

CASTLEREAGH, AGNES BANKS AND WINDSOR DOWNS
NATURE RESERVES
PLAN OF MANAGEMENT

NSW National Parks and Wildlife Service

March 1999

This plan of management was adopted by the Minister for the Environment on 5th March 1999.

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FOREWORD

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves are located in western Sydney in an area bounded by Windsor and Richmond in the north, the Hawkesbury River to the west, Penrith to the south and South Creek in the east.

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves are particularly important because they are located on the Cumberland Plain. The vegetation and soil types of the Cumberland Plain are very different from those of the surrounding sandstone plateaus. The nature reserves protect some of the largest and most ecologically intact remnants of the extensive open forests and woodlands which once covered the Cumberland Plain and dominated western Sydney.

Each nature reserve protects different plant species and associations including a number of threatened and poorly conserved species. Parts of Castlereagh Nature Reserve and Windsor Downs Nature Reserve support Cumberland Plain Woodland, a vegetation association which has been listed as an Endangered Ecological Community under the Threatened Species Conservation Act. The unique and restricted sand deposits of Agnes Banks Nature Reserve support a different woodland community which is not known to occur elsewhere and contains species which are usually found on coastal sand deposits.

The diverse vegetation of the nature reserves provides habitat for a variety of native animals, especially birds. Many of the bird species are more typical of the those found on the western slopes and plains of New South Wales than of Sydney. The nature reserves also provide valuable habitat for reptiles, amphibians and invertebrates. Part of Castlereagh Nature Reserve is listed on the Register of the National Estate because it provides habitat for a rare jewel beetle.

This plan of management provides for the protection of these important nature reserves and their promotion for education and scientific research. Disturbed areas will be rehabilitated, and introduced plants and animals will be controlled and eliminated. Use of Castlereagh, Agnes Banks and Windsor Downs Nature Reserves will be restricted to low impact day use. Information signs will be erected on the reserve boundaries and fencing undertaken where necessary to reduce uncontrolled access to the reserves.

Pam Allan
Minister for the Environment

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1. INTRODUCTION

The *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each nature reserve. A plan of management is a legal document that outlines how the area will be managed in the years ahead.

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 is required to submit the plan to the Minister, together with any comments or suggestions of the Advisory Council; and
- the Minister may adopt the plan without alteration or with such alterations as the Minister may think fit, or may refer it back to the Director-General and Council for further consideration.

Once a plan of management has been adopted by the Minister, no operations may be undertaken within Castlereagh, Agnes Banks and Windsor Downs Nature Reserves except in accordance with the plan.

A number of additions have been proposed to Castlereagh, Agnes Banks and Windsor Downs Nature Reserves. If added, these lands will be managed in accordance with the objectives and policies identified in this plan of management.

Although not a requirement under the Act, this plan of management was placed on public exhibition from 12th June until 14th September 1998. A total of 15 submissions which raised 12 issues were received on the plan. All comments received were carefully considered by the National Parks and Wildlife Advisory Council. The submissions and the recommendations of the Council were in turn considered by the Minister for the Environment before adopting this plan of management for Castlereagh, Agnes Banks and Windsor Downs Nature Reserves.

Additional information or enquires about the nature reserves or this plan of management may be obtained from the Service's Hills Sub-District Office, which is located in Scheyville National Park, or by telephone on (045) 723 100.

2. MANAGEMENT CONTEXT

2.1 NATURE RESERVES IN NSW

Reserving areas to include nature conservation as a general purpose was introduced to Australia with the establishment of Royal National Park in 1879.

Nature reserves in New South Wales arose out of fauna reserves. Fauna reserves in New South Wales were first established under the *Fauna Protection Act 1948*. Under the *National Parks and Wildlife Act 1967* fauna reserves were reclassified as nature reserves. The 1967 Act has since been replaced by the *National Parks and Wildlife Act 1974*.

Under the 1974 Act, nature reserves are areas of special scientific interest containing wildlife or natural environments or natural phenomena.

The purpose of nature reserves are defined in the Act as:

- (a) the care, propagation, preservation and conservation of wildlife;
- (b) the care, preservation and conservation of natural environments and natural phenomena;
- (c) the study of wildlife, natural environments and natural phenomena; and
- (d) the promotion of the appreciation and enjoyment of wildlife, natural environments and natural phenomena.

Nature reserves differ from national parks which include as a major objective the provision of opportunities for outdoor recreation. 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 CASTLEREAGH, AGNES BANKS AND WINDSOR DOWNS NATURE RESERVES

2.2.1 Location and Regional Context

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves are located on the western rim of the Cumberland Plain, which is a sub-section of the broader Cumberland Basin (refer Map A, page 3). The Cumberland Plain lies between the Macdonald Ranges to the north, Woronora Plateau to the south, Hornsby Plateau to the east and the Blue Mountains Plateau to the west. It consists of low lying, gently undulating country with low hills on Wianamatta Group shales and sandstones and Tertiary alluviums (Bannerman and Hazelton, 1990).

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves protect an important component of the remaining five percent of Cumberland Plain native plant and animal associations which once dominated western Sydney. Over 90% of the native vegetation which once covered the Cumberland Plain has been cleared and only around 1.5% of what remains is reserved in existing national parks, nature reserves or other protected areas (NPWS, 1997). In contrast, there are a large number of national parks and reserves on the surrounding Sydney sandstone including Blue Mountains National Park, Wollemi National Park, Murrumbidgee National Park, the Nattai Reserve System and the majority of Cattai National Park. The pressure to further develop the Cumberland Plain for urban, commercial and industrial uses, agriculture and mining will place increasing emphasis on the protection and management of existing reserves and the dedication of additional conservation areas in western Sydney.

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves are located within a 100 square kilometre area bounded by Windsor and Richmond in the north, the Hawkesbury River to the west, Penrith to the south and South Creek in the east. The nature reserves are within the Hawkesbury-Nepean catchment area and are covered by Sydney Regional Environmental Plan No. 20 (Hawkesbury-Nepean).

Castlereagh Nature Reserve

Castlereagh Nature Reserve, which is 495 hectares in size, was dedicated in 1995. It is situated at Llandilo, approximately 10 km north-east of Penrith in the Parishes of Castlereagh and Londonderry, and is within the Penrith Local Government Area. The nature reserve was formerly Castlereagh State Forest and managed as a production forest from 1917 to 1988, then as a demonstration forest from 1988 to 1995. It is bounded by The Northern Road and Llandilo Road with rural properties to the south and south-west and the Castlereagh Waste Management Centre to the north (refer Map B, page 22).

Agnes Banks Nature Reserve

Agnes Banks Nature Reserve, which is 114 hectares in size, was dedicated in 1982. It is situated at Agnes Banks, approximately 5 kilometres south-west of Richmond, in the Parish of Castlereagh. It is also within the Penrith Local Government Area. Agnes Banks Nature Reserve is bounded by Rickards Road to the west, vacant Crown Land to the south and east, and private freehold land to the north. A small area of private land adjacent to the northern boundary of the nature reserve is subject to a Permanent Conservation Order under the NSW Heritage Act 1977, while other lands to the north are subject to active mining leases. Sand and gravel extraction has occurred throughout much of the Agnes Banks sand deposits. Around 90 percent of the aeolian dunes at Agnes Banks have been extracted over the last 30 years with the nature reserve containing much of the remaining unaltered sand deposit.

Windsor Downs Nature Reserve

Windsor Downs Nature Reserve, which is 332 hectares in area, was dedicated in 1990. It is situated approximately 3.5 kilometres south of Windsor between the suburbs of Bligh Park and Berkshire Park in the Parish of St. Matthew. It is within the Hawkesbury Local Government Area. Windsor Downs Nature Reserve is bounded by Richmond Road, Sanctuary Drive, residential and rural-residential areas of Bligh Park and Windsor Downs Estate and vacant Crown land (refer Map D, page 24). The area which is now Windsor Downs Nature Reserve was owned and managed by the Riverstone Meatworks for cattle grazing for over 100 years until the mid-1980s. During that time the land was also used for firewood collection and other informal forestry operations. Considerable urban development has occurred in the area surrounding the nature reserve since the mid 1980s.

