

**LITTLE LLANGOTHLIN NATURE RESERVE
PLAN OF MANAGEMENT**

NSW National Parks and Wildlife Service

October 1998

This plan of management was adopted by the Minister for the Environment on 4th October 1998.

Acknowledgments:

This plan of management was prepared by the Glen Innes District of the National Parks and Wildlife Service.

Photo: Little Llangothlin Lagoon by Jeff Johnston.

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FOREWORD

Little Llangothlin Nature Reserve was established in 1979 and contains one of the few high altitude freshwater lagoons on basalt soil remaining on the New England Plateau of New South Wales.

The nature reserve is a significant wetland providing a range of habitats for waterfowl and other fauna and is a drought refuge for waterbirds. The waters of Little Llangothlin Lagoon contain rare and restricted populations of invertebrates, including the only known location of a genus of planktonic flatworms.

Little Llangothlin Lagoon and the lunette associated with it are of considerable geomorphic interest and are valuable resources for research and education. Studies of the lagoon's sediments provide a key to the denudation chronology of the New England Tablelands as well as illustrating the effects of clearing. Many similar lagoons and swamp depressions in the region have been either drained or dammed for agriculture. In an area that has been largely cleared, the remnant vegetation in the nature reserve is an important refuge for native plants and animals.

Because of these high nature conservation values, the nature reserve has been listed under the Convention on Wetlands of International Importance (the Ramsar Convention). Countries which are parties to this convention undertake to implement policies that guarantee the wise and sustainable use of wetlands.

This plan provides for the protection of the scenery, natural features and cultural features of Little Llangothlin Nature Reserve. Existing weed and feral animal control programmes will be continued in the reserve and the most appropriate methods of undertaking revegetation of the cleared land around the lagoons will be investigated.

Limited public use of the reserve will be encouraged for low intensity recreation and environmental education. To cater for this use it is proposed to establish a carpark, toilet and an interpretive display on the edge of the road past the nature reserve. It is also proposed to utilise an existing management track as a combined management/walking track.

An historical study of the old dairy and windmill will be undertaken to assess their significance.

This plan of management establishes the scheme of operations for Little Llangothlin Nature Reserve. In accordance with the provisions of Section 76 of the National Parks and Wildlife Act, 1974, this plan of management is hereby adopted.

PAM ALLAN

Minister for
the Environment

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1. INTRODUCTION

The National Parks and Wildlife Act of 1974 requires that a plan of management be prepared for one or more nature reserves. A plan of management is a legal document which outlines how the nature reserve will be managed in the foreseeable future.

The procedures for the adoption of a plan of management for a nature reserve are specified in the Act:

- * Where a plan of management has been prepared, the Director-General is required to refer the plan to the National Parks and Wildlife Advisory Council for its consideration and advice.
- * The Director-General submits the plan to the Minister, together with any comments or suggestions of the Advisory Council.
- * The Minister may adopt the plan with or without alteration, or may refer the plan back to the Director-General and Council for further consideration.

Once a plan has been adopted by the Minister, no operations may be undertaken within the nature reserve except in accordance with the plan.

Although not a requirement of the Act the plan of management for Little Llangothlin Nature Reserve was placed on public exhibition for a period of three months ending 24th March 1997. The plan of management attracted 10 submissions which raised 17 issues. All comments received were referred to the National Parks and Wildlife Advisory Council for its consideration and advice. The comments and suggestions of the Advisory Council were in turn considered by the Minister when adopting this plan.

Further information on the management of Little Llangothlin Nature Reserve may be obtained from the:

Glen Innes District Office
National Parks and Wildlife Service
68 Church Street
(PO Box 281)
GLEN INNES 2370

or by telephoning (02) 6732 5133 during office hours.

2. MANAGEMENT CONTEXT

2.1 NATURE RESERVES IN NSW

Nature conservation is concerned with ensuring the survival of free living populations of native animals and plants and maintaining genetic diversity and natural environments, including geological and geomorphological sites of scientific and cultural interest. Nature conservation is an integral part of land-use planning.

Nature reserves are areas of special scientific interest containing wildlife and natural phenomena and where management practices aim at maximising the value of the area for fauna and flora, scientific investigation and educational purposes.

The National Parks and Wildlife Act 1974 provides for the setting aside and management of land as nature reserves for the purpose of:

- i) the care, propagation, preservation and conservation of wildlife;
- ii) the care, preservation and conservation of natural environments and natural phenomena;
- iii) the study of wildlife, natural environments and natural phenomena; and
- iv) the promotion of the appreciation and enjoyment of wildlife, natural environments and natural phenomena.

Nature reserves are a part of the regional pattern of land use. Nature reserves differ from national parks which include as an objective the provision of opportunities for outdoor recreation. The management of a nature reserve aims at minimising disturbance to natural and cultural resources. Other land uses are distinguished by an acceptance or encouragement of environmental modification. Nature reserves therefore provide for only a limited part of a range of land uses in any region. The value of nature reserves lies in their role as refuge areas where natural processes, phenomena and wildlife can be studied, maintained and conserved.

2.2 THE RAMSAR CONVENTION

Little Llangothlin Nature Reserve has been recognised as a Wetland of International Importance under the Ramsar Convention.

