CT 16D/1211 and CT 67D/621 under S.239, Resource Management Act 1991.	Required exercising S.16(2A), Reserves Act 1977.
Total Area		38.6331			



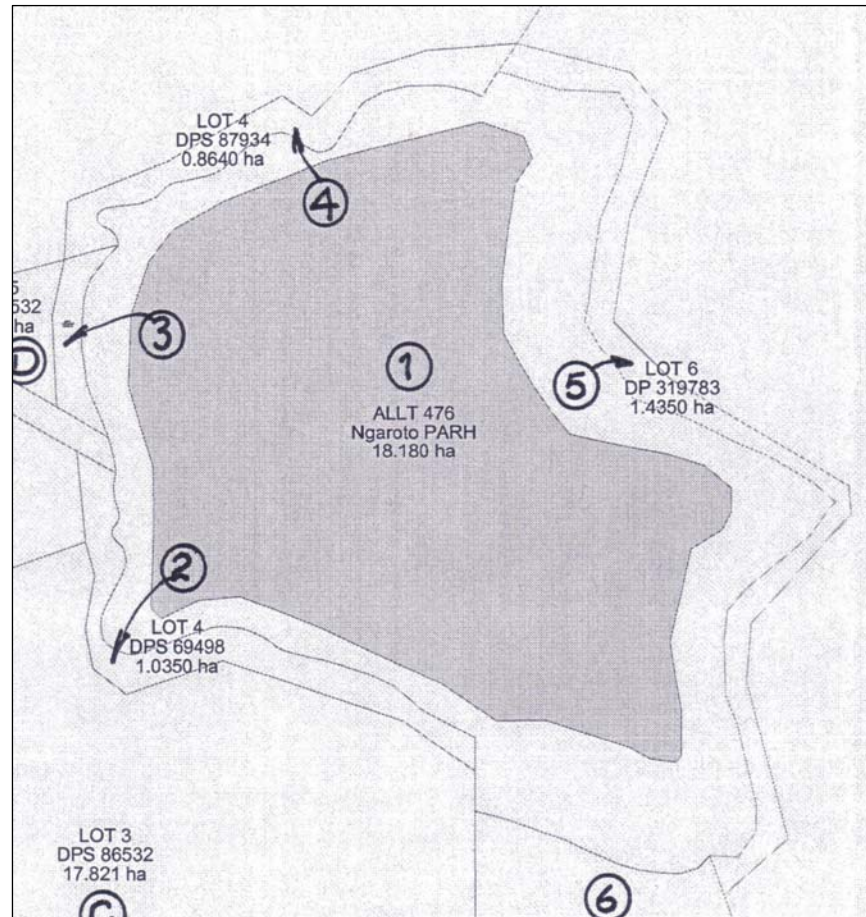
11.4 Lake Serpentine (Rotopiko)

Parcel No.	Legal Description	Area (Ha)	Title Ref	Acquisition History	Classification
1	Allotment 467, Ngaroto Parish [SO 50589]	30.3000	NA [Crown}	Crown land set apart as a Government purpose (wildlife management) reserve by NZ Gazette 1983 p.570 [Document H.457598].	Classified Government purpose (wildlife management) reserve subject to the Reserves Act 1977 by NZ Gazette 1986 p.11 [Document H.636979].
2	Allotment 470, Ngaroto Parish [SO 50990]	7.7148	NA [Crown}	Crown land set apart as a recreation reserve by NZ Gazette 1983 p.570 [Document H.457597]. Waipa County Council appointed to control and manage by NZ Gazette 1983 p.569. Fee simple remains with the Crown.	Classified recreation reserve subject to the Reserves Act 1977 by NZ Gazette 1984 p.5471 [Document H.563057].
3	Allotment 471, Ngaroto Parish [SO 49318]	.0583	NA [Crown}	Crown land set apart as a recreation reserve by NZ Gazette 1983 p.570 [Document H.457597]. Waipa County Council appointed to control and manage by NZ Gazette 1983 p.569. Fee simple remains with the Crown.	Classified recreation reserve subject to the Reserves Act 1977 by NZ Gazette 1984 p.5471 [Document H.563057].
4	Lot 5, DP 305162	1.1120	21105	Vested in Waipa District Council in 2002 as local purpose (esplanade) reserve on subdivision of CT 729/223 under S.239, Resource Management Act 1991.	Required exercising S.16(2A), Reserves Act 1977.
Total Area		39.1851			



