

IN THE MATTER of Resource Management Act 1991 (“the Act”)

AND

IN THE MATTER of resource consent applications by

BETWEEN **ARNIM PIERAU**
Appellant

AND **RODNEY DISTRICT COUNCIL**
Respondent

AND **AUCKLAND REGIONAL COUNCIL**
Respondent

**STATEMENT OF EVIDENCE OF TIMOTHY JAMES MARTIN
ON BEHALF OF ARNIM PIERAU**

PROFESSIONAL BACKGROUND

1. My name is Timothy James Martin. I have been a senior ecologist with Wildland Consultants Ltd since 2006, based in Auckland. I also hold the degrees of Bachelor of Science and a Master of Science with First Class Honours, both from the University of Auckland, where my studies were undertaken at the School of Biological Sciences and the School of Geography and Environmental Science.
2. In 2007 I was awarded a PhD in Environmental Science by the University of Auckland.
3. I have considerable experience in New Zealand plant ecology, which I studied during both my Masters and Doctoral research. For my Masters research I studied the ecology of hutu¹ which is a rare native tree. My PhD research

¹ *Ascarina lucida*.

focused on the effects of wind disturbance on New Zealand indigenous forests, which involved extensive field research throughout the North Island. I am an author of five scientific papers published on these and other topics in peer-reviewed national and international scientific journals. I have also presented aspects of my research at national and international scientific conferences.

4. My work as an ecological consultant has covered a wide range of habitat types, including wetlands, streams, grasslands, dunelands, shrublands, forests, and estuarine ecosystems. I have provided assessments of ecological effects for a range of development activities in natural areas, provided technical advice on community-led restoration projects, and undertaken surveys for threatened species.
5. I am the manager of three wetland restoration projects in the Auckland and Northland regions. Restoration at these sites has successfully used a combination of planting and encouraging natural regeneration.
6. I was the primary author of "Making the most of Auckland's stormwater ponds, wetlands, and rain gardens" published by the Auckland Regional Council (Wildland Consultants 2008c). This publication included planting guides for wetlands, and guidelines for the management of pest plant and animals.
7. I am very familiar with the wetland assessment criteria in Appendix 7C of the Rodney District Council Proposed District Plan 2000 (hereafter Rodney District Plan). Using these criteria, I have assessed six wetland areas, in Warkworth (1), Coatesville (1), Dairy Flat (3), and Tomarata (1). Of these six wetlands, I regarded only two as meeting the criteria for wetland quality.
8. I have authored or co-authored four reports on the Pierau property: a restoration plan for the wetland margins in March 2007 (Wildland Consultants 2007a), an ecological assessment for the expansion of an existing sand mine in January 2008 (Wildland Consultants 2008a), an ecological assessment of a proposed subdivision, including planting and weed management plans, in February 2008 (Wildland Consultants 2008b), and an ecological assessment of the wetlands in December 2008 (Wildland Consultants 2009).

9. I have read the Code of Conduct for Expert Witnesses 2006 and have complied with it in the preparation of this statement of evidence. Except where I state that I am relying upon the specified evidence of another person, my evidence in this statement is within my area of expertise. I have not omitted to consider any material facts known to me that might alter or detract from the opinions which I express below.

OVERVIEW OF EVIDENCE

10. My evidence addresses:
- The definition of wetland, as described in the Rodney District Plan.
 - The ecological context of the site.
 - A description of wetland areas at the site.
 - Entitlement for subdivision under rule 7.14.3.3 of the Rodney District Plan
 - The long-term effects of the development on indigenous biodiversity, if appropriate restoration and management is successfully implemented.
 - Suggested consent conditions.
 - Conclusions.