The Convention on Wetlands of International Importance (the Ramsar Convention) was adopted in 1971 and signed by Australia in 1974. Countries which are parties to this convention undertake to implement policies that guarantee the wise and sustainable use of wetlands.

The Ramsar Convention defines wise use as “utilisation for the benefit of humans in a way compatible with the maintenance of natural properties of the ecosystem” whilst sustainable use is that which “yields the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations”.

The convention also outlines the management requirements for an internationally important wetland:

“that the essential character of (the) wetland be recognised and that measures (notably inclusion of wetland concerns in landuse and water management planning, adoption of a whole of catchment approach and/or creation of buffer

zones) be taken to ensure that the ecological character of Ramsar sites and wetlands is not placed at risk” (part Recommendation C.5.3); and

“wetlands are dynamic areas open to influence from both natural and human factors. In order to maintain their biological diversity and productivity and to allow the wise use of their resources by human beings, some kind of overall agreement is needed between the various owners, occupiers and interested parties. The management planning process provides this overall agreement” (part Resolution C.5.7).

To date some 5 million hectares of wetland in Australia, including Little Llangothlin Nature Reserve, have been listed under the Ramsar Convention.

2.3 LITTLE LLANGOTHLIN NATURE RESERVE

2.3.1 Location and Regional Context

Little Llangothlin Nature Reserve is located 8 kilometres east of the Great Divide on the New England Tablelands between Glen Innes and Guyra. The reserve covers 257 hectares and includes Little Llangothlin Lagoon of approximately 120 hectares and part of the much smaller Billy Bung Lagoon as well as a major portion of the catchment of both lagoons. The nature reserve was dedicated in December 1979 and was formerly part of a farming, grazing and dairying property.

The lagoon is on the head-waters of the easterly flowing Oban River. Neighbours on all sides of the nature reserve include grazing properties with some limited cultivation in the lagoon’s catchment for potatoes and oats.

The reserve is within easy reach of the New England Tableland towns of Guyra, Glen Innes, Inverell and Armidale for day visitation. Educational institutions from Armidale, including the New England University and a field studies centre, use the nature reserve for research and educational programmes.

2.3.2. Significance of the Reserve.

There are more than 30 natural lagoons and swamp depressions on the New England Tablelands between Uralla and Llangothlin but most are small features (2-3 ha). Wetlands such as these lagoons and swamps are subject to the NSW Wetland Management Policy which was adopted by the government in 1996. This Wetland Management Policy in turn is a major component of the overall NSW State Rivers and Estuaries Policy adopted in 1992 which provides a framework for the sustainable use, conservation and management of the state’s rivers and estuaries. This policy and its components guide the community and state and local government in day to day management of wetlands.

Little Llangothlin Lagoon (120 ha), nearby Llangothlin Lagoon (410 ha) and Mother of Ducks Lagoon (430 ha) are the largest of the New England lagoons and swamps. Only Little Llangothlin Lagoon, part of Billy Bung Lagoon and Mother of Ducks Lagoon are reserved under the National Parks and Wildlife Act, with most of the remainder being either drained or dammed for agriculture. The lagoons are located close to major drainage divides on the oldest parts of the landscape. The area is currently being assessed for inclusion on the Register of the National Estate.

Fauna Value

Little Llangothlin Nature Reserve is a large and significant high altitude wetland on the Northern Tablelands. Located in an area of the New England Tablelands that has been extensively cleared, the remnant vegetation in the nature reserve provides important habitat and refuge areas for birds, mammals, amphibians and reptiles.

Over 100 bird species have been recorded in the nature reserve and it regularly supports large numbers of waterfowl and waders, some of which nest in the reserve. The range of birds using the nature reserve is due to the varied habitats in both Little Llangothlin Lagoon and Billy Bung Lagoon, and the remnant vegetation surrounding these water bodies. These habitats are of special value in supporting vulnerable and rare species such as the comb-crested jacana (*Irediparra gallinacea*) and the blue-billed duck (*Oxyura australis*). Little Llangothlin Lagoon is of special value as a drought refuge for many species of water birds (Briggs 1977, White 1987).

Billy Bung and Little Llangothlin Lagoons support many species of frogs including rare species. The New England Bell Frog (*Litoria castanea*) has been recorded in nearby Llangothlin Lagoon and may still exist in the reserve despite remaining undetected for about 15 years. Frogs are an important indicator of environmental change and studying and monitoring the reserve's frog populations may elucidate some of the reasons for the deterioration of frogs in Australia, where an estimated one third of frogs species are either in decline or have become extinct.

Both lagoons contain interesting aquatic invertebrate fauna including the only known location of the genus *Rhabdoceol*, a planktonic flatworm, and the copepod crustacean *Ectocyclops rubescens*.

Flora Value

Vegetation around the lagoons has been partially cleared and is affected by dieback. However, since the removal of grazing and as revegetation and regeneration proceed, the flora value of the reserve will increase. The rare plants *Thesium australe* and *Discaria pubescens* occur in the reserve. *Thesium australe* is inadequately conserved in existing National Parks and Wildlife Service estate, especially on the Tablelands, increasing the significance of the Little Llangothlin population.

Geomorphological Value

Little Llangothlin Lagoon is of considerable geomorphic interest as the study of its sediments is providing a key to the denudation chronology of the New England Plateau. This research is also illustrating the effects of clearing within catchment areas (Haworth 1989).