2.2.2 Importance of Castlereagh, Agnes Banks and Windsor Downs

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves are particularly important because they are located on the Cumberland Plain. The vegetation and soil types of the Cumberland Plain are very different from those of the surrounding sandstone plateaus. The relatively fertile soils, proximity to Sydney and flat to undulating topography resulted in the Cumberland Plain being one of the first areas in Australia to be extensively cultivated. After 200 years of development, only isolated pockets of native woodland and open forest remain.

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves are significant for their natural and cultural heritage values, education and scientific use and for public appreciation and enjoyment.

Natural Heritage Conservation

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves are 'island remnants' of differing and comparatively unaltered Cumberland Plain geology, landforms and native plant and animal populations. They are indicative of the diversity of the Cumberland Plain which has been significantly altered by human activities in the last 200 years.

Whilst the three nature reserves are located on an underlying bed of Wianamatta sandstones and shales, complex patterns of erosion and deposition have resulted in different soils and native plant and animal communities in each area:

- * Castlereagh Nature Reserve contains a geographically restricted substrate of Tertiary alluvials producing clays, sand and gravel;
- * Agnes Banks Nature Reserve comprises a relic aeolian sand formation which only occurs in a small area near Agnes Banks; and

- * Windsor Downs Nature Reserve is located on Tertiary alluviums producing relic red podsollic soils of the Londonderry clay which are characteristic of a broad area of the Cumberland Plain.

The nature reserves are some of the largest and most ecologically intact remnants of the once extensive open forests and woodlands which covered the Cumberland Plain. The nature reserves are of appreciable botanical significance when placed in a regional and state context. Each nature reserve protects different plant species and associations including a number of threatened and poorly conserved species and regionally rare forest associations. Nine threatened plant species and a number of other species considered rare on the Cumberland Plain are found in the reserves.

Parts of Castlereagh Nature Reserve and Windsor Downs Nature Reserve support Cumberland Plain Woodland vegetation, a community which has been listed as an Endangered Ecological Community under the *Threatened Species Conservation Act 1995*.

The rarity of the Cumberland Plain woodland vegetation found in Windsor Downs Nature Reserve and Castlereagh Nature Reserve, and associated rare plants, resulted in both these areas being listed on the Australian Heritage Commission's Register of the National Estate.

The unique and restricted sand deposits of Agnes Banks Nature Reserve support a different woodland community which is not known to occur elsewhere. The reserve also contains species which are usually found on coastal sand deposits and are at their most westerly known distribution at Agnes Banks. This led to Agnes Banks Nature Reserve and adjoining areas being listed on the Register of the National Estate. It also led to a Permanent Conservation Order being placed over part of the land which is now nature reserve and a small area of adjoining land.

The diverse vegetation of the nature reserves provides habitat for a variety of native animals, especially birds. Many of the bird species are more typical of the those found on the western slopes and plains of New South Wales than of Sydney. The regent honeyeater *Xanthomyza phrygia*, listed as endangered under the Threatened Species Conservation Act, has been recorded in all three nature reserves. Agnes Banks and Windsor Downs Nature Reserves are also likely to contain two of the last remaining populations of the red-capped robin *Petroica goodenovii* in the Sydney Region.

The nature reserves provide valuable habitat for reptiles, amphibians and invertebrates. The green and golden bell frog *Littoria aurea*, listed as endangered under the Threatened Species Conservation Act, has been recorded in Castlereagh Nature Reserve. Castlereagh Nature Reserve and Windsor Downs Nature Reserve are also listed on the Register of the National Estate because they provide important habitat and are part of a movement corridor for a unique assemblage of jewel beetles *Stigmodera* spp., which includes nationally rare and nationally uncommon species.

Cultural Heritage Conservation

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves are within the area which was occupied by the Dharug Aboriginal people. Castlereagh and Windsor Downs Nature Reserves have a number of open campsites with surface scatters of stone and isolated artefacts of chert stone tools and flakes. There are no Aboriginal sites recorded for Agnes Banks Nature Reserve, however there are a number of sites in surrounding areas and it is possible that Aboriginal sites are situated under the sand within the nature reserve.

The vegetated landscape of Castlereagh, Agnes Banks and Windsor Downs Nature Reserves demonstrate, by dramatic contrast with the surrounding lands, the changes to the Cumberland Plain wrought by European settlement. The reserves also contain a number of features related to previous use of the reserves for activities such as grazing and forestry.

Education and Scientific Use

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves provide a representative benchmark for assessing and appreciating ecological changes which have occurred across a broad area of the Cumberland Plain since European settlement.

The native plants and animals have been subject to a range of previous management practices including forestry, cattle grazing and mining. Understanding how the plant and animals of the reserves have responded to previous management practices is important in understanding how they can be best managed in the future. The nature reserves are also a valuable resource for research on threatened plants and animals and other species of conservation significance.

The sand deposits in Agnes Banks Nature Reserve provide a record of the deposition sequence of this unique feature. They are capable of providing valuable information on the topography and climate of the area at the time they were formed.

Public Appreciation and Enjoyment

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves are located within the expanding western suburbs of Sydney. Windsor Downs Nature Reserve has a relatively high level of public use, particularly by children who cycle within the reserve. Castlereagh and Agnes Banks have comparatively low levels of public use. All three reserves have the potential to increase public understanding of the variety and importance of the remaining Cumberland Plain vegetation.

3. OBJECTIVES OF MANAGEMENT

This plan of management has been prepared in accordance with Section 72 of the *National Parks and Wildlife Act 1974*.

3.1 GENERAL OBJECTIVES

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

- * protection and preservation of scenic and natural features;
- * maintenance of natural processes as far as is possible;
- * conservation of wildlife;
- * protection of Aboriginal sites and relics and historic features; and
- * encouragement of appropriate scientific and educational inquiry into environmental features and processes.

3.2 SPECIFIC OBJECTIVES FOR CASTLEREAGH, AGNES BANKS AND WINDSOR DOWNS NATURE RESERVES

In addition to the above, the management of Castlereagh, Agnes Banks and Windsor Downs Nature Reserves will be subject to the following specific objectives:

- * management of the three nature reserves as examples of different aspects of the landforms, geology and native plant and animal associations of the Cumberland Plain;
- * protection and enhancement of the remnant Cumberland Plain vegetation of the nature reserves;
- * promotion of the reserves for education and scientific research; and
- * interpretation of the importance of the nature reserves with emphasis on their:
 - geological significance in terms of the Cumberland Plain;
 - value as remnant areas of Cumberland Plain native plant and animal associations; and
 - protection of threatened and poorly conserved species.

3.3 OVERALL STRATEGY

The overall strategy for the three reserves is to protect and restore the reserves and promote appropriate public use. Priority will be placed on protection of the dunes and other vegetation communities within Agnes Banks Nature Reserve from uncontrolled access, reduction of the number of management trails in Castlereagh Nature Reserve, and reduction of impacts on Windsor Downs Nature Reserve from neighbouring developments and associated users.

4. POLICIES AND FRAMEWORK FOR MANAGEMENT

This section contains the policies and framework for the management of Castlereagh, Agnes Banks and Windsor Downs Nature Reserves together with relevant background information. Policies are summarised under the following headings:

- * Natural and Cultural Heritage
- * Use of the Nature Reserves.

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

The actions identified are those 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 National Parks and Wildlife Act and with the objectives and policies set out in this plan.

4.1 NATURAL AND CULTURAL HERITAGE

4.1.1 Geology, Landforms and Soils

The Cumberland Plain was formed in the early to middle Triassic age when a tectonic episode influenced a number of sediment-laden streams to flow into the area from the north-west. The streams discharged into extensive floodplains and swamps which later formed the Wianamatta group of shales and sandstones and areas of Quaternary and Tertiary sediments (Herbert, 1976; Bannerman and Hazelton, 1990).

The landforms of the area are characteristic of a depositional basin, being low lying plains and gently undulating hills. Although the underlying bedrock of the Cumberland Plain is primarily Wianamatta Group shales and sandstones, complex patterns of erosion and deposition have resulted in a number of geographically restricted substrates and a mosaic of soils within the reserves.