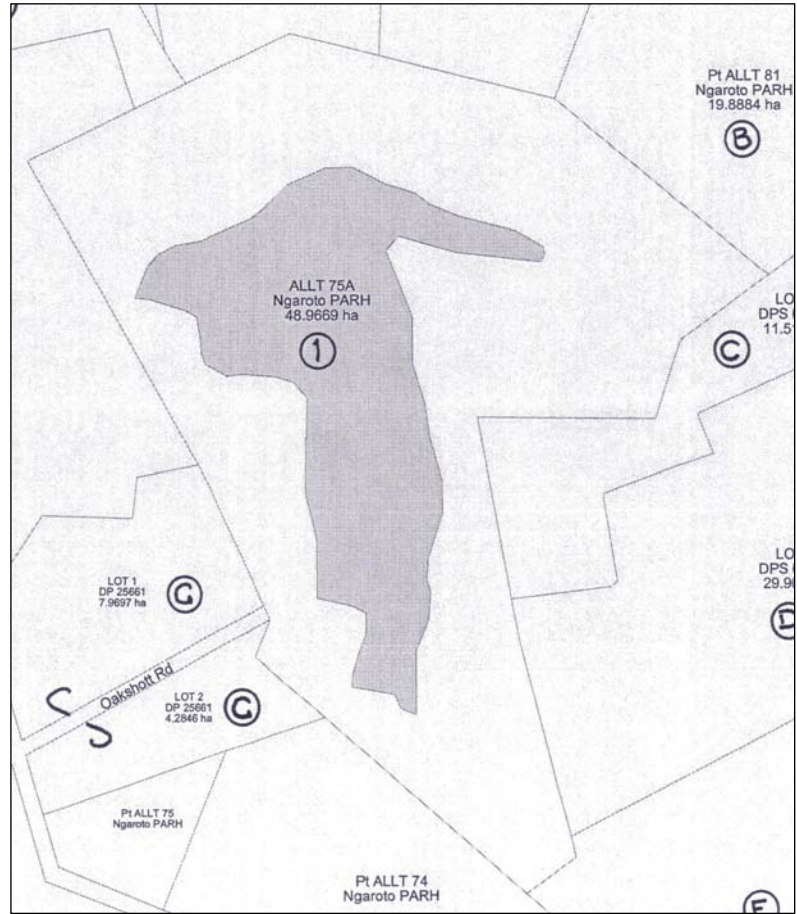
11.5 Lake Ruatuna

Parcel No.	Legal Description	Area (Ha)	Title Ref	Acquisition History	Classification
1	Allotment 476, Ngaroto Parish [SO 52430]	18.1800	NA [Crown]	Crown land set apart as a Government purpose (wildlife management) reserve by NZ Gazette 1983 p.1559 [Document H.467634]. Jurisdiction rests with the Crown.	Classified Government purpose (wildlife management) reserve subject to the Reserves Act 1977 by NZ Gazette 1983 p.2024 [Document H.475078].
2	Lot 4, DPS 69498	1.0350	SA55D/176	Vested in the Waipa District Council in 1995 as local purpose (esplanade) reserve on subdivision of CT 36A/805 under S.239, Resource Management Act 1991.	Required exercising S.16(2A), Reserves Act 1977.
3	Lot 3, DPS 69498	.2700	SA55D/175	Vested in the Waipa District Council in 1995 as local purpose (esplanade) reserve on subdivision of CT 36A/804 under S.239, Resource Management Act 1991.	Required exercising S.16(2A), Reserves Act 1977.
4	Lot 4, DPS 87934	.8640	SA69C/925	Vested in Waipa District Council in 2000 as local purpose (esplanade) reserve on subdivision of CT 66B/747 under S.239, Resource Management Act 1991.	Required exercising S.16(2A), Reserves Act 1977.
5	Lot 6 DP 319783	1.4350	77924	Vested in Waipa District Council in 2003 as local purpose (esplanade) reserve on subdivision of CT 398/252 under S.239, Resource Management Act 1991.	Required exercising S.16(2A), Reserves Act 1977.
6	Part Allotment 176A, Ngaroto Parish	2.2943	NA [Crown]	Formerly part of the Ngaroto Domain declared to be recreation reserve by NZ Gazette 1957 p.627. [Reservation over parts – Allotments 437 and 480, Ngaroto Parish now form an enclave owned by Peter Geoffrey Hampton and Gay Elizabeth Summers.] Waipa County Council appointed to control and manage by NZ Gazette 1981 p.27.	Classified recreation reserve subject to the Reserves Act 1977 by NZ Gazette 1981 p.25 [Document H.324429].
Total Area		24.0783			



11.6 Lake Mangakaware

Parcel No.	Legal Description	Area (Ha)	Title Ref	Acquisition History	Classification
1	Allotment 75A, Ngaroto Parish [SO 1772]	48.9669	NA [Crown]	<p>Crown land set apart as recreation reserve by NZ Gazette 1912 p.1279. Brought under the Public Reserves and Domains Act 1908 as part of the Mangapiko Domain by NZ Gazette 1912 p.1716.</p> <p>Added to the Pirongia Domain and managed by the Pirongia Domain Board by NZ Gazette 1912 p.3631. The Pirongia Domain Board became the Pirongia Recreation Reserves Board on 1 April 1978 by operation of S.16(7), Reserves Act 1977.</p> <p>Administration passed from the Board to the Waipa District Council by operation of Clause 77-79, The Local Government (Waikato Region) Reorganisation Order 1989 [NZ Gazette 1989 p.2460].</p> <p>Fee simple remains with the Crown.</p>	Classified recreation reserve subject to the Reserves Act 1977 by NZ Gazette 1981 p.345 [Document H.330702].



REFERENCES:

Boubee, J.A.T. 1978: Preliminary Recommendations for the Management of the Waipa Peat Lakes: Report presented to the Waipa County Council for the implementation of policies and the conservation and management of the lakes in its district.

Chapman, M.A. Boubee, J.A.T. 1978: A biological survey of the Waipa County. Report 1. A general summary of the survey results . Biological Sciences, University of Waikato

Clarkson B; Merett, M; Downs D; Botany of the Waikato Botanical Society Inc., 2002

Foot Prints in History: Page 4-7, The Waipa Swamps – Moanatuatua and Rukuhia, Number 26, December 200; Published by combined Te Awamutu, Otorohanga and Te Kuiti Historical Societies.

Green J.D. 1988: Draft QE II Booklet presented to Waipa District Council.

Green J.D.; Lowe D.J. 1985: Stratigraphy and development of c.17000-year-old Lake Maratoto, North Island, New Zealand, with some inference about postglacial climatic change. *NZ Journal of Geology and Geophysics* 28: 675-699.

Hamill K. D: June 1996: Small Lakes of the Waikato Region: An Information and Appraisal of Water Quality Monitoring; Volume 1; Appraisal of Environment Waikato Water Quality Monitoring; Report for Environment Waikato.

Thomson K; Greenwood J; Status of Waipa Peat Lakes in 1997 with recommendations for restoration and sustainable management: A consultancy Report prepared by the University of Waikato for Environment Waikato; November 1997.

Part Two

Management Plan for Lake Mangakaware Recreation Reserve

12.0 LOCATION AND ACCESS

Lake Mangakaware Recreation Reserve is located within a north south orientated shallow valley, ringed by Anderson, Kakaramea and Meadways Roads, at Paterangi. Legal access to the lake margin is via an unformed (paper) road opposite the Anderson Oakshot Road intersection.

It is the western most of the sixteen Waipa peat lakes and drains west into the Mangakaware stream and eventually joins the Waipa River at Te Rore.

Information on formation and history refer to Section 3.0., Part One.

13.0 LEGAL DESCRIPTION AND CLASSIFICATION

Allotment 75A SO 177/2, 48.9669ha of Crown land, vested in Waipa District Council and classified as Recreation Reserve, NZ Gazette 1981, pg 345.

Overlying the lake reserve is the status of 'Closed Game Area'. This status is applied via gazette notice under the Wildlife Act 1953, and prevents the hunting and killing of game bird species without authorisation.

13.1 History of Administration

Following reservation as a Recreational Reserve in 1981, the reserve was administered by the Pirongia Domain Board, on behalf of the Commissioner of Crown Lands, Department of Lands and Survey.

The Board was abolished and replaced by the Pirongia Reserve Committee under the Local Government Reform Act 1989. This was deemed a committee of the Waipa District Council and Council remains the administering authority today.