A significant feature of the reserve is the presence of a lunette on the eastern side of the lagoon which is geomorphologically unique in this type of situation on the Australian continent (Walker 1976). The lunette is a potential source of information on the late Pleistocene environmental conditions and Aboriginal occupation of the area. Despite previous draining, the lagoon and lunette have been little altered and have high scientific and educational value.

Cultural Value

Little Llangothlin Nature Reserve lies within the traditional lands of the Banbai Aboriginal nation and falls within the boundaries of the Guyra Local Aboriginal Land Council.

Archaeological surveys have found a number of open campsites and artefacts around Llangothlin Lagoon. These provide indications of both food getting and domestic activities of Aboriginal people who lived in the area prior to its clearing for agriculture. The lunette associated with the lagoon is especially important as it provides a dateable context for the archaeological sites in the reserve.

Little Llangothlin Nature Reserve also clearly demonstrates the impact of European settlement on the natural processes and landscape of the lagoon area.

Educational and Scientific Value

The variety of habitats within and around the lagoon and the high significance of the area as a refuge, particularly for waterbirds and evidence of Aboriginal and European occupation, makes Little Llangothlin Nature Reserve a valuable location for scientific research and teaching. Palynological, geochemical and lithostratigraphic studies of the lagoon and lunette have not only provided evidence of past climates but have also revealed the catastrophic nature of early European farming on highland soils (Haworth and Gale 1993). Little Llangothlin Nature Reserve is currently used for educational and research visits by schools and universities. There is considerable potential for increased use for this purpose.

3. OBJECTIVES OF MANAGEMENT

3.1 GENERAL OBJECTIVES FOR NATURE RESERVES

The following general objectives relate to the management of nature reserves in New South Wales:

- * Protection and preservation of the scenic and natural features.
- * Maintenance of natural processes.
- * Conservation of wildlife.
- * Preservation of Aboriginal sites and historic features.
- * Encouragement of scientific and educational inquiry into environmental features and processes and into Aboriginal heritage.
- * Promotion of the appropriate use of the nature reserve.

3.2 SPECIFIC OBJECTIVES FOR LITTLE LLANGOTHLIN NATURE RESERVE

In addition to the above general objectives, Little Llangothlin Nature Reserve will be managed to retain its significance and in particular to:

- * Maintain the reserve as a healthy and diverse wetland habitat for native wildlife, including migratory birds which are the subject of international treaties for the protection of migratory species and their habitats.
- * Regenerate native vegetation communities around the lagoons.

3.3 OVERALL STRATEGIES

The following strategies will be implemented in managing the nature reserve:

- * Management will be designed to encourage the return of the reserve to as natural a condition as possible following the cessation of farming and grazing by promoting regeneration, undertaking revegetation programmes, controlling and eliminating weeds and feral animals and establishing an appropriate fire regime.
- * High priority will be given to research and monitoring in fields such as archaeology, botany, geomorphology, palynology, herpetology, ornithology and aquatic fauna and flora investigations to establish the most appropriate management policies and programmes. Priority will also be placed on the management and interpretation of Aboriginal and European sites within the Little Llangothlin Nature Reserve.
- * Limited public use of the reserve will be encouraged for environmental education. Priority will be placed on the interpretation of wetlands of the Tablelands, including Aboriginal interaction with the natural environment. Only interpretative displays and basic visitor infrastructure will be provided.
- * Close co-operation will be encouraged and maintained between the Service, neighbouring landholders and the local community.

4. POLICIES AND FRAMEWORK FOR MANAGEMENT

This chapter contains the policies and framework for the management of the Little Llangothlin Nature Reserve together with relevant background information. Policies are summarised under the following section headings:

Nature Conservation
Cultural Heritage
Use of the Area

The policies established in this plan of management will provide the framework for management consistent with anticipated resources available to the Service and with anticipated community trends for the next five to ten years.

The actions identified are those proposals to which priority will be given in the foreseeable future. Other management actions may be developed over the life span of this plan of management consistent with the objectives and policies set out in the plan.

Where not specifically provided for in this plan of management, the management of Little Llangothlin Nature Reserve will be in accordance with the National Parks and Wildlife Act and with general Service conservation and management policies.

4.1 NATURE CONSERVATION

4.1.1. Geology, Geomorphology, Soils and Water Quality

Little Llangothlin Nature Reserve is located on Tertiary basalt on the New England Plateau at a elevation of 1360 m. It is the only protected area on the New England Tablelands on basaltic soils. Immediately east of the nature reserve are outcrops of Permian granite. This area of the Eastern Highlands forms part of a major tectonic unit of the Australia continent. The slopes around both Little Llangothlin Lagoon and Billy Bung Lagoon are cut in basalt and are strewn with basalt blocks.

The basalt weathers to clay-rich red and brown soils. However the lunette associated with Little Llangothlin lagoon is capped by coarse sand derived from the granite soils to the east. Laterite or detrital ironstone is present at the lagoon outlet. There are remains of several old exploration holes in the lighter soil around the lunette which are probably early attempts to find gems or minerals in the area; however fossicking on the reserve has been prohibited since the area became a nature reserve.