The relatively fertile soils of the area, proximity to Sydney and flat to undulating topography resulted in the Cumberland Plain being one of the first areas in Australia to be extensively cultivated.

Castlereagh Nature Reserve

Castlereagh Nature Reserve is located on a geographically restricted substrate of former lake deposits. These Tertiary alluvial deposits are made up of a variety of materials including sand, clay, gravel and laterites with Wianamatta Group shales at depth.

The nature reserve lies between 30 and 40 metres above sea level and is essentially flat with broad, shallow depressions forming a sparse drainage network. Gravels and

other alluvials have been extracted in the north-west of the nature reserve. In these areas a number of small, shallow lakes form after wet weather. In other parts of the reserve, soils range from sand to clay loam, clay and river gravels.

A one hectare area on the north western boundary of the nature reserve, adjacent to the Castlereagh Waste Management Centre, was previously used as an area for the disposal of heavy metals such as zinc, cadmium and lead and other chemicals. The contaminated soil was removed in 1996 and replaced with clean local fill. Recent studies indicate that no contaminants remain on site. Six groundwater sampling stations are located within the nature reserve and used by Waste Services to monitor groundwater quality.

The sand, gravel and clay soils within the nature reserve have high erosion potential and susceptible to both sheet and gully erosion.

Agnes Banks Nature Reserve

Agnes Banks Nature Reserve is made up of quartz sands derived from sandstones found in the catchments of the Grose and Upper Nepean Rivers. It is underlain by laterized Tertiary alluvial deposits of clays and silts.

The nature reserve lies between 20 and 30 metres above sea level and contains an isolated occurrence of undulating white sands. This sand formation was probably created by the wind redistributing river-deposited fine sand to form a series of low longitudinal dunes.

The dune sands are without structure and loose throughout their profile. The sub-surface is bleached and overlies a dark brown and yellow-brown mottled sub-soil horizon, coloured by organic matter and iron. Drainage in the centre of the dune area results in the formation of internal swamps in the swales between the main dunes. At these locations a hard and impermeable layer of rock has formed creating localised perched water tables.

Approximately 85 percent of the Agnes Banks sand deposits have been mined. The nature reserve protects most of the remaining undisturbed sand deposits. The dune sands have high erosion potential, particularly when cleared of vegetation cover or subject to inappropriate uses.

Only around 50% of Agnes Banks Nature Reserve is aeolian sand deposits. In the east and south-east of the reserve is Tertiary alluvium, which is more poorly drained than the sand dunes.

Windsor Downs Nature Reserve

Windsor Downs Nature Reserve lies on Tertiary alluviums of former lake deposits (Wallace and Gobert, 1974). The main soil type is a red podzolic derived from Londonderry Clay, however sandy clays and recent alluviums are also found within the reserve. A natural shale levee is located in the south-eastern section of the reserve.

The area is basically flat and lies between 20 and 24 metres above sea level. Drainage is indefinite but tending towards the south. There are no permanent watercourses in the reserve, however a number of depressions are poorly drained and form localised soaks, particularly in the east and south of the reserve. Stormwater from Richmond Road and properties within Windsor Downs Estate is concentrated into large drainage swales and dams just outside the reserve boundary. In periods of wet weather, considerable stormwater enters the reserve from the south western corner carrying nutrients and weeds, and causing localised gully and sheet erosion.

The soils within the reserve have high erosion potential and are subject to both sheet and gully erosion. They are particularly susceptible to degradation where stormwater is concentrated and public use is focused. This is evident on a number of formal and informal tracks and trails within the reserve and around an old bicycle track and the dam near the centre of the reserve.

Policies

- * All land management works carried out on the reserves will be designed and undertaken so as to minimise soil erosion and will incorporate soil erosion control measures where necessary.
- * Features and sites of geological, geomorphological and/or pedological significance will be protected from disturbance. These include the Agnes Banks dunes, the undisturbed gravels in Castlereagh Nature Reserve and the shale levee in Windsor Downs Nature Reserve.
- * All disturbed sites not required for public or management use, including unnecessary roads and trails, will be progressively closed and revegetated.
- * The Service supports the concept of Total Catchment Management and will work with the Hawkesbury-Nepean Catchment Management Trust to protect water quality and other values of the catchment.
- * The continued monitoring of groundwater in Castlereagh Nature Reserve will be encouraged to ensure that the groundwater is not being contaminated by leachates from the waste management centre.

Actions

- * Unofficial trails in Castlereagh, Agnes Banks and Windsor Downs Nature Reserves will be closed and allowed to revegetate.
- * A formal access agreement will be negotiated with Waste Services for access to the monitoring sites in Castlereagh Nature Reserve.

- * The area previously used for a bicycle track and the dam wall in Windsor Downs Nature Reserve will be progressively fenced-off to facilitate natural revegetation.
- * Hawkesbury City Council will be approached regarding means of ameliorating the impacts of soil erosion, nutrients and weeds emanating from stormwater entering Windsor Downs Nature Reserve from Richmond Road and Windsor Downs Estate.

4.1.2 Native Plants and Animals

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves contain a range of native plant and animal associations of the Cumberland Plain. Whilst the nature reserves are in close proximity to each other, the occurrence of different soils in each reserve has resulted in vegetation associations and associated animal populations that differ markedly from each other. They also contain a number of threatened and poorly conserved species.

Under the Threatened Species Conservation Act a recovery plan and/or threat abatement plan must be prepared for endangered and vulnerable plants and animals. The purpose of a recovery plan is to promote the recovery of a threatened species, population or ecological community to a position of viability in nature. A threat abatement plan outlines the management of key threatening processes with a view to their abatement, amelioration or elimination.

The relatively small size of each nature reserve and their proximity to urban and semi-urban areas makes it important to establish and maintain wildlife corridors linking them to other naturally vegetated areas. Whilst the nature reserves may be able to support viable and diverse native plant and animal populations in isolation to each other, wildlife corridors provide key habitat in addition to the reserves and a mechanism for native plant and animal movement.

Castlereagh Nature Reserve

A number of vegetation surveys have been undertaken in the area. One study (Benson, Coveny and Hind, 1984) identified two principal vegetation formations: open-forest and low woodland.

Open-forest occurs on clay soils and is dominated by broad-leaved ironbark *Eucalyptus fibrosa* ssp. *fibrosa* with occasional mugga ironbark *Eucalyptus sideroxylon*, thin-leaved stringybark *Eucalyptus eugenioides* and woollybutt *Eucalyptus longifolia*. There is a diverse shrubby understorey including *Pultenaea ulicifolia*, *Pultenaea violacea*, *Allocasuarina littoralis* and numerous forbs and grasses.

Low woodland covers the remaining area and is dominated by stringybark *Eucalyptus haemastoma* and narrow-leaved apple *Angophora bakeri*. The low woodland has a similar understorey to that which occurs in the open forest within the reserve.

At least six plant species listed under the Threatened Species Conservation Act are found in the understorey of the nature reserve. The threatened plant species *Dillwynia tenuifolia*, *Pultenea parviflora*, *Acacia bynoeana*, dwarf casuarina *Allocasuarina glareicola*, nodding geebung *Persoonia nutans* and *Micromyrtus minutiflora* are well represented within the reserve. In addition, a number of other regionally rare species are found in the reserve including mugga ironbark *Eucalyptus sideroxylon* and woollybutt *Eucalyptus longifolia*. The reserve also contains species not usually found on the Cumberland Plain, such as yellow bloodwood *Corymbia eximia* and red bloodwood *Corymbia gummifera*, which are normally found on Sydney sandstone.

There have been few surveys for native animals in the reserve however sugar gliders *Petaurus breviceps*, brush-tailed possum *Trichosurus vulpecula* and eastern grey kangaroo *Macropus giganteus* have been recorded. The eastern brown snake *Pseudonaja textilis*, red-bellied black snake *Psuedechris porphriacus*, lace monitor *Varanus varius* and a number of frog species have been recorded, including the green tree frog *Littoria caerulea*, bleating tree frog *Littoria dentata*, eastern banjo frog *Lymnodynates dumerilii*, and the green and golden bell frog *Littoria aurea* which is listed as an endangered species under the Threatened Species Conservation Act 1995. The regent honey-eater *Xanthomyza phrygia* which is listed as threatened under the Act has also recently been recorded in the reserve. Part of the reserve is listed on the register of the National Estate as habitat for jewel beetle *Stigmodera (Castiarina) flavovaria* and over 135 species of birds have also been recorded in the reserve.