INTRODUCTION

11. I have considered a number of reports and documents in relation to the current hearing and the preparation of my evidence. These reports are included in the list of references provided at the end of my evidence.
12. I visited the site early in 2007, on 7 and 29 January 2008, and 11 December 2008. My aim during these visits was to assess the existing ecological values of the site and environs, map and describe the habitat types present, and to take representative photographs of habitats present. On 11 December 2008 I undertook detailed mapping and descriptions of wetland areas

METHODS

13. Hard copy aerial photographs of the sites were printed and the relevant parts of Wildland Consultants Reports 1604, 1809, 1909, and 2124 were reviewed.
14. The wetlands at the site were mapped and described, and all vascular plant species and avifauna present were recorded.
15. The boundaries of the wetlands were walked, using high resolution aerial photography as a guide, and recorded at intervals using a GPS. GPS recordings were taken at the ends of each wetland, and along the sides of the wetlands at points where marked changes in width occurred. These GPS points were then superimposed on aerial photography, and used to confirm mapping of the extent of the wetlands undertaken during the field survey.
16. Wetland sites were assessed using the Guidelines for the Field Assessment of Wetland Quality from Appendix 7C of the Rodney District Council Proposed District Plan 2000.

WETLANDS - DEFINITION AND CHARACTERISTIC SPECIES

17. 'Wetland' is defined in the Rodney District Plan as:

“permanently or intermittently wet land, shallow waters, and land-water margins that support a natural ecosystem of plants and animals that are adapted to living in wet conditions”
18. The plan emphasizes that while an area might be land-water margin, or “boggy” it is the presence of species that are specially adapted to living in wet conditions that is the defining factor.
19. Raupo (*Typha orientalis*) is the most common species in the wetlands on the margins of Lake Spectacle and Lake Slipper. Raupo reedland is listed as a representative wetland type within the Rodney Ecological District in the Rodney District Plan (supplement to Appendix 7C, Page 5). The species commonly associated with raupo are characteristic of wet ground or shallow water, including manuka (*Leptospermum scoparium*), swamp kiokio

(*Blechnum novaezelandiae*), water fern (*Histiopteris incisa*), and *Baumea articulata*.

ECOLOGICAL CONTEXT

20. The Tomarata Lakes are situated approximately 1km inland from the east coast, south of Mangawhai, in the Rodney Ecological District, to the north of Auckland. Freshwater wetlands and lakes were once common in the Rodney District, but are now rare, modified, or have been destroyed by vegetation clearance and drainage (Mitchell *et al.* 1992).
21. The cluster of three dune lakes known as the Tomarata Lakes are described as being 'Regionally Significant' for both geomorphic values (Mitchell *et al.* 1992) and ecological values (RDC 2006). The lakes are the only dune lakes in Rodney Ecological District, and the only dune lakes on the east coast of the Auckland Ecological Region (Mitchell *et al.* 1992).
22. The site comprises the northern margins of Lake Spectacle, and the southern margins of Lake Slipper. Lake Slipper and Lake Spectacle, and their associated wetlands, have been identified as warranting protection (Rodney PPP #2A Pakiri Dune Lakes) in the Protected Natural Area Programme survey report for Rodney Ecological District (Mitchell *et al.* 1992) (Appendix 7: Plate 1).

VEGETATION AND HABITATS

23. The site comprises pasture, a sand mining operation, lake margins, residential dwellings and associated gardens, indigenous plantings, and farm accessways. Sixteen vegetation and habitat types were identified, of which eleven were previously mapped and described (Wildland Consultants 2008b).
24. A total of 2.00 ha of wetland habitat is present, of which 0.23 ha is wetland in dune slacks or seepages that do not currently meet the Rodney District Plan criteria for wetland quality, and 1.77 ha is wetland on the lake margins, that does meet the Rodney District Plan criteria for wetland quality, as described in

Appendix 7C. Table 1 presents a summary of the wetland assessment and a map of the wetland areas is provided in Attachment TJM1.