The location of the lagoon close to the Mann-Oban drainage divide means that Little Llangothlin's catchment is relatively small. The lagoons have been periodically dry during the period of European settlement (Walker 1976), especially after the opening of a narrow drainage ditch at the southern end of the lunette. This drainage ditch was subsequently filled by the Service to return Little Llangothlin Lagoon to its natural level. When full, the water depth in Little Llangothlin Lagoon ranges from two metres in the deepest section to the south, to shallow flats in the north and west. Billy Bung Lagoon is normally much shallower than Little Llangothlin Lagoon.

Detailed studies of the sediments within Little Llangothlin Lagoon have been undertaken by Haworth (1989), Haworth and Gale (1993) and Pisanu et al. (in press). This work has enabled the dating of the lagoon, a reconstruction of environmental conditions during the lagoon genesis, the provision of details of the catchment's original flora and a comparison of pre- and post-settlement rates of soil erosion and deposition in the catchment. Cores ranging in depth from 1.5 m to 3.5 m taken from the lagoon's basin illustrate the impact of European settlement. On average the deposition of the first metre to metre-and-a-half of sediment took at least 7,000 years while the top metre of

sediment was deposited in the lagoon in the last 200 years. In the last 40 years erosion rates have increased seven-fold and the eroded material includes more top soil.

Little Llangothlin Nature Reserve is within the area of the Clarence Catchment Management Committee. Total Catchment Management provides an umbrella framework to aim for amongst other matters, cleaner water, less soil erosion, improved vegetation cover, the maintenance of ecological processes and a balanced and healthier environment. It also provides a focus to balance conservation needs and development pressures and encourages a more aware and involved community. The Catchment Management Committee is an important means of protecting the water catchment values of Little Llangothlin Nature Reserve.

Policies

- * All activities within Little Llangothlin Nature Reserve will incorporate effective soil erosion and sedimentation control principles and practices.
- * The current natural outlet from Little Llangothlin Lagoon will continue to be the only outlet for water from the lagoon.
- * The Service will support and provide input into the Clarence Catchment Management Committee and liaise with neighbours, local government and Landcare organisations to maintain and improve the water quality of the catchments in the park.
- * Where significant water pollution from agriculture is shown to be affecting wetland values the Service will seek its correction in conjunction with appropriate catchment land users.
- * The Service will continue to encourage scientific inquiry into the geomorphology of the lagoon.
- * Fossicking will not be permitted on the reserve.

Actions

- * A simple gauging system will be established to monitor water levels in Little Llangothlin Lagoon.
- * The water quality of Little Llangothlin Lagoon will be monitored.
- * The service will co-operate with local landowners, the Department of Land and Water Conservation and the Clarence Total Catchment Committee to help reduce erosion and sedimentation in the two lagoons and their catchments.
- * Sediment control works will be undertaken within the nature reserve if required.

4.1.2. Native and Introduced Plants

There is a succession and zonation of plant communities in the nature reserve from submerged communities in the lagoon, to a floating leaved stage, to sedge-meadow to terrestrial vegetation (Briggs 1976). Vegetation zones in the lagoons are determined by water depth. The deepest parts of Little Llangothlin Lagoon are occupied by reed swamps dominated by *Eleocharis sphacelata*. The deeper waters to the south of the lagoon also support an aquatic community of submerged plants dominated by *Potamogeton ochreatus* and *Chara sp.* In shallow water there is a zone of wet meadow swamp (*Myriophyllum propinquum* and sedge swamp (*Juncus articulatus*). Towards the land in waterlogged and occasionally flooded soil there is a zone of wet grass

swamp (*Glyceria australis*). The main communities in Billy Bung lagoon are wet swamps, sedge swamp and wet grass swamp.

Little Llangothlin Lagoon is also encircled by a zone of dry grass swamp (*Glyceria australis*) and grass meadows (*Holcus lanatus* and *Carex gaudichaudiana*). The terrestrial vegetation around the lagoons has been either wholly or partially cleared. Remnant snow gum communities (dominated by *Eucalyptus pauciflora* with some *E. stellulata*) occur in the north west section of the reserve with a smaller population on a hill in the north east corner. Isolated mountain gums (*E. dalrympleana*) are found on higher areas of the reserve. The lunette to the east of the lagoon also supports snow gum woodland with peppermints (*E. acaciformis* and *E. nova-anglica*) occurring closer to the lagoon's margin.

Many of the eucalypts in the reserve are affected by dieback, a common occurrence throughout the New England Tablelands. Limited regeneration, including a shrub layer (mainly *Acacia dealbata*), has occurred since the removal of grazing however the ground layer is dominated by introduced grasses and pasture species.

Palynological studies are giving a clue to the composition of the original vegetation in the reserve's catchment (Pisanu *et al.* in press). It appears that at one time casuarinas grew in the area. These and other studies will assist in determining the most appropriate species to be used for revegetation programmes.

The main weed present in the nature reserve is blackberry (*Rubus ulmifolius*). There are also isolated patches of nodding thistle (*Carduus nutans*). Successive years of weed control programmes since Service acquisition of the area are controlling and eliminating both species. Weed control measures used include manual removal and spraying with herbicides where appropriate, avoiding any contamination of the wetlands. Biological control of blackberry has been trialed in the reserve, while research into control of nodding thistle using the rosette weevil currently being conducted in the Glen Innes area may be extended to the reserve.

Because of the possible effects of herbicides on frog populations and other wetland species it will be necessary to choose chemicals which are considered safe to use and to monitor their effects.