Mineral extraction, timber harvesting, firewood collection and frequent fires occurred in Castlereagh State Forest prior to its dedication as Castlereagh Nature Reserve. In 1987 the area around the old gravel pits was planted with over 3,000 seedlings. Species planted included hard-leaved scribbly gums *Eucalyptus sclerophylla*, black she-oaks *Allocasuarina littoralis*, narrow-leaved grey ironbark *Eucalyptus beyeri*, *Eucalyptus parramattensis* and the threatened *Acacia bynoeana*. Much of the seed used for the plantings did not come from the reserve and this, plus past logging and other plantings, has resulted in parts of the reserve being dominated by immature regrowth and has modified species composition and abundance.

Agnes Banks Nature Reserve

The vegetation of the Agnes Banks sand deposit and nature reserve has been surveyed by the National Herbarium (Benson, 1981; Benson, 1985).

Woodland is the most widespread vegetation formation and occurs as two communities. On well to moderately drained soils hard-leaved scribbly gum *Eucalyptus sclerophylla* reaching heights of 15 metres occur, with smaller trees of narrow-leaved apple *Angophora bakeri* and old man banksia *Banksia serrata*. This is the only known reserved occurrence of this association. On shallower and more

poorly drained soils is a woodland association consisting of hard-leaved scribbly gum, drooping red gum *Eucalyptus parramattensis* and *Banksia aemula*. In both woodlands, a similar species-rich sclerophyllous understorey exists which includes *Leptospermum attenuatum*, *Conospermum taxifolium*, *Ricinocarpus pinifolius* and *Isopogon anemonifolius*.

Low open woodland occurs on poorly drained soils and consists of drooping red gum as individuals or in groups. The understorey is dominated by *Banksia oblongifolia* which forms a treeless low shrubland in the depressions.

The alluvium in the east and south-eastern sections of the nature reserve supports a woodland dominated by ironbark *E. fibrosa* ssp. *fibrosa*, although hard-leaved scribbly gum, drooping red gum and narrow-leaved apple occur occasionally. The rich shrub understorey is replaced with a more open one, predominantly of *Melaleuca decora* and blackthorn *Bursaria spinosa* with a dense ground cover of grasses.

The nature reserve supports a number of threatened plant species including *Dillwynia tenuifolia*, *Micromyrtus minutiflora*, *Acacia bynoeana* and nodding geebung *Persoonia nutans*. The reserve also contains plant species which are usually found on coastal sand deposits, including *Banksia aemula* and *Dillwynia glaberrima* which are at their most westerly known distribution within the reserve.

At least 71 species of birds are known to inhabit the nature reserve, including the threatened regent honey-eater *Xanthomyza phrygia* and one of the few remaining populations of the red-capped robin *Petroica goodenovii* in the Sydney region.

The vegetation of Agnes Banks Nature Reserve is significantly different from plant communities occurring in adjacent areas. Similarities in species exist with both Hawkesbury sandstone and coastal dune vegetation communities, however the species composition in the nature reserve is unique. Approximately one third of the species are not found on Hawkesbury sandstone but nearly half of the species are found at Myall Lakes.

Windsor Downs Nature Reserve

Windsor Downs Nature Reserve contains five vegetation formations (Benson, 1985).

An open forest-woodland association occurs on the clay soils within the nature reserve. The dominant species are broad-leaved ironbark *Eucalyptus fibrosa* ssp. *fibrosa*, mugga ironbark *Eucalyptus sideroxylon*, drooping red gum *Eucalyptus parramattensis* and narrow-leaved apple *Angophora bakeri*, with *Melaleuca decora* as a prominent component of the understorey.

A low woodland occurs on more sandy, better drained soils in the south-west of the reserve. It consists of hard-leaved scribbly gum *Eucalyptus sclerophylla*, drooping red gum and narrow-leaved apple.

A taller open forest occurs in the reserve's north-eastern corner. It consists mainly of thin-leaved stringybark *Eucalyptus eugenioides*.

A woodland consisting of grey box *Eucalyptus moluccana* and broad-leaved ironbark *Eucalyptus fibrosa* ssp. *fibrosa*, with isolated occurrences of thin-leaved stringybark *Eucalyptus eugenioides*, occurs on a relic natural levee of shale in the south-east of the reserve.

Closed low forest is found in depressions and is dominated by *Melaleuca decora* and *Melaleuca linearifolia* with *Eucalyptus amplifolia* occurring as emergents along creeks and on recent alluvium. The understorey is dominated by *Melaleuca nodosa* but near the creek, shrubs give way to herbaceous groundcover species such as *Adiantum aethiopicum*, *Entolasia marginata* and *Dichelachne micrantha*.

Four threatened plant species *Dillwynia tenuifolia*, *Pultenaea parviflora*, nodding geebung *Persoonia nutans* and *Grevillea juniperina*, and one regionally rare species, *Murdannia gramminea* occur in the understorey of the nature reserve.

There have been no comprehensive surveys of native animals in the reserve, however eastern grey kangaroos *Macropus giganteus*, swamp wallabies *Wallabia bicolor*, sugar gliders *Petaurus breviceps*, goannas *Varanus varius*, eastern brown snakes *Pseudonaja textilis* and red-bellied black snakes *Pseudechis porphyriacus* have been recorded (M. Smith pers. com. 1997). A variety of other reptiles, amphibians and invertebrates are also expected to be present in the reserve.

At least 68 species of birds are known to inhabit the nature reserve, including the yellow-tailed black cockatoo *Calyptorhynchus funereus*. Of particular note are the number of species found in Windsor Downs Nature Reserve which usually frequent drier habitats on the central western slopes of New South Wales. The regent honey-eater *Xanthomyza phrygia* which is listed as endangered under the Threatened Species Conservation Act has been recorded at Windsor Downs. In common with Agnes Banks Nature Reserve, the reserve is likely to contain one of the few remaining populations of the red-capped robin *Petroica goodenovii* in the Sydney region.

Cattle grazing, informal timber harvesting, firewood collection and frequent fires occurred prior to the area's dedication as a nature reserve. Much of the vegetation is therefore sub-mature and does not have the optimal species and structural diversity and associated native animal populations which would be expected from a mature forest in this area. An old paddock in the reserve is naturally regrowing with *Hakea sericea*.

Policies

- * The management of native plant and animal communities will aim to:
 - maintain natural biodiversity;
 - protect threatened and uncommon species, populations and ecological communities; and
 - encourage regeneration of areas previously cleared or disturbed.

- * Species recovery plans and threat abatement plans will be implemented for all species and communities within the reserves listed under the Threatened Species Conservation Act 1995. The “precautionary principle” will guide the conservation of threatened species prior to the adoption of species recovery or threat abatement plans.
- * Native plant and animal communities within the reserves will be monitored, and processes which threaten their health assessed and where practicable controlled.
- * Research into the distribution and management requirements of plant and animal species will be encouraged. Priority will be given to species and communities which are endangered, vulnerable or regionally uncommon.
- * The Service acknowledges Penrith and Hawkesbury City Councils’ proposed flora and fauna corridor plans and will encourage the establishment of wildlife corridors linking the reserves to other remnant Cumberland Plain vegetation communities.

Actions

- * More detailed vegetation maps will be prepared for each reserve.
- * The addition to the reserves of adjoining lands of significant conservation value will be sought so as to increase the viability of each reserve to sustain native plants and animals.

4.1.3 Introduced Plants and Animals

Introduced Plants

Castlereagh, Agnes Banks and Windsor Downs Nature Reserve are relatively free of significant weed infestations. The occurrence of weeds is generally confined to boundary areas, along formal and informal vehicle trails, along drainage lines and in other areas associated with human disturbance.

Under the *Noxious Weeds Act 1993*, the Service is required to control noxious weeds to the extent necessary to restrict them from spreading to neighbouring properties. No noxious weeds have been recorded in the nature reserves. There are however, occurrences of African lovegrass *Eragrostis curvula* and whisky grass *Andropogon virginicus* along management trails and on the boundaries of the reserves.