Table 1: Assessment of wetlands at 662 Ocean View Road in terms of Rodney District Plan criteria for wetland quality (Appendix 7C)

	Indigenous Wetland on Lake Margin	Willow Over Indigenous Reedland	Wetland in Dune Slack	Seepage on Hillslope	Totals
PNAP survey programme	Yes	No	No	No	
Naturalness/Viability	Yes	No	No	No	
Rarity of species	Yes	No	No	No	
Wildlife habitat	Yes	Yes	No	No	
Linkages/buffering/corridors	Yes	Yes	No	No	
Potential for improvement	Yes	Yes	No	No	
Total area	1.73 ha	0.04 ha	0.19 ha	0.04 ha	2.00 ha
Qualifying area (2010)	1.73 ha	0.04 ha	0 ha	0 ha	1.77 ha
Possible additional qualifying area in future	0 ha	0 ha	0.19 ha	0.04 ha	0.23 ha

Indigenous Vegetation Communities on Lake Margin (1.73 ha)

25. The margins of both lakes are vegetated with a band of raupo-dominant reedland, with locally dominant sedges (*Eleocharis sphacelata* and *Baumea articulata*) (Attachment TJM2 - Plates 1 and 2). Kiokio (*Blechnum novaezelandiae*) is common throughout. There is occasional tangle fern (*Gleichenia dicarpa*), harakeke (*Phormium tenax*), swamp millet (*Isachne globosa*), and an indigenous sedge (*Schoenoplectus tabernaemontanii*), with locally scattered stands of manuka (*Leptospermum scoparium*) and ti kouka (*Cordyline australis*). Occasional mature trees of willow (*Salix* sp.), and poplar (*Populus* sp.) are present on the landward edge of the wetlands on the margin of Lake Spectacle.
26. Two invasive species, reed sweetgrass (*Glyceria maxima*) and mercer grass (*Paspalum distichum*), are common around the margins of both lakes, and alligator weed (*Alternanthera philoxeroides*, an 'Unwanted Organism' under the Biosecurity Act 1993) is frequent around the margin of Lake Spectacle, and is also spreading into pasture habitats in places.
27. The highly invasive species, royal fern (*Osmunda regalis*, an 'Unwanted Organism' under the Biosecurity Act 1993), was recorded in two locations on

the margin of Lake Spectacle, growing amongst manuka, harakeke, raupo and kiokio, and alongside the channel that links the two lakes.

28. The wetlands on the margins of Lake Spectacle have been fenced to exclude livestock. The margin of Lake Slipper has recently been fenced but in 2009 there was still occasional intrusion of stock into this area.
29. The indigenous wetland communities on lake margins meet the Rodney District Plan criteria for wetland quality. The wetlands have previously been identified in the PNAP survey of Rodney Ecological District (Mitchell *et al.* 1992), which means they are automatically treated as being of sufficient quality to justify a subdivision Lot. In addition to this, the lake margin wetlands meet all six of the criteria outlined in Appendix 7C.
 1. **Diversity** - The wetlands contain indigenous vegetation sequences from permanently wet ground through to open water.
 2. **Naturalness** - The reedlands are largely unmodified from their original character.
 3. **Rarity of species** - The wetlands support at least six threatened bird species and one regionally uncommon plant species.
 4. **Wildlife habitat** - The wetlands provide important habitat for threatened wetland bird species such as spotless crane, Australasian bittern, and North Island fernbird.
 5. **Linkages/buffering/corridors** - The wetlands form part of a larger area of dune lake vegetation to both the north and south of the property.
 6. **Potential** - The wetlands have the potential to further increase in value in a short time frame through weed control and the planting of a terrestrial buffer.

Willow Over Indigenous Reedland on Lake Margin (0.04 ha)

30. On the south-eastern edge of the channel that links the two lakes, an area of poorly-drained land with pools of shallow water has a canopy of willow (*Salix matsudana*) trees. Under the canopy, there are areas of indigenous sedgeland (*Eleocharis sphacelata*, *Baumea articulata*, and *Schoenoplectus tabernaemontani*).
31. The patch of willow over indigenous sedgeland meets three of the criteria outlined in Appendix 7C.
 1. **Linkages/buffering/corridors** - This wetland area forms part of a larger area of dune lake vegetation to both the north and south of the property, and decreases the distance between the wetland vegetation on the periphery of Lake Slipper and Lake Spectacle.
 2. **Wildlife habitat** - Spotless crake are present in the Tomarata Lakes wetlands and are known to breed in areas with a willow canopy (Heather and Robertson 1996).
 3. **Potential** - The wetlands have the potential to further increase in value in a short time frame through the removal of the willows and the planting of a terrestrial buffer.