Policies

- * Introduced plants will be controlled and if possible eliminated from the nature reserve. Preference will be given to those techniques which have minimal environmental impact.
- * Preference will be given to weed control measures which have minimal impact on water quality and on frog and bird populations. Impacts on native species, particularly frogs, will be monitored.
- * Regeneration and revegetation of native vegetation, especially in cleared and dieback areas and along watercourses, will be encouraged.
- * Control programmes will be planned in consultation with neighbours and appropriate authorities and will wherever practicable be undertaken as part of a co-operative programme.
- * Research into the habitat value of the various vegetation zones and communities, the original vegetation of the area and into causes and control of dieback will be encouraged.

Actions

- * The current weed management programme will continue to be implemented employing chemical and mechanical methods. Priority will be given to the control of blackberry and nodding thistle. Biological controls will be used where practical.
- * Trials will be conducted to determine the most appropriate method to remove introduced grass and pasture species from the ground layer, including fire, herbicides, mechanical reduction and revegetation of the shrub layer.
- * A revegetation plan will be prepared and implemented for the nature reserve using species that occur in the lagoon's catchment and immediate area, and species identified in palynological studies. Revegetation along watercourses will be highest priority.

4.1.3. Native and Introduced Animals.

Despite clearing of vegetation, dieback damage and competition and predation from introduced animals which are likely to have reduced populations and species diversity, Little Llangothlin Nature Reserve contains important and varied habitats which support a large number of native animals.

Over 40 species of waterbirds have been recorded in the reserve, including the vulnerable and rare comb-crested jacana (*Jacana gallinacea*) and the blue-billed duck (*Oxyura australis*). Many of the waterbirds at Little Llangothlin are commonly associated with particular habitats eg. black swans (*Cygnus atratus*), grey teal (*Anas castanea*), Eurasian coots (*Fulica atra*), Australian grebes (*Tachybaptus novaehollandie*) and hardheads (*Aythya australis*) occur on open water; purple swamphens (*Porphyrio porphyrio*) in reed swamps; comb-crested jacanas in meadow swamp; white-faced herons (*Ardea novaehollandiae*) and straw-necked ibis (*Threskiornis spinicollis*) in meadow and grass swamp; and Latham's snipe (*Gallinago hardwickii*) in grass meadow (Briggs 1979).

Despite the clearing and dieback around the lagoon, a large variety of land birds inhabit the remnant vegetation including red-rumped parrots (*Psephotus haematonotus*), flame robins (*Petroica phoenicea*), superb blue wrens (*Malurus cyaneus*), yellow-faced honeyeaters (*Lichenostomus chrysops*) and dusky woodswallows (*Artamus cyanopterus*). Raptors are also common including wedge tailed eagles (*Aquila audax*), little eagles (*Hieraaetus morphnoides*), nankeen kestrels (*Falco cenchroides*), brown falcons (*Falco berigora*), swamp harriers (*Circus approximans*), boobook owls (*Ninox novaeseelandiae*) and white breasted sea eagles (*Haliaeetus leucogaster*). Tall mountain gums (*E. dalrympleana*) provide nesting sites for the sea eagle while hollows in trees affected by dieback are utilised by owls. The same hollows provide habitat for bats such as Goulds long-eared bat (*Nyctophilus gouldi*) and great pipistrelle (*Falsistrellus tasmaniensis*). Eastern grey kangaroos (*Macropus giganteus*), swamp wallabies (*Wallabia bicolor*), wallaroos (*Macropus robustus*) and brush-tailed possums (*Trichosurus vulpecula*) occur in the reserve. Small mammal surveys carried out in the reserve have not detected any such animals; their decline is probably due to predation by cats and foxes and loss of cover through clearing and grazing.

The nature reserve provides habitat for a wide range of reptiles and amphibians. Copperhead snakes (*Austrelaps superbus*) are commonly seen along with skinks, such as Whites skink (*Ergernia whitii*) and eastern water skinks (*Eulamprus quoyii*), which utilise basalt boulder piles. Eastern long-necked tortoises (*Chelodina longicollis*) nest in the lunette's sandy soil.

Billy Bung and Little Llangothlin Lagoons provide ideal habitat for frogs. Species recorded in these lagoons include: *Crinia parinsignifera*, *C. signifera*, *Limnodynastes dumerilli*, *L. tasmaniensis*, *Neobatrachus sudelli*, *Pseudophryne coriacea*, *Uperoleia fusca*, *U. laevigata*, *Litoria castanea*, *L. dentata*, *L. fallax*, *L. latopalmata*, *L. peronii* and *L. verreauxii*. The New England bell frog (*Litoria castanea*) may also exist within the reserve.

Invertebrates are not only a food resource for waterbirds but studies of the ostracod fauna of Llangothlin Lagoon (Backhouse and McKenzie 1983) have highlighted the importance of invertebrates as indicator species when monitoring the effects of management practices.

The short-finned eel (*Anguilla australis*) is believed to inhabit the lagoon.

As well as providing habitat and only known location for the undescribed genus of planktonic platyhelminth (flatworm), *Rhabdoceol*, the copepod crustacean *Ectocyclops rubescens* and conchostracean *Limnadia* sp., the reserve's lagoons contain other invertebrate species at the limit of their range or with restricted ranges (Australian Heritage Comm. 1995). The copepod *Boeckella montana* is at the northern limit of its range in the reserve while disjunct populations of *B. major* have been recorded there.