Apart from the above species, Castlereagh Nature Reserve is relatively free of weeds. However a few slash pines *Pinus elliotti* remain in the northern section of the reserve from when parts of Castlereagh State Forest was used for trial plantings of pines in the 1920s and 1930s.

Agnes Banks Nature Reserve is relatively free of weeds, however unregulated human activities in Agnes Banks Nature Reserve have the potential to spread a number of weed species from neighbouring vacant Crown Land into the reserve.

Windsor Downs Nature Reserve has the worst weed problem of the three reserves. Stormwater drainage in the vicinity of Sanctuary Drive and Richmond Road enters Windsor Downs Nature Reserve and has contributed to a localised weed infestation on the south-western boundary of the reserve and near Mr Corns Trail. In these areas, kikuyu *Pennisetum clandestinum*, paspalum *Paspalum dilatatum*, fireweed *Senecio madagascariensis*, couch *Cynodon dactylon* and purple top *Verbena bonariensis* occur in association with a number of other weed species. Prickly pear *Opuntia stricta* occurs along Sanctuary Drive and in the vicinity of the dam in the reserve.

Introduced Animals

Introduced animals in Castlereagh, Agnes Banks and Windsor Downs Nature Reserves include foxes *Vulpes vulpes*, cats *Felis catus*, dogs *Canis familiaris*, rabbits *Oryctolagus cuniculus* and brown hares *Lepus capensis*. A small number of pigs *Sus scrofa* have been sighted in the Crown Lands adjoining Agnes Banks Nature Reserve and pose a potential threat to the reserve.

Introduced animals can compete with and prey on native plant and animal species. Evidence of introduced species include scats, diggings and disturbed vegetation which not only affects native species, it detracts from the experience when visiting natural areas. Cats and dogs are generally domestic animals entering the reserve from the neighbourhood, or are abandoned in or adjacent to the reserves. The responsibility is vested in the owner for the effective control and management of domestic dogs and cats.

Policies

- * Introduced species in Castlereagh, Agnes Banks and Windsor Downs Nature Reserves will be controlled, and where practicable eliminated.
- * Dogs, other domestic animals and stock are not permitted in the reserves. People bringing or allowing introduced animals into the reserve will be prosecuted.
- * Control strategies will as far as possible be species specific and have minimal impact on biological diversity, neighbouring landholders and reserve visitors.
- * Introduced plant and animal control programs will be monitored to assess their effectiveness.
- * Neighbouring landholders, stakeholders and the local community will be informed of introduced plant and animal control programs being implemented in the reserve through media releases, signs and written correspondence where appropriate.

Actions

- * A strategy for the control of introduced species within the reserves will be prepared, with priority given to control of:
 - prickly pear and the localised weed infestation in the south-western portion of Windsor Downs Nature Reserve;
 - the remaining pine trees in Castlereagh Nature Reserve.
 - African lovegrass and whisky grass in each reserve;
 - foxes in each reserve;
 - cats in each reserve; and
 - rabbits and hares in each reserve.

- * A brochure will be prepared reminding neighbouring landholders and the local community of the prohibition on introduced animals in the reserves and on appropriate domestic cat and dog management.

4.1.4 Fire Management

The management of fires within natural areas is a complex and often controversial issue. The achievement of many of the objectives of management for a nature reserve depends to a large degree on careful and well considered fire management planning.

It is believed that fire has been an important factor influencing the environment of Castlereagh, Agnes Banks and Windsor Downs Nature Reserves for many tens of thousands of years. Fire is regarded by the National Parks and Wildlife Service as a natural process, one of the established physical factors of the Australian environment to which native plant and animal communities have become adapted. The correct management of fire is essential to avoid extinction of native plant and animal species. However, little research has been undertaken into fire management prescriptions for Cumberland Plain woodland and forest associations when compared to the nearby Hawkesbury sandstone communities.

Available records suggest that in recent times the reserves have been subject to high intensity fires every five to seven years. This has altered the understorey of the forest and woodland communities allowing the invasion of weeds such as African lovegrass along boundaries and management trails, and localised dominance of pyrogenic species such as bladey grass in Windsor Downs Nature Reserve. The reduction in ground fuel and understorey has led to a reduction in the number and diversity of smaller native animals.

The National Parks and Wildlife Service has as its primary aims in fire management:

- to reduce the risk of bushfire damage to life and property both within and immediately adjacent to areas where the Service has a statutory responsibility;
- to effectively manage bushfire for the protection and conservation of the natural, cultural and scenic features of Service areas; and
- to cooperate and work with other organisations in fire management planning and implementation within the area.

Castlereagh and Agnes Banks Nature Reserves are within the Penrith Bushfire Management Committee area and Windsor Downs Nature Reserve is within the Hawkesbury Bushfire Management Committee area. Under the *Rural Fires Act 1997*, the Service is required to work co-operatively with local bushfire management committees to develop a co-operative fire management plan for the local area.

In addition, the Service is a fire authority and is responsible for controlling fires in Castlereagh, Agnes Banks and Windsor Downs Nature Reserves. This includes the control and suppression of fires and the implementation of fuel management programs to protect life and property from fires. The Service may also assist with the control and suppression of fires adjacent to the nature reserves.

Castlereagh Nature Reserve

Records on fire history in Castlereagh Nature Reserve indicate that the last major fire occurred in 1982 and burnt over 75 percent of the reserve. Prior to 1995, fire management was performed by State Forests of NSW and local brigades. A short fire regime for the majority of the reserve was maintained due to the need to protect the timber in the forest and the threat of a fire from arson (particularly the burning of stolen motor vehicles) within the reserve. State Forests have estimated that arson caused an average of approximately 15 to 20 fires within the reserve each year.

At the time of reservation there were approximately 20 management trails within the nature reserve. Many of these trails have been closed and are rehabilitating, however the Service has retained and upgraded a number of management trails within the reserve to provide strategic control lines in the event of a fire occurring within the reserve (refer Map B, page 22). Further rationalisation of trails to reduce duplication and impact on the natural environment may be desirable.

Agnes Banks Nature Reserve

The last major fire in Agnes Banks Nature Reserve occurred in the western half of the reserve in 1987 and burnt much of the banksia scrub south of the Sandy Trail. This followed a fire in 1979 and burnt over 75 percent of the reserve. The nature reserve has relatively large areas of vacant Crown Land on its eastern and southern boundaries and the naturally vegetated area totals more than 1,300 hectares. Fire in this nature reserve is therefore best managed in conjunction with Penrith Council and the Department of Land and Water Conservation as part of the larger natural system.

Agnes Banks Nature Reserve has special conservation significance because it contains plant communities usually found on coastal sand dunes and on Sydney sandstone. It also contains a number of threatened plant species and regionally rare species which are at their western range limit. This means that fire in Agnes Banks Nature Reserve needs to be carefully managed to maintain the biodiversity of these communities. The Sandy Trail and the trail along the eastern boundary of the reserve (refer map C, page 23) will be retained for fire management purposes.

Windsor Downs Nature Reserve

The last two major fires in Windsor Downs Nature Reserve occurred in 1979 and 1997. Both burnt almost the entire reserve. Smaller fires occur at more frequent intervals resulting in a fire regime of approximately 3-5 years across the reserve. By far the major cause of fire in recent years has been arson, either in the reserve or in the adjoining unfenced Vacant Crown Land.

The Service has retained a number of management trails within Windsor Downs Nature Reserve to provide strategic control lines for wildfire suppression and fuel reduction activities (refer Map D, page 24).

Policies

Preventing Wildfire

- * Fire in the reserves will be managed in accordance with a fire management plan prepared for each reserve by the National Parks and Wildlife Service.
- * A management trail network will be maintained within the reserves to provide access for strategic fuel management and wildfire control. The existing trails will be assessed to determine if all are required for fire management purposes.
- * Fuel reduction zones will be maintained:
 - along the boundaries of Castlereagh Nature Reserve behind the properties on Llandilo Road, Fourth Avenue and The Northern Road which adjoin the reserve; and
 - along the boundaries of Windsor Downs Nature Reserve behind the private properties on Sanctuary Drive, Richmond Road and in Bligh Park which adjoin the reserve.
- * Alternative strategies to burning will be investigated for the fuel reduced zones.