14.0 PHYSICAL DESCRIPTION

The lake is T shaped, 15ha in size, less than 5m deep, lies within a basin of peat from 1 to 2.5m in depth and has a catchment area of around 300ha.

Soils on the surrounding rolling hills consist of a mantle of light friable ash (Mairoa) which overlies the older Hamilton ash showers. The Mairoa deposits have developed into yellow brown, friable, finely structured loams. At the base of the hills, these ash/loams have mixed with the organic peat substrates forming loamy peat.

14.1 Catchment Use and Vegetation

An 1865 survey plan (SO 177) shows the area around the lake to be in forest or tall shrubland (probably the latter) that extended beyond the peat onto the surrounding rolling hills. Analysis of pollen extracted from peat during archaeological investigation, indicated the lake basin was within an area of coniferous forest. Pollen samples revealed a canopy of kahikatea, matai (*Prumnopitys taxifolia*), rimu (*Dactyldium cupressuim*), pukatea (*Lautelia novae-zelandiae*); an under storey of mahoe (*Melicytus ramiflorus*), titoki (*Alectryon excelsus*), pate (*Schefflera digitata*), cabbage tree (*Cordyline australis*) and pokaka (*Elaeocarpus hookerianus*). This forest was likely to have flanked a lake margin of peat tolerant rushes, sedges, mosses and woody species.

The original native forest and peat communities have long since been cleared and ground water levels lowered. There were periods when tall gorse, willow and large “bull rush” (*Juncus spp*) grew rank around the lake (Trevor Law pers com). This secondary growth was cleared using excavators and tractor driven mowers and the area managed to encourage pasture grasses. Stumps and logs exposed as the peat settled were heaped into the lake edge or burnt in piles.

Drying of the peaty margins and continual stock grazing to the water edge, has reduced or removed most native wetland plants/communities other than the most resilient and less palatable rushes, sedges and shrubs. This has encouraged the colonisation around the immediate edge of introduced trees like willow (*Salix spp*), grey alder (*Alnus glutinosa*) and pest plants like gorse (*Ulex europaeus*), blackberry (*Rubus fruticosus agg*) and yellow flag Iris (*Iris pseudacorus*).

14.2 Water Levels

No reliable lake level records were available until an automatic water level recorder was positioned in the lake by Environment Waikato in 2002.

The outlet ran south and exited through a narrow ridge now bridged by Andersons Road. A culvert was excavated through this low ridge and ‘bricked’ to contain the outflow. This outflow was in turn used to power a flour mill commissioned in January 1856, for £320. This mill was originally recorded as ‘Mangaewarewa’, but later called Rore (Issue No 7, Footprints of History, 1999).

Long standing land owners (J. Krippner pers. com.) believed the outlet from the lake was likely to have been first excavated to improve drainage in the 1920’s and drainage continued into the 1960’s.

A landowner east of the lake abandoned the original lake outlet and excavated a drain along the Reserves western boundary and into the lake’s south western corner some thirty or more years ago. (Trevor Law pers com), This outfall continued until the original outfall was again opened in April 1997. This work resulted in very low lake levels and remedial work by Waipa District Council, who installed a rock and rubble weir at the lake outlet. The height of the weir was set at 29.01m. While the

weir was designed to maintain a minimum lake level, the lack of data meant the level selected was based on anecdotal information rather than precise records.

Following concerns at the continuing low summer levels, drying of the lake margins and potential detrimental effects on the Swamp Pa sites, Council together with Environment Waikato, undertook hydrological investigation and sought resource consent to raise the level by 15cm. A timber weir was installed across the lake outlet in June 2007.

The water level recorder positioned in the lake in 2002 has provided very useful data on the timing and extent of seasonal water fluctuations. Between April 2004 and December 2007 the lake fluctuated around 0.90m, with highs in June and July of each year (average highs are some 0.50m below the peaks), and the lows occurring from February to March. Fluctuation patterns were similar over the four years. Refer Appendix Four.

14.3 In Lake Conditions

A description of the Waipa peat lakes in 1977/78 (Boubee and Chapman) described them as becoming "... less dystrophic and more eutrophic, with increases in pH and increased water clarity. This in turn was assisting chlorophyll (algae) production..". These changes have been attributed to drying margins and farming practices within the catchment, but the "closed game area" status also attracts large populations of waterfowl – dabbling ducks, black swan and Canada geese - which contribute a considerable amount of nutrient through faecal contamination.

By 1987/1988 Mangakaware was described as 'hypertrophic' with a pH between 6.7 and 7.2, chlorophyll levels rising from 32 mg per cubic metre to 39.1 mg per cubic metre and a small reduction in secchi disc reading from 1m to 0.9m. The comparison also showed a substantial reduction in benthic animals from 657 identified in 1977/78 to 57 in 1987/88. Most other parameters measured remained similar.

Analysis of limnological data collected by EW in 1981 and 1994, revealed anoxic conditions occurring in the bottom waters (July 1993); algae appeared to be most limited by light availability, but also nitrogen concentration; phytoplankton (Chl.a) showed a distinct peak in late summer (March), while turbidity peaks in June, nitrate/nitrite and ammonium were at their maximum levels during mid winter.

In 2005, NIWA researchers described the lake's submerged plant communities as being diverse despite the presence of the invasive weed, *Egeria densa*, for in excess of fourteen years. The most recent survey suggests a "... reduced impact by this species and a slight expansion of native plants, although vegetation remains sparse...". The weed *Elodea canadensis* was recorded for the first time during the 2005 survey, but it is regarded as less invasive than *Egeria*.

The general trend appears to be one of slow deterioration and loss of indigenous character resulting from nutrient inflows and invasion of pest plants. This emphasizes the need to initiate changes in current land use practice within the lake catchment and a greater emphasis on pest/weed management.

15.0 WILDLIFE AND FISHERIES

15.1 Wildlife

A mixture of native and introduced resident and frequenting perching birds, wetland birds and water fowl, utilise the lake and the immediate margins. The “Closed Game Area” status over the lake reserve attracts significant numbers of waterfowl during the annual game bird hunting season. Refer Appendix Two: Birds Recorded at Lake Mangakaware Reserve.

The open water area and wetted perimeter provide food (fish) for diving species and dabbling duck (insects and seeds); during times when the adjoining land is inundated or moist, waders will forage for insects and small fish. There is little riparian habitat (trees and shrubs) to support a greater variety of terrestrial species, but it is expected the lake will serve as a part of their habitat range.