Introduced animals in Little Llangothlin Nature Reserve include rabbits, foxes and feral cats. Rabbit burrows cause special problems in the lunette due to the mixing of soil jeopardising the stratigraphic integrity of the profile. These important geomorphological and archaeological areas cannot be fenced with netting to exclude rabbits because the same areas are nesting sites for tortoises. Predation by foxes and cats affects numbers of birds and reptiles, however the impact of this predation on native fauna populations is unknown. Programmes to control rabbits, cats and foxes are in place and run concurrently in the reserve.

Policies

- * The reserve will be managed to conserve its value as habitat for native animals.
- * Research will be encouraged into the ecology of waterbirds in the reserve and monitoring programmes established to determine variation in distribution, abundance and habitat usage of birds.
- * Any developments, including research facilities, hides or walking tracks, will be located to avoid disturbance of waterbird feeding, breeding or resting areas.
- * Domestic stock will be excluded from the nature reserve.
- * Control programmes for foxes, cats and rabbits will be planned in consultation with neighbouring land owners and appropriate authorities and will where practicable be undertaken as part of a co-operative programme.

Actions

- * Surveys will be carried out to determine the presence and abundance of native animal species in the nature reserve in various habitats. Priority will be given to surveys of birds and amphibians.
- * Feral animal control will continue to be undertaken on an on-going basis and the effectiveness of the programme monitored, for example by track counts at bait stations.
- * Rabbit-proof boundary fencing will be erected around the boundaries of the reserve.

4.1.4. Fire Management

Fire is a natural part of the Australian environment and is essential to the survival of some plant communities. Fire may also be a useful management tool in re-establishing native species that require fire to initiate germination at specific sites or to alter the mix of native and introduced species in the ground layer. However fire can cause significant damage to wetland communities, especially when they are dry.

Fires are now a rare occurrence at Little Llangothlin Nature Reserve and are usually as a result of isolated lightning strikes, but this was not always the case. Analysis of cores taken from the lagoon, in particular of phosphorus concentrations, reflect changes induced by rapid and widespread alteration of vegetation as a result of European pastoralism and cultivation including burning (Pisanu, Haworth and Gale, in press). A marked increase in phosphorus concentration within the core after 1840 is attributed to widespread clearing and burning in the catchment. Norton (1971) concludes from historical evidence for the Northern Tablelands that: "By the end of the [19th] century the Tableland had changed from a park-like grassland grazed by marsupials and frequently but irregularly burnt, to a mixture of brush and savanna grazed mainly by ruminants and periodically burnt, often on an annual basis".

Fire may be used to assist regeneration of native species including *Acacia dealbata* and to assist in the control of weeds such as blackberry.

Under the *Rural Fires Act, 1997*, the Service is a fire authority and is responsible for controlling fires on national parks and nature reserves and is to ensure they do not cause damage to neighbouring land or property. This responsibility includes the implementation of fuel management programmes. The Service may also assist with the control and suppression of fires adjacent to the nature reserve. An important part of the Service's fire management is participation as a member of local Bush Fire Management Committees in the preparation of bush fire management plans which are required under the Rural Fires Act. The nature reserve is included within the area of the Guyra Bushfire Management Committee, which currently has a fire management plan under the Rural Fires Act.

Policies

- * Fire management will aim to protect life and property within and adjacent to the reserve.
- * Fire may be used to assist regeneration of native species including *Acacia dealbata* and to assist in the control of weeds such as blackberry.
- * Close liaison will be maintained with local bushfire brigades and neighbours in order to attain co-operative fire management.

- * No hazard reduction burning will be undertaken on the reserve for the life of this plan of management (apart from trial burns to encourage regeneration).
- * Bushfire frequency on the reserve will be minimised to allow regenerating seedlings to establish.
- * Boundary and internal fire trails will be maintained by slashing. Grading of trails will be permitted in cases of wildfire.
- * No fire places will be installed and fires will not be permitted on the reserve.

Action

- * As a natural vegetation community is re-established in the reserve a fire management plan will be prepared incorporating up to date ecological advice and detailing fire management programmes and strategies to protect neighbouring lands.

4.2 CULTURAL HERITAGE

Cultural heritage includes both Aboriginal and non-Aboriginal sites and places. Effective management of cultural resources requires the protection of individual sites, places and relics and their interpretation for visitors.

4.2.1. Aboriginal Sites

The nature reserve was within the area occupied by the Banbai people, whose territory stretched from Llangothlin/Backwater area to Dorrigo/Ebor area. Today it lies within the area of the Guyra Aboriginal Land Council.

Artefacts found around Little Llangothlin Lagoon provide evidence of activity of Aboriginal people in an area where important resources of water and food were available. Open sites provide indications of both food getting and domestic activity. A detailed survey of the area in 1978 (Davidson 1982) revealed edge-ground hatchets, grinders and flakes from the lunette and other parts of the reserve. An Aboriginal site survey by the Guyra Local Aboriginal Land Council (Banbai Cultural Resources Officers 1995) found five scarred trees and one stratified open site in the reserve. Eels, which were caught in the lagoon by the non-Aboriginal population in the nineteenth century, were probably used by Aborigines as well.