Fire Management Activities

- * Records of all fires occurring in the reserves will be kept and used for fire management planning.

- * A mosaic of fire age classes ranging from 15 to 25 years will as far as possible be maintained in each vegetation community within the reserves, with the exception of fuel reduction zones.
- * No planned fuel reduction burn will be undertaken within seven years of a previous fire in the same area. A fire regime of 7 to 10 years will be adopted in fuel reduced zones provided plant and animal species diversity is not altered.
- * Planned fire management activities will include pre and post fire:
 - control and monitoring of introduced plant species; and
 - surveys and monitoring for native plants and animals.
- * Species indicators will be identified so as to monitor fire effects within fuel reduced zones and other areas in the reserves.

Wildfire Suppression

- * All wildfires will be managed and controlled as far as possible within the reserve.
- * Preference will be given to fire suppression methods which have least adverse environmental impact.
- * Fire suppression and other fire management activities will be undertaken on a co-operative basis between the Service, New South Wales Fire Brigade and the Rural Fire Service.
- * Temporary trails and fire breaks established during fire events will be rehabilitated as soon as possible after the fire.

Fire Research

- * Research will be encouraged into the effects of fire on plant and animal communities within the reserves and into traditional Aboriginal burning practices for the area.

Actions

- * A fire management plan consistent with the above policies will be prepared for the reserves by December 2000 and placed on public exhibition.
- * The Service will participate in the preparation of section 52 operational plans and bush fire risk management plans under the Rural Fires Act in association with Penrith and Hawkesbury Bush Fire Management Committees.

4.1.5 Aboriginal Heritage

The Dharug Aboriginal people inhabited the area which includes Castlereagh, Agnes Banks and Windsor Downs Nature Reserves for more than 8,000 years. European exploration of the area occurred soon after the establishment of a colony in Sydney, between 1788 and 1791. The Dharug people were soon decimated by European invasion, firstly through the spread of disease (smallpox, measles, influenza etc) and secondly through dispossession. Large tracts of land traditionally occupied by the Dharug people were given to settlers who cleared it for farming and fought the traditional occupiers of the land.

Although most Aboriginal sites and relics on the Cumberland Plain have been destroyed by development, evidence of their way of life has survived in the form of open camp sites with stone artefact scatters at Castlereagh and Windsor Downs Nature Reserves. Fourteen Aboriginal sites have been recorded in Castlereagh Nature Reserve and fifteen sites in Windsor Downs Nature Reserve. Although no sites have been found in Agnes Banks Nature Reserve, sites may be present under the sands. All sites recorded to date have been open camp sites with surface scatters of chert and other stone. No comprehensive surveys have been undertaken of the reserves and it is likely that more Aboriginal sites exist in the reserves.

The Aboriginal sites within the nature reserves are important evidence of the original inhabitants of the area and their way of life, little of which remains today. The location of sites within the reserves will not however be publicised due to their fragility. There are various groups and individuals who represent the contemporary views of Aboriginal people in the area.

Policies

- * All Aboriginal sites found on the reserves will be recorded and conserved.
- * Local Aboriginal groups and individuals will be consulted and involved in the management of Aboriginal sites on the reserves.
- * Prior to any surface disturbing works being undertaken on the reserves, a survey for Aboriginal sites will be undertaken. Where sites are found, the works will be modified or relocated.
- * Non-destructive research into the Aboriginal heritage of the reserves in association with the local Aboriginal community will be encouraged.

Action

- * The Aboriginal heritage of the reserves will be included in new information brochures when prepared for the reserves.

4.1.6 Historic Heritage

The relatively fertile soils, proximity to the central business areas of the colony and the flat to undulating topography resulted in the Cumberland Plain being one of the first areas in Australia to be extensively explored and cultivated. By the 1790s much of the area surrounding the nature reserves had been explored by Europeans and clearing of the land for agriculture and the development of small settlements had commenced.

Castlereagh Nature Reserve

Little is known about tenure and land use of Castlereagh Nature Reserve prior to the dedication of Castlereagh State Forest in 1917, however the history of management of the area since that time was well documented by the then Forestry Commission of NSW (now State Forests of NSW).

From 1917 until the 1970s broad-leaved ironbark was harvested from the forest for power poles, firewood and mining props. In the 1920s and 1930s part of the forest was used for trial plantings of pine trees, but this program was not successful and stopped in 1935 with 300 hectares of pine established. Heavy harvesting of ironbark during the Second World War, illegal timber collection and numerous fires generally thinned the forest, resulting in no mature trees in some areas. Gravel for road-base and other uses was quarried from the reserve in large amounts during World War II.

Two large areas were revoked from the State Forest: 266 hectares in 1960 for a Child Welfare Training School; and 389 hectares in 1971 for the Castlereagh liquid waste disposal facility (now Castlereagh Waste Management Centre). From 1985 to 1988 the Forestry Commission of New South Wales and a number of local four-wheel drive clubs removed hundreds of dumped cars from the forest. The gravel pits were revegetated and formed into small dams, management trails upgraded and a carpark and walking track were constructed. In 1995 the remaining 448 hectares of Castlereagh State Forest was dedicated as Castlereagh Nature Reserve.

Agnes Banks Nature Reserve

The Agnes Banks sand deposit has an area of approximately 3.7 square kilometres and has been mined since the 1950s. At that time, much of the area was Crown Land (which was either vacant or held under permissive occupancies) and private freehold land. Mining exploration licences covered almost the entire area. In 1968 the Scientific Committee on Parks and Reserves recommended that a conservation reserve be established to protect the unique vegetation and remaining sand deposits.

In 1982 64 hectares of the Agnes Banks sand deposit was gazetted as Agnes Banks Nature Reserve. In 1989 a Commission of Inquiry was held into the proposed mining of sand deposits to the immediate north of the nature reserve. The Commissioner found that the subject lands contained extremely high nature conservation values and applied a Permanent Conservation Order under the NSW Heritage Act 1977 over the area. Forty-two hectares, which included around 80% of the land covered

by the order, was added to the nature reserve in 1995. The Order still applies over this land and a small area of private land adjoining the nature reserve.

Windsor Downs Nature Reserve

European exploration of the Windsor Downs area occurred early in Sydney's development, between 1788 and 1791. The Colonial Government gave a land grant to Richard Rouse who established Jericho Farm, part of which now forms Windsor Downs Nature Reserve.

In 1878 the Riverstone Meatworks was established by Benjamin Richards on part of the Jericho Farm estate. The company owned over 2,000 hectares which were used for cattle grazing, dairies and holding yards. An overhead water tank, dam, concrete feed troughs, and remnants of a windmill and wooden fences remain in the reserve from this period.

In the late 1980s the Angliss Group, which now owned the Riverstone Meatworks, donated part of the Jericho Farm to the Service for dedication as a nature reserve. Windsor Downs Nature Reserve was dedicated in 1990.

Policies

- * The provisions of the Burra Charter of Australia ICOMOS (1988) for the conservation of places of cultural significance will guide management decisions for historic places within the reserves.
- * A survey for historic places will be undertaken prior to any earth works being commenced in the reserves. Where sites or places of cultural significance are found, the works will be modified or relocated.
- * Wooden and steel uprights of old fences will be left in place unless found to be a problem to environmental management or public use of the reserves.
- * The concrete feed troughs and windmill remains in Windsor Downs Nature Reserve will be left *in situ*.
- * The overhead tank in Windsor Downs Nature Reserve will be regularly assessed for structural stability and may be removed or lowered to ground level if assessed as unsafe.

Actions

- * The overhead tank, dam, concrete feed troughs and remains of the windmill in Windsor Downs Nature Reserve will be recorded and an interpretative sign erected in the vicinity of the tank and feed troughs.
- * All wire and steel pickets/spacers associated with redundant internal fences will be removed from Agnes Banks and Windsor Downs Nature Reserves.

4.2 USE OF THE NATURE RESERVES

The major categories of use that can be appropriate in nature reserves are:

- education and interpretation of the areas;
- research; and
- management operations.