15.2 Fish

Fish surveys have recorded both native and exotic species. The exotic species were likely to have been introduced intentionally (illegally) or by accident via inflowing tributary streams/drains. Large carp were caught in the outlet drain using nets when levels were low (Trevor Law pers com).

Refer Appendix Three: Fish Recorded from Lake Mangakaware.

Most native fish have a marine phase in their life cycle and require access to and from the sea. Any impediment or obstacle (dam, culvert, weir, high velocities) preventing access, will ultimately cause the extinction of migratory native species. The only migrating native fish recorded in the lake is the eel, an adept climber even traveling over land through wet grass to negotiate an obstacle. It is possible the gradients downstream of the culvert under Andersons Road pose a significant barrier to other upstream migrants.

Further, changes in lake conditions (water quality, temperature, contaminants) will impact on the ability of fish to survive. Ironically, exotic fish species are generally more adaptable to environmental change than most native species and will out compete native populations.

15.3 Mammal and Animal Pests

Mammals likely to frequent the Reserve will be similar to those found in the adjoining agricultural landscapes. All are introduced species and regarded as a threat to wildlife and wildlife habitats/vegetation within the Reserve.

Predatory species – mustelids, cats and possums - will target native birds and insects especially when their usual prey (rodents, rabbits and hare) become scarce. Possums and hedgehogs are opportunists and their diet includes a wide range of vegetable and animal items. Possums, although generally thought to be vegetarian, have been confirmed as primary predators of eggs, nestlings and even adult birds on

nests. Further, they will compete with many native birds for foliage, fruit, flowers and insect food.

Rats will also consume a variety of food items both animal and vegetable, and can reach high populations within agricultural landscapes in late summer, especially where cropping for grain occurs. Rats, especially black rats, are adept tree climbers and will target eggs and nestlings. Refer to Appendix Three: Mammals found within Mangakaware Reserve.

16.0 ARCHAEOLOGICAL SITES

Three sites are registered by the NZ Archaeological Society, and all are Swamp Pa. Extensive surveys of these sites together with the lake bed were commissioned by the Society during four periods between August 1968 and December 1970. Extracts from published reports referred to:

“... the dwelling areas of the site were built up from sand lenses laid on the original peat surface and the whole unit would have been defended by the surrounding lake and swamp as well as man made palisades. The site dates to the sixteenth and seventeenth centuries A.D. and is one of the best preserved examples of a classic Maori habitation site to be excavated in New Zealand...” (Bellwood, P 1978).

At least three canoes/waka found by divers during the survey lie in the mud and sediment of the lake bed. These were recorded, but left undisturbed. There are also examples of palisades still present at two sites although they are now in poor condition through lowering ground water levels and drying peat .

Water levels are crucial for the preservation of organic materials within and around the three Pa on the shores of the Lake. Levels determines the degree to which archaeological deposits/artifacts are saturated and rate of aerobic decomposition.

17.0 AGRICULTURAL USE OF THE RESERVE LAND

The land beyond the immediate lake margin has been leased for stock grazing for many years and there is little to distinguish it from the adjoining farmland. Further, lessees have undertaken development on the Reserve land to generally improve the grazing available. This included drainage and clearing surface vegetation and other wood material (logs and stumps) ‘appearing’ as the peat surface oxidises and subsides.

In 2005 a stock proof fence was erected around the lake. The fence line skirted around the existing riparian vegetation, largely tall willows with occasional native flax, cabbage tree and *Coprosma* sp. But excluded extensive low lying areas. These remain as grazed land. Re-positioning the fence to take into account: any potential change in minimum water levels; establishing an adequate buffer to filter point and non point inflows; the restoration of riparian habitats and lake environments; and, the protection of the archaeological sites, is required.

These are matters which Council is duty bound to consider under Section 17(2) of the Reserves Act 1977.

18.0 RECREATION AND PUBLIC USE

There is no formed public access to, nor signage identifying the existence of, the Reserve. Understandably, current recreation and general public use is low. Adjoining land owners have used the lake for pleasure boating (rowing and sailing) and fishing for carp and eel.

The Te Awamutu Fish and Game Association has invested time in planting several small groves of trees in the south western and northern quarters of the lake. The purpose of this planting was to provide food trees for waterfowl and habitat for native birds.

19.0 MANAGEMENT OBJECTIVES

The Objectives of this Plan will be reviewed in five years of the Plan being adopted.

19.1 Buffer Margins around the Lake

The purpose of the buffer is to reduce the impacts of agricultural land use on wetland communities and processes and to permit the restoration of riparian and moist plant communities.

- An effective “buffer” will be created around Lake Mangakaware. This buffer will be 20m - 50m or more in width, depending on contour, retired from grazing and fenced, by June 2009. (Policy 10.1.1)

19.2 Minimum Lake Levels and Drainage

- Water levels resulting from the new wooden weir, crest of 29.26m Moturiki Datum, will be monitored monthly and the performance of the weir reviewed in May 2009 (Policy 10.2.1).
- No new drains will be permitted within the buffer zone. Existing drains will be modified to prevent direct discharge to the lake and include vegetation filters, by June 2009 (Policy 10.2.3)

19.3 Inflows of Sediments and Contaminants

- A fertilizer plan will be prepared by the lessee for the land leased by Council. This plan will be reviewed by Council annually.
- Appropriately designed sediment traps will be constructed on all existing drains, to settle inflowing sediments by May 2009 (Policy 10.3.3)

19.4 Introduced Pests

- Pest plants will be controlled within the Reserve’s fenced margins annually, with priority placed on the more aggressive species like yellow flag and those that detrimentally change or prevent the establishment of indigenous plant

communities like willow. The species controlled and the area treated will be appropriately recorded each visit by the contractor involved (Policy 10.4.3)

19.5 Recreational Use

- Foot and vehicle access to Lake Mangakaware for both management and recreation purposes will be developed, and the entry will be identified with appropriate signage. Negotiation with landowners to re-route the existing paper road will commence 2007, with formed vehicle access completed by 2010 (Policy 10.6.1).

19.6 Enhancing Habitats

- Around the margins of the lake, suitable trees, shrubs, rushes and sedges will be planted to restore riparian plant communities and improve the habitat for wildlife. Prior to planting, the existing fence will be repositioned to achieve the desired buffer width. A target of 500 plants annually to be planted from April to June for the next five years (Policy 10.7.4 and 10.7.7).