The lunette on the eastern side of Little Llangothlin Lagoon is especially important as it provides a datable context for archaeological remains (Davidson 1982). However the stratigraphic integrity of the lunette is being jeopardised by rabbits digging burrows.

Policies

- * Aboriginal sites found on the reserve will be managed in consultation with the local Aboriginal community.
- * All works proposed for the nature reserve will be preceded by an Aboriginal sites survey.
- * All sites found on the reserve will be recorded on the Aboriginal Sites Register.

Actions

- * A programme in collaboration with the Local Aboriginal Community will be undertaken to develop interpretation of Aboriginal Sites and occupations of the area.
- * Impacts on Aboriginal sites will be monitored. Where appropriate, work will be undertaken to retard natural degradation of sites and protect sites from user impacts.
- * Regular monitoring will be undertaken of rabbits in the lunette and beach area to ensure no further damage occurs to the soil profile.

4.2.2. Historic Places

The Llangothlin district was settled around 1840 for sheep grazing. The first station in the area was a lease held by William Rawson. It covered an area of 50,000 acres and had a carrying capacity of 300 cattle and 10,000 sheep (Sommerlad and Cammeron, 1972). Wheat was grown in the catchment of Little Llangothlin Lagoon from 1864-65, with a change to heavier feeding crops in the 1880s.

The Free Selection Acts of the 1860s brought to the land many people who did not have a tradition of farming practice and led to closer settlement of many areas. Almost the entire catchment of Little Llangothlin Lagoon became small farms, many occupied by large families who suffered extreme hardship in the early decades of the twentieth century (Haworth 1989).

A number of structures within the nature reserve date from pastoral use of the area before it was reserved. These include the sluice gate and drainage ditch which were used to drain Little Llangothlin Lagoon to provide additional grazing land, milking bails, fences, and a windmill, trough and water tank. The windmill was used to pump water to a trough away from the muddy lagoon margins which could trap stock. A number of boulder heaps are located around the reserve which appear to be piles of rocks gathered from the reserve to make ploughing easier.

Policies

- * Research into the farming and grazing history of the lagoon and the historical significance of all structures on the reserve will be encouraged.
- * Places of historic importance will be conserved in accordance with the Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (the Burra Charter).

Actions

- * An historical assessment will be undertaken of the old dairy, windmill and boulder piles in the reserve. The outcome of this study will determine subsequent action; either stabilise structures, restore structures, allow structures to deteriorate and collapse, or demolish and remove structures.
- * The old dairy and windmill will be fenced to ensure visitor safety while historical assessment is completed.

4.3 USE OF THE AREA

National Parks and Wildlife Service parks and reserves provide a significant proportion of the opportunities available for outdoor recreation in the New England region. In providing for this activity the Service must balance the demand for recreation against its conservation objectives. Little Llangothlin Nature Reserve will be managed to ensure that its use, whether by the general public, special interest groups or for management purposes, is appropriate and conforms with the Act and the management objectives and policies of this plan.

The major categories of use which may be appropriate within Service areas are:

- promotion of natural and cultural heritage conservation.
- environmental and cultural education.
- scientific research.
- recreation in a natural setting; and
- management operations by the Service and other authorities.

The extent to which these categories of use are appropriate to Little Llangothlin Nature Reserve are indicated below.

4.3.1. Scientific Research and Environmental Education

Little Llangothlin Nature Reserve has been used extensively for research in many disciplines including geology, geomorphology, palynology, zoology, ornithology, wetland ecology, botany and archaeology.

Scientific study in the nature reserve provides valuable information which assists the Service to improve management of the natural and cultural heritage and to understand the processes which affect them. Research is also used by the Service to establish the requirements for the management of particular species. The Service, however, does not presently have the resources to undertake long term research in the reserve and a prospectus will be prepared as the basis for the involvement of research organisations in Little Llangothlin Nature Reserve.

Research will also lead to enhanced educational opportunities for schools, universities and colleges from nearby towns as well as special interest groups and the general public. Little Llangothlin Nature Reserve is currently used for educational and research visits by New England University and schools. There is considerable potential for increased use for this purpose.

Policies

- * Research will be encouraged into all aspects of the ecology of Little Llangothlin and Billy Bung lagoons and their catchments where it is demonstrated that the research will not have a significant environmental impact. Priority will be given to research which will directly assist management of the nature reserve.
- * Relevant information on the lagoon and its management gained through research programmes and community knowledge will be made available to other owners and managers of New England lagoons as well as to other interested members of the community.
- * Interpretive programmes for the reserve will be developed in consultation with relevant researchers, educational groups and the local Aboriginal community consistent with the primary purposes of management of the area as a nature reserve.

Actions

- * Printed interpretive information about the reserve will be prepared for use by educational and community groups.
- * The importance of the nature reserve will be promoted through such techniques as open days on the reserve and by close liaison with landcare and other community groups.
- * Existing research programmes will continue to be supported.
- * A prospectus will be prepared which lists preferred areas for scientific research.

4.3.2 Public Access and Use

Little Llangothlin Nature Reserve has had little public use due to the relatively short time since Service acquisition of the area, the lack of promotion of the reserve and limited access to the area. Up to now most public use has been by researchers and birdwatchers and no facilities were provided.