The extent to which these categories of use will be provided for in Castlereagh, Agnes Banks and Windsor Downs Nature Reserves is indicated below.

4.2.1 Environmental Education, Interpretation and Public Use

The primary purposes of nature reserves are the conservation of wildlife, natural environments and environmental education (including scientific research).

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves have only recently been established. Public use of Agnes Banks and the Windsor Downs areas was largely unregulated prior to the areas being dedicated as nature reserves, while use of Castlereagh was restricted by State Forests.

In 1988 State Forests of NSW undertook a program of substantial works in Castlereagh State Forest including revegetation of disturbed areas, fencing, rubbish removal and the provision of a car park on Old Northern Road, a walking track and picnic tables. The picnic tables have since been removed and the walking track has revegetated.

Windsor Downs Nature Reserve is by far the most visited reserve of the three. It is surrounded by the rapidly expanding residential areas of Bligh Park, Berkshire Park and Windsor Downs Estate and is estimated to have over 10,000 visitors a year. Both Castlereagh and Agnes Banks Nature Reserves are surrounded by rural and semi-rural areas with lower population densities.

The population of the Penrith Local Government Area was 154,900 in 1991 and is predicted to increase to 206,200 in 2021. The population of the Hawkesbury Local Government Area was 52,900 in 1991 and is predicted to increase to 65,700 in 2021 (Department of Urban Affairs and Planning, 1995). The implications of population growth in the areas surrounding the reserves are:

- increasing pressures on the reserves from increased urbanisation in the immediate vicinity of the reserves; and

- the increasing value of the reserves for nature conservation, environmental education and scientific research.

Cattai National Park, Blue Mountains National Park, Wollemi National Park and a number of other local parks and reserves in the vicinity of Castlereagh, Agnes Banks and Windsor Downs Nature Reserves cater to a broad demand for public recreation. The proximity of these neighbouring reserves and the recreational opportunities they offer, means Castlereagh, Agnes Banks and Windsor Downs Nature Reserves can provide for primarily natural and cultural heritage management and education.

Recent works in Windsor Downs and Castlereagh Nature Reserves have greatly reduced the unauthorised use of motor vehicles in both areas. Agnes Banks Nature Reserve is linked to adjacent vacant Crown Land by an *ad hoc* system of badly eroded trails which are subject to substantial motor vehicle use. There is evidence of unauthorised motor cycle use in all three reserves.

Some illegal horseriding occurs in all three reserves, particularly in Agnes Banks Nature Reserve. Horseriding is not consistent with the provisions of the National Parks and Wildlife Act for the protection and management of nature reserves and will continue to be prohibited in the nature reserves.

Castlereagh and Windsor Downs Nature Reserves are popular with local children for bicycle riding. Bicycle riding can pose a threat to the public safety and cause soil erosion and vegetation loss when undertaken off trails. The flat terrain and predominantly clay and gravel soils in Castlereagh and Windsor Downs Nature Reserves mean that cycling may be acceptable in these reserves if it is restricted to formed trails. Agnes Banks Nature Reserve, in contrast, comprises scientifically important relic sand dunes which have high erosion potential and is unsuitable for bicycle riding.

Prominent and active community education programs are key management activities that assist the protection and management of the reserves. Existing interpretation material includes information brochures for Castlereagh and Windsor Downs Nature Reserves. These reserves also have prominent signs at public entrances and on public road boundaries. Agnes Banks Nature Reserve does not have an information brochure and has no on-site interpretation.

Policies

- * Public use of Castlereagh, Agnes Banks and Windsor Downs Nature Reserves will be limited to low impact, day use recreational opportunities consistent with the objectives of this plan of management.
- * Walking and bicycle riding will be permitted in the reserves providing visitors keep to formed management trails and no unacceptable impacts occur.
- * The use of motor vehicles for non-management purposes and horseriding will continue to be prohibited in the nature reserves.

- * Any organised activities within the nature reserves will require permission of the District Manager.

- * In interpretation of the reserves will emphasise:
 - the reserves as examples of the geology and landforms of the Cumberland Plain, with particular emphasis on the Tertiary sand dunes of Agnes Banks Nature Reserve;
 - the reserves as important and different components of the remnant Cumberland Plain plant and animal communities;
 - the value of the reserves for environmental education and scientific research;
 - appropriate public use; and
 - the importance and purpose of management programs in natural heritage conservation.

Actions

- * A community relations strategy will be developed for the reserves. This may include guided walks during school holidays, signs, brochures and school visits.

- * An information brochure will be developed for Agnes Banks Nature Reserve and the existing information brochures for Castlereagh and Windsor Downs Nature Reserves will be replaced with new, updated brochures.

- * The boundaries of the reserves will be clearly marked and signs indicating the name of the reserve will be erected adjacent to public roads and entrances to the reserves and elsewhere as necessary.

- * Information signs, which include information on the purposes of the reserves, will be erected at:
 - the Llandilo Road and The Northern Road public entrances to Castlereagh Nature Reserve;
 - the Sandy Trail entrance to Agnes Banks Nature Reserve; and
 - the public entrances to Windsor Downs Nature Reserve on Richmond Road, Surprise Crescent, Alex Place and Sanctuary Drive.

- * The impacts of bicycle riding in the nature reserves will be monitored and may be temporarily or permanently excluded from all or part of the reserves if necessary.

- * The Service will liaise with Hawkesbury Shire Council regarding the provision of an alternative bicycle riding area outside Windsor Downs Nature Reserve.

4.2.2 Research

Research into the native plants and animals of the reserves, their management requirements, methods to control introduced species and the impacts of park users is essential to the development of appropriate management practices. Important research topics have been included in other sections of this plan.

In particular, additional information is required to improve understanding of the management requirements for remnant Cumberland Plain woodland and forest associations. Understanding of the management required for these communities is incomplete and the management of Castlereagh, Agnes Banks and Windsor Downs Nature Reserves and other Cumberland Plain remnants will be improved with further research.

Fire has the greatest potential impact on the natural heritage of the reserves and is specifically addressed at 4.1.4 of this plan. However, research in other areas will also provide for improved management of the nature reserves for the protection of biological diversity. This information could also be applied to better management of other Cumberland Plain remnants and the rehabilitation of ecologically degraded areas in western Sydney.

As well as research undertaken by the Service, research projects are undertaken in the reserve by others, mainly students. This research is of high benefit if it enhances management of the reserve.

Policies

- * Priority will be given to research and monitoring programs which have the potential to facilitate better management of the nature reserves, and in particular research into:
 - the distribution and management requirements of threatened and regionally uncommon species;
 - fire ecology
 - Aboriginal heritage; and
 - control of introduced plants and animals.
- * All research will be subject to Service policies and procedures for the granting of permits, conduct of research and production of results.

Action

- * A prospectus will be prepared as a guide to preferred research projects in the nature reserves.

4.2.3 Management Operations

Management operations refers to the operational activities of the NSW National Parks and Wildlife Service and others within Castlereagh, Agnes Banks and Windsor

Downs Nature Reserves. Whilst the primary function of the nature reserves is for the protection of natural and cultural heritage, a number of uses which existed prior to the areas being dedicated as nature reserves remain today.

Castlereagh, Agnes Banks and Windsor Downs Nature Reserves are managed by the North Metropolitan District of the NSW National Parks and Wildlife Service. Administration of the nature reserves is based at the Hills Sub-District Office in Scheyville National Park.

It is a long term aim of the Service to reduce and if possible remove power lines and other utilities that are not required for ongoing management of the reserves. To this end such occupancies will be kept under regular review and where warranted the facility will be relocated and or closed and the site rehabilitated.

Castlereagh Nature Reserve

Castlereagh Nature Reserve has three vehicle entrances, one off Llandilo Road and two off The Northern Road. These entrances will be retained and gated to prevent unauthorised motor vehicle use (including motor cycles) and horse riding within the reserve. All vehicle entrances have locked gates and the public road boundaries of the reserve are fenced.