19.7 Historic Sites and Features

- A plan for the three known swamp Pa will be prepared and forwarded to the Historic Places Trust for comment and advice. This Conservation Plan will be prepared by December 2008, and once approved by the Historic Places Trust, will be attached to this Management Plan and implemented (Policy 10.9.3)

19.8 Grazing

- Land surplus to ecological and historic restoration will be grazed. Grazing will be offered to adjoining land owners and a licence to lease/occupy for 10 years will be prepared for implementation by 1st July 2007 (Policies 10.10.1 & 10.11.2).

APPENDIX ONE: RESERVE PLAN



APPENDIX TWO:

WILDLIFE RECORDED WITHIN THE LAKE RESERVE

Common Name	Scientific name	Origin	Status
mallard duck	<i>Anas platyrhynchos</i>	introduced	game bird
grey duck	<i>Anus superciliosa</i>	native	game bird
grey teal	<i>Anus gracilis</i>	native	protected
NZ Shoveler	<i>Anas rhynchotis</i>	endemic	game bird
paradise shelduck	<i>Tadorna variegata</i>	endemic	game bird
black swan	<i>Cygnus atratus</i>	introduced	game bird
Canada goose	<i>Branta canadensis</i>	introduced	game bird
pukeko	<i>Porphrio porphyrio</i>	native	game bird
large black shag	<i>Phalacrocorax carbo</i>	native	protected
little shag	<i>Phalacrocorax melanoleucos</i>	native	protected
pieb stilt	<i>Himantopus himantopus</i>	native	protected
whitefaced heron	<i>Ardea movaehollandiae</i>	native	protected
spur-winged plover	<i>Vanellus miles</i>	SI native	protected
Australasian harrier	<i>Circus approximans</i>	native	protected
grey warbler	<i>Gerygone igata</i>	endemic	protected
fantail	<i>Rhipidura fuliginosa</i>	native	protected
welcome swallow	<i>Hirundo tahitica</i>	SI Native	protected
morepork	<i>Ninox novaeseelandiae</i>	native	protected
NZ Kingfisher	<i>Halcyon sancta</i>	native	protected
silveryeye	<i>Zosterops lateralis</i>	native	protected
chaffinch	<i>Fringilla coelebs</i>	introduced	unprotected
yellow hammer	<i>Emberiza citrinella</i>	introduced	unprotected
dunnock	<i>Prunella modularis</i>	introduced	unprotected
blackbird	<i>Turdus merula</i>	introduced	unprotected
Song thrush	<i>Turdus philomelos</i>	introduced	unprotected
greenfinch	<i>Carduelis choris</i>	introduced	unprotected
goldfinch	<i>Carduelis carduelis</i>	introduced	unprotected
redpoll	<i>Carduelis flammea</i>	introduced	unprotected
house sparrow	<i>Passer domesticus</i>	introduced	unprotected
starling	<i>Sturnus vulgaris</i>	introduced	unprotected
myna	<i>Acridotheres tristis</i>	introduced	unprotected
Australian magpie	<i>Gymnorhina tibicen</i>	introduced	unprotected

IS Native = self introduced native

APPENDIX THREE: FISH AND MAMMALS RECORDED WITHIN THE LAKE RESERVE

1) Fish Recorded from Lake Mangakaware

Name	Scientific Name	Origin	Status
common bully	<i>Gobiomorphus cotidianus</i>	endemic	not protected
smelt	<i>Retropinna retropinna</i>	endemic	not protected
short finned eel	<i>Anguilla australis</i>	native	not protected
long finned eel	<i>Anguilla dieffenbachii</i>	endemic	not protected
bullhead catfish	<i>Ictalurus nebulosus</i>	exotic	not protected
goldfish	<i>Carassius auratus</i>	exotic	not protected

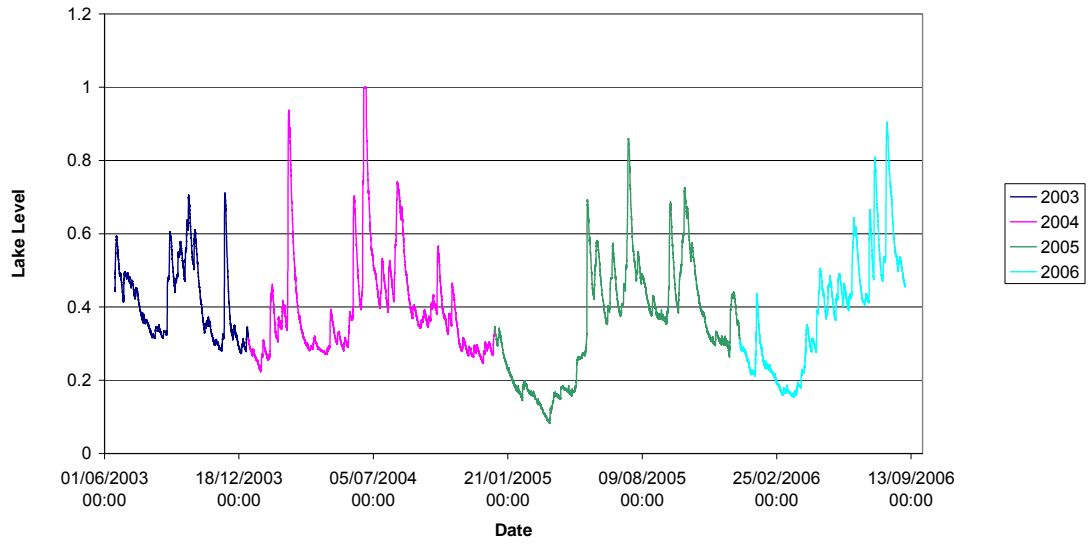
Note: The harvest of long and short finned eel is controlled - (6) per person.