With increased public awareness of conservation organisations, Landcare groups and Catchment Management groups in the New England area generally, the publicity generated by the nomination of Little Llangothlin Nature Reserve as a RAMSAR site and the increased use of the area by special interest groups such as bird watchers, it is likely that public use of the reserve will increase. However, the primary purpose of the reserve is the conservation of wildlife and their habitat, and the increased educational and scientific use cannot jeopardise the conservation management of the reserve.

Only limited facilities will be provided in the reserve and no camping will be permitted. Re-organisation of the current entry points to the reserve is necessary to provide visitors with one easily accessible and identifiable entry point. A small parking area, a pit toilet and a walking track around the lagoon will also be provided for visitors (see map, centre pages).

To increase public awareness, understanding and appreciation of the value of the reserve, of high altitude wetlands and of conservation generally in the Northern Tablelands, information on the formation of the lagoon, changes in its management and use and the research being undertaken on the reserve will be presented on a display located on the reserve.

Policies

- * Appropriate public use of the nature reserve will be permitted where it will not interfere with waterbird behaviour, disturb significant habitats or cause damage to the environment
- * Limited facilities and interpretative information will be provided at the main entrance to Little Llangothlin Nature Reserve. Public access on the reserve past the main entrance will be on foot only.
- * Camping will not be permitted in the reserve.
- * Fires will not be permitted and rubbish disposal facilities will not be provided.

Actions

- * A car park with a capacity for 10 cars will be provided at the public entry to the reserve. The car park will be fenced off from the body of the reserve with a stile leading to the walking tracks.
- * An encased pit toilet will be erected in the vicinity of the car park. The toilet will be located and designed to avoid pollution of wetlands.
- * An interpretive display will be located near the car park.
- * A walking track will be incorporated into the existing management track around Little Llangothlin Lagoon, with a side loop to Billy Bung Lagoon. This will include the construction of a crossing over the lagoon inlet.

4.3.3 Management Support

Effective implementation of the management programmes outlined in this plan requires a number of management facilities. These include a network of slashed management tracks and a water supply which can be used for weed control programmes. Existing structures on the reserve may be utilised for management purposes but no new structures will be constructed, except for the toilet, interpretative display and inlet crossing mentioned in 4.3.2.

Fences along the reserve boundaries will continue to be maintained in co-operation with adjacent landholders. Internal fencing will not be maintained and the wire will be progressively removed as it can be a hazard to visitors and wildlife.

Policies

- * The Service will liaise closely with neighbouring landholders and relevant community groups to encourage the exchange of information and co-operative management.
- * The Service may, in accordance with its policy on fencing assistance, continue to assist neighbouring landholders to erect stock proof fences on the boundary of the reserve.
- * The slashed management track network in the reserve will be maintained.
- * The well may be used as a water source for herbicide spraying.

Actions

- * Internal fencing will be removed.
- * Periodic fixed wing aerial photography of the reserve will continue to be undertaken to monitor the effects of management programmes.

5. PLAN IMPLEMENTATION

This plan of management is part of a system of management developed by the Service. The system includes the National Parks and Wildlife Act, management policies, established conservation and recreation philosophies and strategic planning at corporate, regional and district levels.

The orderly implementation of this plan of management will be undertaken within the annual programmes of the Service's Glen Innes District. Priorities, determined in the context of district and regional strategic planning, will be subject to the availability of necessary staff and funds and to any special requirements of the Minister or Director-General.

District programmes are subject to ongoing review, within which works and other activities carried out in Little Llangothlin Nature Reserve are evaluated in relation to the objectives laid out in this plan.

The environmental impact of all development proposals will continue to be assessed at all stages from planning to implementation and any necessary investigations will be undertaken in accordance with established environmental assessment procedures.

Under section 81 of the National Parks and Wildlife Act, 1974, this plan shall be carried out and given effect to and no operations will be undertaken within Little Llangothlin Nature Reserve except in accordance with the plan. However, if after adequate investigation, operations not included in the plan are found to be justified, this plan will be amended in accordance with the Section 76 (6) of the Act.

As a guide to the orderly implementation of this plan of management, relative priorities for identified activities are summarised below :

Activity	Plan Reference
High Priority	
Monitor the water quality of the lagoon	4.1.1
Investigate methods to reduce erosion and sedimentation	4.1.1
Continue to implement weed management programme	4.1.2
Continue to implement feral animal control programme	4.1.3
Undertake rabbit control on the lunette	4.1.3
Monitor and protect Aboriginal sites	4.2.1
Construct safety fence around old dairy and windmill	4.2.2
Conduct historical study of old dairy, windmill and rock piles	4.2.2
Support existing research programmes	4.3.1
Undertake neighbour relations programmes	4.3.1
Establish interpretation display	4.3.2

Medium Priority

Conduct trials into the removal of introduced grass species	4.1.2
Prepare and implement revegetation plan	4.1.2
Undertake fauna surveys in the reserve	4.1.3
Prepare research prospectus	4.3.1
Produce printed interpretive information for educational groups	4.3.1
Continue aerial monitoring	4.3.3
Establish car park and toilet	4.3.2

Low Priority

Establish gauging system to monitor water levels in the lagoon	4.1.1
Prepare fire management plan	4.1.4
Construct inlet crossing for walking track	4.3.2
Remove internal fencing wire	4.3.3

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