Wetland in Dune Slacks (0.19 ha)

32. On the eastern side of Lake Spectacle, the lowest-lying dune slacks are often contiguous with wetlands on the lake margin (Attachment TJM2 - Plate 3). The ground is wet to slushy underfoot, with occasional small pockets of open water. Edgar's rush (*Juncus edgarii*) is common, with frequent mercer grass (*Paspalum distichum*), Yorkshire fog (*Holcus lanatus*), willow weed (*Persicaria decipiens*), and a native sedge (*Isolepis prolifer*), and occasional primrose willow (*Ludwigia peploides*). Further to the east the dune slacks are well drained and species indicative of wetland environments, such as sedges, are absent.

33. The wet dune slacks currently do not meet the Rodney District Plan criteria for wetland quality. They have been highly modified by vegetation clearance, followed by a long history of grazing. With appropriate management (e.g. blockage of drainage ditches, and planting and weed control as per Wildland Consultants Contract Report No. 1909 – February 2008), this area may meet the criteria in the future. However this improvement is unlikely to be met within the 2-3 year time frame stipulated for Criterion 3 (f) Potential in Appendix 7C.

Seepage on Hillslope (0.04 ha)

34. There is a small seepage on the hillslope between Ocean View Road and Lake Spectacle. The ground is wet to slushy underfoot, with a poorly-defined water course. Edgar's rush is abundant, Yorkshire fog is common, and mercer grass, willow weed, and starwort (*Callitriche stagnalis*) occur occasionally. The lower hillslope on which this seepage is located has recently been fenced to exclude livestock and is now covered in rank grassland.
35. This seepage currently fails to meet the Rodney District Plan criteria for wetland quality. With appropriate management (e.g. planting and weed control as per Wildland Consultants 2008), this area may meet the criteria in the future. However this improvement would not be met within the 2-3 year time frame stipulated for the Criterion 3 (f) Potential in Appendix 7C.

Drainage Ditches and Reflooding of Former Wetland Areas

36. On the eastern side of Lake Spectacle, several ditches cross the low-lying dune slacks and drain westwards into Lake Spectacle. The western end of these ditches held water at the time of the field survey in December 2008. The ditches support dense growth of indigenous and exotic wetland plants, with abundant sedges and rushes (*Isolepis prolifer* and Edgar's rush), and occasional soft rush, kiokio, and raupo. These ditches are not mapped as wetland due to their small size and highly modified state.
37. However, the presence of these ditches indicates that, prior to drainage, a much greater area of the low-lying dune slacks would have formerly been wetland. All of the dune slacks on the eastern side of Lake Spectacle are

within the property. If all of the ditches that drain the restoration areas are blocked, the area of dune slack wetlands could increase by up to 8.47 hectares.

38. If the ditches are to be blocked this should be done using earth sourced from the site, to avoid the introduction of new weed species. The close proximity of the dune slacks to the indigenous wetland vegetation on the lake margins would result in rapid natural regeneration of indigenous species within newly-flooded areas. Allowing the opportunity for natural regeneration of wetland vegetation, rather than planting immediately, is desirable. If wetland vegetation establishes without planting, the new areas of dune slack wetland would be of greater naturalness and ecological value, than if they were planted.
39. The natural regeneration of indigenous species should be assessed one to two years after flooding. If indigenous wetland species are of low density and/or diversity at this time, supplementary planting of the reflooded areas should then be undertaken. A suggested planting schedule for these areas is provided in Table 2. The numbers of plants of each species and their spacing will need to be decided one to two years after flooding, according to water depths, and the density and diversity of the wetland vegetation at this time.

Table 2: Plant schedule for supplementary planting of reflooded dune slacks if natural regeneration is poor.