2) Mammals founds within the Mangakaware Recreation Reserve

Name	Scientific Name	Origin	Status
ferret	<i>Mustela furo</i>	introduced	pest
stoat	<i>Mustela erminea</i>	introduced	pest
weasel	<i>Mustela nivalis vulgaris</i>	introduced	pest
house cat	<i>Felis catus</i>	introduced	pest
hedgehog	<i>Erinaceus europaeus occidentalis</i>	introduced	pest
black rat	<i>Rattus rattus</i>	introduced	pest
Norway rat	<i>Rattus norvegicus</i>	introduced	pest
house mouse	<i>Mus musculus</i>	introduced	pest
brush tail possum	<i>Trichosurus vulpecula</i>	introduced	pest
European rabbit	<i>Oryctolagus cuniculus</i>	introduced	pest
brown hare	<i>Lepus europaeus occidentalis</i>	introduced	pest

APPENDIX FOUR: SEASONAL WATER LEVEL FLUCTUATIONS

Lake Mangakaware Level



REFERENCES

- Boubee, J.A.T. 1978: Preliminary Recommendations for the Management of the Waipa Peat Lakes: Report presented to the Waipa County Council for the implementation of policies and the conservation and management of the lakes in its district.
- Bellwood, p.1978: Archaeological research at Lake Mangakaware, Waikato, 1968-1970. Otago Univeristy Studies in Prehistory Anthropology vol.12. NZ *Archaeological Association monograph 9*.
- Chapman, M.A. Boubee, J.A.T. 1978: A biological survey of the Waipa County. Report 1. A general summary of the survey results . Biological Sciences, University of Waikato
- Clarkson B; Merett, M; Downs D; Botany of the Waikato Botanical Society Inc., 2002
- Green J.D. 1988: Draft QE II Booklet presented to Waipa District Council.
- Green J.D.; Lowe D.J. 1985: Stratigraphy and development of c.17000-year-old Lake Maratoto, North Island, New Zealand, with some inference about postglacial climatic change. *NZ Journal of Geology and Geophysics 28: 675-699*.
- Footprints of History, No 22 June 1999: Journal of the combined Te Awamutu, Te Kuiti, Otorohanga and Waitomo Historical Societies and Pio Pio Museum Society.
- Gumbley, Warren; Dilys, John; and Law, Garry; Management of wetland archaeological sites in New Zealand. Science for Conservation 246; Department of Conservation 2005.
- Hamill K. D: June 1996: Small Lakes of the Waikato Region: An Information and Appraisal of Water Quality Monitoring; Volume 1; Appraisal of Environment Waikato Water Quality Monitoring; Report for Environment Waikato.
- Thomson K; Greenwood J; Status of Waipa Peat Lakes in 1997 with recommendations for restoration and sustainable management: A consultancy Report prepared by the University of Waikato for Environment Waikato; November 1997.

Part Three

Management Plan for Lake Cameron (Kareaotahi) Recreation Reserve

20.0 LOCATION AND ACCESS

Lake Cameron lies immediately south west of Rukuhia township. It can be viewed from Rukuhia Road, 200m from the SH 3 intersection. Access to the Reserve is from a maintained and signposted walk track off Rukuhia Road.

Information on formation and history refer to Section 3.0. Part One.

21.0 LEGAL DESCRIPTION AND CLASSIFICATION

Allotment 509, Te Rapa Parish, being 6.1480ha of Crown land, is set aside as Recreation Reserve by Gazette 1985 p.2088 (Document H.591561). Waipa District Council has been appointed to control and manage the reserve by NZ Gazette 1985 p.2781 (Document H.599798).

Surrounding the lake reserve are three local purpose reserves (Esplanade). These parcels have been vested in Waipa District Council on subdivision.

They are:

- 1) Lot 2, DPS 13741 being .3667ha. Vesting ref: CT 1717/29 in 1970 under S.35, Counties Amendment Act 1961
- 2) Lot 3, DPS 91539 being 1.485ha. Vesting ref: CT 49B/654 under S.239, Resource Management Act 1991
- 3) Lot 3, DPS 315251 being .6100ha. Vesting ref: CT 9D/1179 under S.239, Resource Management Act 1991.

21.1 History of Administration

Prior to reservation in 1985, the lake attracted little if any management attention. It was known as a 'public lake' by District residents and they accessed the water for a range of recreational activities.

Through the 1980's both government agencies and interest groups recognized that many lakes and wetlands were under threat from urbanization and intensifying land use and promoted their protection. Lake Cameron along with other Ohaupo peat lakes was subsequently reserved and classified under the Reserves Act 1977.

The Department of Conservation assumed responsibility for a range of initiatives around the lake including, signage, tracking, planting, removal of willow from the lake margin, control of royal fern (*Osmunda regalis*) and working with the Lake Care group.

22.0 PHYSICAL DESCRIPTION

The lake is triangular in shape, with approximately 3.375ha of open water - although this will vary with water level - and a depth of <1.5m. It is sandwiched between the north south orientated Rukuhia ridge and the Rukuhia peat bog. It has a catchment area of around 26.6ha.

Land to the north and east consists of high density fen peats, grading into yellow brown, friable, finely structured loams on the Rukuhia ridgeline. To the west and south are the deep acid peat of the Rukuhia Bog.

22.1 Catchment Use and Vegetation

To the north and east of the lake are residential and life style blocks with associated urban infrastructure and to the west and south, is farmed pastureland. There are no special or unusual features to record.

The immediate lake margins support a range of native and introduced plants including: a canopy, of grey willow (*Salix cinerea*), cabbage tree (*Cordyline australis*), scattered kahikatea (*Dacrycarpus dacrydioides*), planted tortured willow (*Salix matsudana*), swamp cypress (*Taxodium distichum*), grey alder (*Alnus glutisona*) and oak (*Querus sp.*). Elsewhere rushes and sedges with occasional woody plants dominate. These include: hikuhiku (*Coprosma tenuicaulis*), nigger head (*Carex secta*) a conspicuous feature of the lake, rush (*Juncus saophorus* and *J. effusus*), tall reed (*Baumea tenax*), beggar's tick (*Bidens frondosa*), water pepper (*Polygonum hydropiper*), centella (*Centella uniflora*), penny wort (*Hydrocotyle novae-zeelandiae*), *Blechnum minus*, *Hydrocotyle novae-zeelandiae* with occasional peat moss (*Spagnum cristatum*).

Around the waters edge are floating mats of water primrose (*Ludwigia pepoidies*) and swamp willow weed (*Polygonum salicifolium*), with water fern (*Azolla rubra*), duck weed (*Spirodela punctata*) and water meal (*Wolffia australiana*) in the protected margins (Coffee, Dr B.T. 1999).

22.2 Water Levels

No reliable lake level records are available for the lake. Originally, the lake levels would have fluctuated seasonally according to rainfall and ground seepage and runoff from the hillsides to the north and east.

The development of the peat land within the Lake Cameron catchment, estimated at 834.7ha, was well underway by 1945. At that time the then Waipa County Council was collecting rates from all land owners to maintain some "5 miles and 7 chains" of drain (Waipa District Council files).