A large number of vehicle trails and a carpark located adjacent to The Northern Road were developed in Castlereagh Nature Reserve by State Forests of NSW and its predecessors when the area was managed as a production and demonstration forest between 1917 and 1995. Many of the trails and the carpark were no longer necessary when the area became a nature reserve. The carpark was also used as a site for dumping of rubbish and building materials, vandalism and other illegal activities.

The Service has recently closed the carpark and rationalised the network of management trails. Those trails not needed for management of the reserve have been ripped to encourage revegetation and bitumen has been removed from the carpark. North Trail, Llandilo Trail, South Perimeter Trail, Herbs Trail, Barbaras Trail, Centre Trail and Powerline Trail (see Map B, page 22) have been retained and will be maintained as necessary to meet operational requirements as management trails. The Powerline Trail is used by Integral Energy to maintain and service a 11Kv power transmission line which transects the western portion of the reserve from north to south. A number of other trails are used to service the groundwater monitoring stations. The Llandilo Trail runs parallel to Llandilo Road and may not be necessary for management purposes. The need for retaining this trail, the Link Trail, and the unnamed trail between the Powerline Trail and Herbs Trail will be reviewed.

Agnes Banks Nature Reserve

Agnes Banks Nature Reserve has one formal management trail: Sandy Trail off Rickard Road (refer Map C, page 23). A number of other trails have however been pushed into the reserve from the adjacent vacant Crown Land to the east and south. These trails were part of the *ad hoc* public use of the area and are generally eroded

and a focus for rubbish and vehicle dumping, arson and other illegal activities. Sandy Trail will be maintained and upgraded. Other trails will be closed and where necessary rehabilitated.

Part of the Rickard Road boundary and boundaries adjoining private property are fenced. Additional fencing is however needed along the unfenced section of Rickard Road and behind some properties, and locked gates are needed on all trails leading into the reserve.

Windsor Downs Nature Reserve

Windsor Downs Nature Reserve has an established management trail network which includes the Surprise, Uncles, Hakea, Dip, Mr Corns and Richmond Road Trails (see Map D, page 24). All except Uncles and Mr Corns Trails are currently fitted with locked gates. The Dip Trail is not directly linked to a public thoroughfare and has comparatively little value for public use or management operations. The need for retaining this trail will be reviewed.

Much of the boundary of Windsor Downs Nature Reserve is fenced, however part of the reserve boundary adjacent Sanctuary Drive and behind houses adjoining the south-west corner of the reserve is unfenced. As part of the development consent covering the Windsor Downs Estate, private properties adjacent to the reserve are required to provide and maintain a boundary fence between their properties and the reserve. Specifications describing the style of fence are contained in covenants over neighbouring lots within the estate.

A Telstra telephone exchange and Integral powerline and structure are located within the reserve adjacent to Richmond Road. These facilities are currently unlicensed.

Policies

- * All works, facilities and operations by other authorities will be subject to a lease, licence, easement or agreement under the National Parks and Wildlife Act.
- * The Service will seek to reduce and if possible eliminate, power lines and other utilities within the nature reserves. To this end such occupancies will be kept under regular review and where warranted the facility will be relocated and/or closed and the site rehabilitated.
- * A system of management trails will be maintained within the reserves to provide access for authorised management purposes. These are shown on Maps B, C and D (pages 22-24). All other tracks and trails within the reserves will be closed and revegetated.

Actions

- * Fences will be constructed in Agnes Banks Nature Reserve adjacent to Rickard Road, and in Windsor Downs Nature Reserve adjacent to Sanctuary

Drive. Fencing may also be constructed along the north-western edge of Windsor Downs Nature Reserve and along other boundaries of Agnes Banks Nature Reserve if necessary.

- * The Service will request landholders in Windsor Downs Estate adjacent to Windsor Downs Nature Reserve to construct a fence between the rear of their properties and the reserve as required by the covenant on the development.
- * Gates and/or fencing will be constructed where necessary across the trails between Agnes Banks Nature Reserve and the adjacent Vacant Crown Land to prevent unauthorised motor vehicle access.
- * The need for Llandilo Trail within Castlereagh Nature Reserve and the Dip Trail within Windsor Downs Nature Reserve to be retained as management trails will be reviewed.
- * Leases, licences or other agreements will be negotiated with Telstra over the use of the telephone exchange within Windsor Downs Nature Reserve and with Integral Energy regarding maintenance of the power line within Castlereagh Nature Reserve and the powerline and structures in Windsor Downs Nature Reserve. This is in addition to the previously mentioned agreement covering monitoring of toxic waste in Castlereagh Nature Reserve (see section 4.1.1).
- * Gates into the reserves from adjoining private property will be fenced off unless such gates are part of the fire access system identified in the fire management plan for the reserve.

5. PLAN IMPLEMENTATION

This plan of management is part of the system of management developed by the National Parks and Wildlife Service. The system includes the National Parks and Wildlife Act, the Service's Corporate Plan, associated strategies and management policies. It also includes regional and district operational planning.

The orderly implementation of this plan of management will be undertaken within the annual programs of the Service's North Metropolitan District. Priorities will be determined during the development of these programs and will be subject to regional priorities, the availability of funding and staff to any specific requirements of the Director-General or the Minister.

District programs are subject to on-going review within which works and any other activities carried out in Castlereagh, Agnes Banks and Windsor Downs Nature Reserves will be evaluated in relation to the objectives laid down in this plan.

The environmental impact of all development proposals will be assessed in accordance with established environmental assessment procedures.

In accordance with Section 81 of the *National Parks and Wildlife Act 1974* this plan shall be carried out and given effect to and no operations shall be undertaken in relation to Castlereagh, Agnes Banks and Windsor Downs Nature Reserves unless those operations are in accordance with the plan of management. If after adequate investigation, operations not included in this plan are found to be justified, the plan may be amended in accordance with Section 75 of the Act.

As a guide to the implementation of this plan, relative priorities for identified activities are summarised on the following pages. The following criteria have been used to allocate priorities:

High Priority: programs that need to be done in the immediate to near future on the basis that to not undertake these works will result in unacceptable degradation of the resource and/or greatly increased costs associated with rehabilitation at a later date. Also included as high priority are programs which are given a high priority for legal or public safety reasons.

Medium Priority: programs which are important but can be deferred without unacceptable loss of natural and/or cultural heritage values.

Low Priority: programs which will be undertaken only after high and moderate priority programs have been completed or which can be undertaken by other means such as volunteers, grant, concession operation, sponsorship or similar.

Actions	Plan Reference
High Priority	
Close unofficial trails in reserves	4.1.1
Fence-off old bicycle track in Windsor Downs NR	4.1.1
Approach council re ameliorating impacts of stormwater entering Windsor Downs NR	4.1.1
Seek addition to the reserves of adjoining lands	4.1.2
Prepare fire management plans for reserves	4.1.4
Record historic structures in Windsor Downs and erect interpretive sign	4.1.6
Mark and signpost boundaries to reserves	4.2.1
Erect information signs at key entrances to reserves	4.2.1
Request neighbours of Windsor Downs NR to erect fences	4.2.3
Construct boundary fences in Agnes Banks NR and Windsor Downs NR	4.2.3
Fence/gate trails between Agnes Banks NR and adjacent crown land	4.2.3
Review need to retain Llandilo Trail in Castlereagh NR and Dip Trail in Windsor Downs NR as management trails	4.2.3
Medium Priority	
Prepare detailed vegetation maps for reserves	4.1.2
Prepare introduced species control strategy for the reserve	4.1.3
Prepare brochure on introduced animals 4.1.3	
Participate in preparation of section 52 fire plans	4.1.4
Develop community relations strategy for reserve	4.2.1
Liaise with council re alternative cycling areas	4.2.1
Institute program for monitoring impacts of bicycle riding	4.2.1

Medium Priority (continued)	Reference
Prepare research prospectus	4.2.2
Negotiate agreements with Telstra and Integral Energy	4.3.3
 Low Priority	
Negotiate access agreement to monitoring sites in Castlereagh NR	4.1.1
Include information on Aboriginal heritage on brochures	4.1.5
Remove wire and steel pickets on internal fences	4.1.6
Update information brochures for Windsor Downs NR and Castlereagh NR	4.2.1
Develop brochure for Agnes Banks NR	4.2.1

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