Species	Water Depth	Grade
<i>Baumea articulata</i>	0-0.6 m	1 L
<i>Carex secta</i>	0-0.3 m	1 L
<i>Cordyline australis</i>	Moist soils on margin	1 L
<i>Eleocharis sphacelata</i>	0-1.5 m	1 L
<i>Leptospermum scoparium</i>	Moist soils on margin	1 L
<i>Phormium tenax</i>	Moist soils on margin	1 L
<i>Schoenoplectus tabernaemontani</i>	0-1.2 m	1 L

40. All plantings should follow the guidelines provided in “Making the most of Auckland’s stormwater ponds, wetlands, and rain gardens” (Wildland Consultants 2008c).

41. Restoring wetlands within the dune slacks, once their natural hydrology has been restored, would be of much greater ecological value than planting the dune slacks with forest and shrubland species.
42. The blockage of drainage ditches may increase the total area of wetlands within the property by up to 8.47 ha. If appropriately restored, these new wetland areas may meet the Rodney District Plan wetland quality criteria in the future. However this increase in wetland area, and improvement so that it meets the quality criteria, is unlikely to be met within the 2-3 year time frame stipulated for Criterion 3 (f) Potential in Appendix 7C.
43. Any blockage of drainage ditches should be monitored regularly in order to document changes in water level and wetland extent, and to identify any management requirements that may arise, such as weed control.

ENTITLEMENT FOR SUBDIVISION UNDER RULE 7.14.3.3

44. The covenanting of all of the lake margin wetlands within the property qualifies for one additional lot under Rule 7.14.3.3. The qualifying wetland areas total 1.77 ha in area, and easily meet the assessment criteria in Appendix 7C. The wetland contains several representative vegetation types, and supports nationally threatened wetland bird species.
45. In addition to the covenanting of 1.77 ha of qualifying wetland, other areas of wetland, totalling 0.23 ha, will be restored, and 20.9 ha of lake margin and reflooded dune slacks will be restored with indigenous forest, shrubland, and wetland species. The total area of lake margin to be covenanted and restored is 22.9 ha.
46. Any reflooded dune slacks are included within the area calculations for enhancement planting, not qualifying wetland areas. This is necessary, as the exact extent of reflooded dune slacks can only be determined by blocking drainage ditches and waiting for the water levels to increase. The inclusion of reflooded dune slacks within the area of enhancement plantings (which can occur on dry land **or** wetlands) should remove any uncertainty the Rodney

District Council has regarding dune slacks and the justification of additional lots.

PLANTINGS

47. The species to be planted are presented in Section 9.3 of Report No. 2124. Two tables are presented, one for dune ridges and one for dune slacks. The species to be planted are all found locally on the dune systems of the Pakiri area, and are appropriate for the soil types, topography, and exposure of the site. In addition to this, a plant schedule for reflooded dune slacks is presented in Table 2 of this evidence.
48. The plant grades to be used should be either 1 L or PB3, according to the most appropriate grade on a species by species basis.
49. The location of the plantings is shown in Plan 617A (Terra Nova Planning 2010). Within this area, the dune ridges and dune slacks have not been separately mapped. The area of dune ridges, dry dune slacks, and reflooded dune slacks should be estimated after ditches have been blocked and water levels stabilised. This will need to be done prior to plant ordering.
50. The density of the plantings should be 1.4 m apart.
51. All plants should be sourced from naturally-occurring indigenous species in the Rodney Ecological District.
52. All plantings on well-drained substrates should be fertilised at the time of planting by incorporating one fertiliser tablet into each planting hole. To minimize additional nutrient input into the lake, no fertilizer should be used within the wetland plantings.
53. Section 9.4 of Report No. 2124 outlines the maintenance of plantings, including frequency and method of releasing, and Appendix 6 of this report gives a month by month schedule of works for a six-year maintenance period.
54. Section 9.8 of Report No. 2124 outlines pest control.
55. Mulching is not feasible over 20.9 ha. However the plantings will be into

blanket or spot sprayed grasses, and the dead grass will provide a mulch for the first critical months of establishment.