The outlet is in the lakes south western corner. Minimum levels appear to be controlled by a culvert under a farm track some 100m downstream of the lake outlet.

22.3 In Lake Conditions

Lake Cameron has been described as dystrophic (peat stained), highly influenced by surrounding peat deposits, acidic with a pH around 5, with a secchi disc measurement in 1977 of 0.3m (Chapman 1977).

No submerged macrophytes have ever been recorded from the lake due to peat staining and poor clarity (Champion et al.,1993).

The only benthic animals specifically reported were chironomid larvae (*Crironomus zelandicus* sallinarius type), mites (*Piona pseudouncata*) and worms (*Dero/Aulophorus*), and (*Glossiphonia multistriata*) Chapman (1982).

On the basis of the low species diversity, Thompson and Greenwood (1997) considered the lake to have “low limnological” value although the ecological value was considered high. In Sept 1987 Council files record severe blooms of duck weed (*Azolla rubra*) and (*Lemna minor*) on the lake. Both species generally respond to nutrient enrichment.

A summary of chemical and physical statistics reported in Nov 2005 is presented as Table One.

Table One: Physical statistics for Lake Cameron taken from most recent literature available (EW 2005)

Lake Area	3.4ha
Catchment area	26.6ha
Maximum depth	1.5m
Average depth	1.5m
pH	5.08
Alkalinity ($\mu\text{eq L}^{-1}$)	94.34
Mg $\text{CaCO}_3 \text{ L}^{-1}$)	4.72
TP	0.5120
TN	0.8649
Ratio TP:TN	1:2
DRP (Phosphate mg/L)	0.3892
Ammonium ($\text{NH}_4\text{-N}$)	-0.00076
Nitrate (mg/L $\text{NO}_3\text{-N}$)	0.0181
Nitrite (mg/L $\text{NO}_2\text{-N}$)	0.0091

23.0 WILDLIFE AND FISHERIES

23.1 Wildlife

A mixture of native and introduced resident and frequenting perching and wetland birds and water fowl, utilise the lake and immediate margins. Refer Appendix Two: Birds Recorded at Lake Cameron Reserve.

The open water area and wetted perimeter provides food (fish) for diving species and (insects and seeds) for dabbling duck. During times when the adjoining land is inundated or moist, waders will forage for insects and small fish. The vegetated margins (trees and shrubs) support more common perching birds like finches, but also provide permanent or seasonal habitat for native species like fantail, morepork, silvereve and harrier.

23.2 Fish

No official records are available for the lake, however anecdotal comment indicate eel, likely short (*Anguilla australis*) and long finned (*A. dieffenbachia*) species, being present and occasional caught.

23.3 Mammals and Animal Pests

Mammals likely to frequent the Reserve will be similar to those found in the adjoining agricultural landscapes. All are introduced species and regarded as a threat to wildlife and wildlife habitats/vegetation within the Reserve.

Predatory species – mustelids, cats and possums - will target native birds and insects especially when their usual prey (rodents, rabbits and hare) become scarce. Possums and hedgehogs are opportunists and their diet includes a wide range of vegetable and animal items. Possums, although generally thought to be vegetarian, have been confirmed as primary predators of eggs, nestlings and even adult birds on nests. Further, they will compete with many native birds for foliage, fruit, flowers and insect food.

Refer to Appendix Three: Mammals found within Cameron Reserve.

24.0 HISTORY OF THE RESERVE MANAGEMENT

The lake was formally reserved for recreational purposes in 1985. Since that time, an Esplanade margin has been added to the reserve's northern, eastern and southern margins as the surrounding residential land was sub-divided.

Prior to reservation the lake received little management attention. Stock generally had access to the water edge and the original marginal vegetation of manuka rushes and sedges, as shown in 1943 photographs (Thompson and Champion 1993) was systematically cleared for pasture.

More recently, interest in the lake by local residents and members of the Hamilton Fish and Game Association (Care Group). This Group together with the Department of Conservation, has planted the northern lake margins, constructed a walking track around the lake and erected a picnic table next to the lake's northern edge. The Department of Conservation has also been active in funding the removal/control of willow and other exotic trees around the lake margin, controlling of royal fern infestations, and constructing bridges over the in-flowing and out-flowing drains.

In 2005 the Lake Care group were successful in sourcing funding from the Honda Tree Trust. This resulted in 2,800 trees, shrubs and rushes being planted the lake's eastern and southern lake margins.

25.0 RECREATIONAL AND PUBLIC USE

Formed public access is available to the Reserve and lake from Rukuhia Road. The entrance is well signposted.

Recreation and general public use is generally passive by nature and includes walking, picnicking, fishing and canoeing. During the months of May and June of each year licensed game bird hunters harvest game birds from the lake.

The Lake Cameron Care Group and Hamilton Fish and Game Association, continue to invest considerable time and resources planting the Esplanade and Recreation Reserve, maintaining walking routes, picnic and viewing sites around the lake.

26.0 MANAGEMENT OBJECTIVES

The Objectives of this Plan will be reviewed in five years of the Plan being adopted.

26.1 Establish and Maintain Buffer Margins around the Lake

The purpose of the buffer is to reduce the impacts of agricultural, residential and commercial land use on wetland communities and processes and to permit the restoration of riparian and moist plant communities.

Recommendations received in 1992 (Thompson and Champion 1992), promoted the establishment of a 50m (ideally 100m) buffer zone around the western and south western margin to combat the effect to expected settlement of the Rukuhia bog peat.

- An effective "buffer" will be created around Lake Cameron. This buffer will be 50m or more in width, depending on contour, retired from grazing and fenced, by June 2009. (Policy 10.1.1)

26.2 Set Minimum Levels and Control Drainage

- Water levels will be regularly monitored. Should monitoring reveal a change in water levels is required to maintain or enhance wetland values, an application with supporting information will be lodged with Environment Waikato.
- No new drains will be permitted within the buffer zone. Existing drains will be modified to prevent direct discharge to the lake by June 2009. These modifications will include filtering through riparian vegetation. Maintenance of existing drains within the Reserve will be subject to the Reserves Act 1977 (Policy 10.2.3).

26.3 Controlling Inflows of Sediments and Contaminants

- The performance of the sediment trap, approved in 2001 and positioned on the main inlet drain, will be monitored. Should monitoring reveal poor performance the trap will be modified to ensure performance is adequate. Sediment accumulating in the trap will be moved as and when required (Policy 10.3.3).

26.4 Managing Introduced Pests

- Regular surveillance for pest plants will be undertaken and those species likely to threaten indigenous species and communities or change habitat values, will be controlled annually. The species controlled and the area treated will be recorded by the contractor involved (Policy 10.4.3)

26.5 Promoting Recreation and Public Use

The Lake Cameron Care Group, with assistance from Council have developed a circular walking track around the lake, viewing corridors/areas and picnic facilities. The track is maintained by regular mowing, culverts have been placed in low lying areas and soft substrates have been in-filled to create a solid pedestrian surface.

Public use is increasing and it is predicted the lake will become an increasingly popular destination for District residents and visitors.

- Council will maintain access and develop further opportunities for visitors to experience the lake and its surroundings as demand requires. Members of the Lake Care Group will be engaged to assist with the maintenance and development of recreation facilities (Policy 10.6.2).

26.6 Enhancing Habitat

- Vegetation around the margins of the lake will be permitted to regenerate. Suitable trees, shrubs, rushes and sedges will be planted to aid natural regeneration, improve habitat for wildlife and landscape values. A planting plan guiding restoration will be developed, in consultation with interest groups, by June 2008. Annual planting will continue until the objectives of this planting plan are realised (Policy 10.7.4 and 10.7.7)

26.7 Managing Historic Sites and Features

- No specific cultural or archaeological sites have been recorded within the Reserve boundaries. However representatives from Nga Iwi Toopu O Waipa have previously expressed concern at excavation on the lakes western margins. Nga Iwi Toopu O Waipa will be consulted prior to any development involving surface excavation or modification of natural features (Policy 10.9.2).

26.8 Grazing

- Grazing will be permitted within the Reserve only for the purpose of controlling pasture grasses and weeds prior to planting. Stock will not have access to the waters edge. This grazing will be short term and monitored by Council staff (Policy 10.10.1 & 10.11.2).

APPENDIX ONE: RESERVE PLAN



**APPENDIX TWO:
RESERVE**

WILDLIFE RECORDED WITHIN THE LAKE CAMERON

Common Name	Scientific name	Origin	Status
mallard duck	<i>Anas platyrhynchos</i>	introduced	game bird
grey duck	<i>Anus superciliosa</i>	native	game bird
grey teal	<i>Anus gracilis</i>	native	protected
NZ Shoveler	<i>Anas rhynchotis</i>	endemic	game bird
paradise shelduck	<i>Tadorna variegata</i>	endemic	game bird
black swan	<i>Cygnus atratus</i>	introduced	game bird
Canada goose	<i>Branta canadensis</i>	introduced	game bird
pukeko	<i>Porphrio porphyrio</i>	native	game bird
large black shag	<i>Phalacrocorax carbo</i>	native	protected
little shag	<i>Phalacrocorax melanoleucos</i>	native	protected
pieb stilt	<i>Himantopus himantopus</i>	native	protected
whitefaced heron	<i>Ardea movaehollandiae</i>	native	protected
spur-winged plover	<i>Vanellus miles</i>	SI native	protected
Australasian harrier	<i>Circus approximans</i>	native	protected
grey warbler	<i>Gerygone igata</i>	endemic	protected
fantail	<i>Rhipidura fuliginosa</i>	native	protected
welcome swallow	<i>Hirundo tahitica</i>	SI native	protected
morepork	<i>Ninox novaeseelandiae</i>	native	protected
NZ Kingfisher	<i>Halcyon sancta</i>	native	protected
silveryeye	<i>Zosterops lateralis</i>	native	protected
chaffinch	<i>Fringilla coelebs</i>	introduced	unprotected
yellow hammer	<i>Emberiza citrinella</i>	introduced	unprotected
dunnock	<i>Prunella modularis</i>	introduced	unprotected
blackbird	<i>Turdus merula</i>	introduced	unprotected
song thrush	<i>Turdus philomelos</i>	introduced	unprotected
greenfinch	<i>Carduelis choris</i>	introduced	unprotected
goldfinch	<i>Carduelis carduelis</i>	introduced	unprotected
redpoll	<i>Carduelis flammea</i>	introduced	unprotected
house sparrow	<i>Passer domesticus</i>	introduced	unprotected
starling	<i>Sturnus vulgaris</i>	introduced	unprotected
myna	<i>Acridotheres tristis</i>	introduced	unprotected
Australian magpie	<i>Gymnorhina tibicen</i>	introduced	unprotected

SI Native = self introduced native

APPENDIX THREE: MAMMALS FOUNDS WITHIN THE LAKE CAMERON RECREATION RESERVE

Name	Scientific Name	Origin	Status
ferret	<i>Mustela furo</i>	introduced	pest
stoat	<i>Mustela erminea</i>	introduced	pest
weasel	<i>Mustela nivalis vulgaris</i>	introduced	pest
house cat	<i>Felis catus</i>	introduced	pest
hedgehog	<i>Erinaceus europaeus occidentalis</i>	introduced	pest
black rat	<i>Rattus rattus</i>	introduced	pest
Norway rat	<i>Rattus norvegicus</i>	introduced	pest
house mouse	<i>Mus musculus</i>	introduced	pest
brush tail possum	<i>Trichosurus vulpecula</i>	introduced	pest
European rabbit	<i>Oryctolagus cuniculus</i>	introduced	pest
brown hare	<i>Lepus europaeus occidentalis</i>	introduced	pest

REFERENCES:

Chapman, M A 1982: The fauna of peaty lakes in the Waikato Valley. New Zealand Entomologist, Vol 7., No. 3, pp 282

Coffee Dr. B. T. 1999: Discussion Paper – Draft only 1, Lake Cameron: Rukuhia, Waikato; An Issues and Options Analysis for the Maintenance / Enhancement of Aquatic Habitat Quality, Report prepared for Environment Waikato.

Faithfull, Carolyn L; Hamilton, David P; Burger David F; Duggan, Ian: Nov 2005: Waikato Peat Lake Sediment Nutrient Removal Scoping Exercise:: Report prepared for Environment Waikato.

Thompson, K. and Champion, P. (1993). Esplanade Reserve recommendations of Lake Serpentine (Rotopiko), Mangahia, Rotomanuka and Cameron (Kareaotahi) (Waipa District), Hamilton Research Unit, University of Waikato. 24p. Consultancy Report for Waipa District Council and Waikato Conservancy, Department of Conservation.