LONG TERM ECOLOGICAL EFFECTS

Restoration of Indigenous Wetland Communities and Improvement in Water Quality

56. Lake Spectacle is presently classed as hypertrophic by the Auckland Regional Council (ARC) lake water quality monitoring programme. The lake waters are “highly fertile, supersaturated in phosphorus and nitrogen, rarely suitable for recreation, and with limited habitat for desirable aquatic species” (ARC 2010). The most significant problems for water quality in the lake have been identified as high levels of nutrients, largely derived from intensive agriculture in the lake catchment, and factors that contribute to the mixing of water and sediments, including the presence of koi carp, the absence of submerged aquatic plants, and the lake’s exposure to prevailing winds (ARC 2010).
57. The major mitigation opportunity at the property is to retire the lake margins from grazing, and to restore indigenous wetland, shrubland, and forest communities. Until recently, cattle have had full access to the lake margins in several places and, at these locations, the landward margins of the wetlands were severely grazed and trampled.
58. Where indigenous shrubland and scrub is present on the landward margins of the wetlands, this occurs as a narrow band and provides inadequate buffering of the lake from adjacent grazing land. Grazing of the lake margins is restricting indigenous vegetation to areas beyond where cattle can reach, preventing the development of a more natural gradation from terrestrial to aquatic indigenous habitats. Furthermore, grazing within the property, with the associated inputs of livestock effluent into the water and soil pugging, continues to contribute to the poor water quality of the lakes, which are in an advanced state of eutrophication.
59. The subdivision plan includes the restoration of all lake margins within the Lots. The total area to be restored is c. 22.9 ha, and will be subject to a protective covenant. The plantings will substantially increase the buffering of

the lakes, contributing to improved water quality. The proposed fencing will exclude livestock from 0.6 km, or 77%, of the remaining margins of Lake Slipper that are being grazed, and approximately 1.2 km, or 29%, of the margins of Lake Spectacle that are being grazed.

60. At present, the greatest width of wetland vegetation buffering Lake Spectacle, at any one point, is 50 m (on the south-western edge of the northern arm). If the dune slacks are reflooded and restored as per Attachment TJM1, the width of the wetland buffer, from which livestock are excluded, will extend up to 250 m along some of the margins of the lake (on the eastern edge of the northern arm).
61. This restored buffer of wetland vegetation will be similar in width to that around Lake Tomarata, which has a wetland buffer up to 300 m wide on its south-western edge. The sizeable wetland buffer around Lake Tomarata contributes to its high habitat values. Lake Tomarata supports good numbers of North Island fernbird and Australasian bittern.
62. The restoration of indigenous forest on the western and eastern margins of the northern arm of Lake Spectacle, as per Wildland Consultants Contract Report No. 2124, will reduce the exposure of the lake margins to wind. This will reduce wind disturbance of bottom sediments in the lake shallows.
63. Complete transitions from open water to wetlands to indigenous forest are rare in Rodney Ecological District, and the proposed development has considerable potential for the restoration of more natural complete vegetation sequences of this type.

Enhancement of Wildlife Habitat

64. The wetlands within the property support populations of at least six nationally threatened wetland bird species. These species are likely to utilize wetland habitats throughout the site, and elsewhere in the wider Pakiri dune system. All areas of wetland habitat within the Pakiri dune system are therefore a high priority for protection.

65. Buffering of the wetlands will result from the terrestrial plantings on the lake margins and will substantially increase the value of the wildlife habitat present, as well as providing new forest habitats for species currently uncommon or absent in the local area. Few areas of indigenous vegetation now remain on stabilized dunes along the Pakiri coastline and the terrestrial habitats that are to be restored are therefore also, potentially, of high ecological value.

SUGGESTED CONSENT CONDITIONS

66. All of the restoration areas are legally protected by covenants.
67. All drainage ditches within restoration areas are blocked to restore the natural hydrology of the dunes, and to maximise wetland area. Natural regeneration of wetland species in reflooded dune slacks is supplemented by plantings, if needed, one to two years post flooding.
68. All of the indigenous plantings at the site are sourced from the Rodney Ecological District.
69. Environmental pest plants, as listed in Wildlands Contract Report No 2124, are controlled prior to planting. Monitoring and control of any new invasions by pest plants will need to be ongoing.
70. No plant species listed under the Biosecurity Act 1993, in the National Plant Pest Accord (NPPA) or the Auckland Regional Pest Management Strategy (ARPMS) are permitted to be planted or cultivated within any of the lots, either in the ground or in pots.
71. Domestic cats are prohibited from all of the proposed lots within the property, and dogs should be prohibited from the lake margins and all of the covenanted restoration areas.

CONCLUSIONS

72. A total of 2.00 ha of wetland habitat is currently present at 622 Ocean View Road, of which 1.77 ha meets the Rodney District Plan wetland quality criteria as outlined in Appendix 7C. An additional 0.23 ha of existing wetland may

meet the criteria in the future if managed appropriately. The wetlands on the margins of Lake Spectacle have been previously recommended for protection by the PNAP survey of Rodney Ecological District (Mitchell *et al.* 1992), and meet all six of the criteria in Appendix 7C. Legal and physical protection of the wetlands at 622 Ocean View Road entitles the land owner to one additional lot under Rule 7.14.3.3.2 of the Proposed District Plan.

73. Wetlands were formerly more extensive on the property, prior to the excavation of drainage ditches on the eastern side of Lake Spectacle. Blocking these drainage ditches would reflood some of the low-lying dune slacks, and may increase the area of wetland on the property by up to 8.47 ha. Restoration of wetland communities in the dune slacks would have far greater ecological benefits than restoration of these areas as dryland vegetation communities, and is likely to require less intensive planting. The reflooding of dune slacks, with subsequent plantings if natural regeneration is inadequate, will require some degree of flexibility to be retained with regard to exact plant numbers and species.

74. Protection of the wetlands, including fencing, weed control, pest animal control, and planting of a terrestrial buffer is of high importance, particularly because of the presence of nationally threatened wetland bird species. Additionally, the 20.9 ha of forest, shrubland, and wetland restoration that is planned, will provide significant buffering around the southern side of Lake Slipper, and the northern end of Lake Spectacle. This buffering will not only protect and enhance indigenous biodiversity at the site, but also contribute towards improvements in the water quality of the lakes.

REFERENCES

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- Wildland Consultants 2007b: Ecological assessment of proposed sand mine site at Tomarata and proposed restoration strategies. *Wildland Consultants Ltd Contract Report No. 1716*. Prepared for Sandglass Corporation Limited. 14pp.
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- Wildland Consultants Ltd 2008c. Making the most of Auckland's stormwater ponds, wetlands, and rain gardens. Prepared for Auckland Regional Council. 25pp.
- Wildland Consultants Ltd 2009: Ecological assessment of wetlands at 662 Ocean View Road, Tomarata. *Wildland Consultants Ltd Contract Report No. 2124*. Prepared for Arnim Pierau. 39 pp.

ATTACHMENT TJM1

WETLAND MAP

ATTACHMENT TJM2
SITE PHOTOGRAPHS



Plate 1: View from Ocean View Road across the northern end of Lake Spectacle showing a nearly continuous band of indigenous wetland along the shoreline.



Plate 2: Wetland zonation on the western margin of Lake Spectacle. Water fern (*Histiopteris incisa*) fernland on the well-drained margin grades into wetland with *Baumea articulata* reedland (red-brown colour), which grades into raupo (*Typha orientalis*) reedland (green), which grades into kuta (*Eleocharis sphacelata*) (dark green) in the deeper water.



Plate 3: Eastern margin of Lake Spectacle with pasture on well drained dune ridges alternating with Edgar's rush (*Juncus edgariae*), mercer grass (*Paspalum distichum*), and willow weed (*Persicaria decipiens*) in dune slacks.