



Management Plan for
Australian White Ibis (*Threskiornis molucca*)
Lake Mandurama, Ambarvale



August 2015

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1. Executive Summary

The Australian White Ibis (AWI) is a common native avian species, it is therefore protected in New South Wales (NSW) under the NSW *National Parks and Wildlife Act 1974*. The eastern seaboard of Australia is considered an important refuge for AWI populations displaced from traditional inland breeding sites through years of drought and ecologically damaging water management practices.

During 2014 the AWI population at Lake Mandurama Reserve, Ambarvale significantly increased affecting the local environment, public amenity and prompting management action response from Council.

Council has developed this Management Plan for AWI at Lake Mandurama Reserve, Ambarvale to ensure that it is meeting legislative requirements for managing a native species in an urban area and to assist in managing:

- AWI in the area in a strategic and sustainable way
- conflict between AWI and the local community
- impacts of AWI on the local environment.

This plan identifies the site management objectives and makes recommendations for active management of the AWI population at Lake Mandurama Reserve, Ambarvale. Management actions proposed under this plan include population reduction through egg oiling and nest burning, community education, environmental improvement through removal of exotic vegetation and monitoring to understand the AWI population, their impacts and the effectiveness of management actions.

This management plan is proposed to be implemented over the next three years at the conclusion of this time its need and appropriateness will be determined. In the interim it will be reviewed on an annual basis and/or when significant changes in legislation or management direction warrant a review.

2. Introduction

The AWI is distinguishable by its almost entirely white body plumage and black head and neck. The head is featherless with a long black down-curved bill around 16 centimetres in length. Adult birds have a tuft of cream plumes on the base of the neck. During the breeding season the skin on the under-surface of the wing changes from dull pink to dark scarlet. Young birds are similar to adults with slightly smaller, shorter bills.

In flight, flocks of AWI form distinctive V-shaped flight patterns. Breeding season usually occurs from June to February, with between one and three clutches per season. AWI nest in large colonies, often with the Straw-necked Ibis. Eggs incubate for 23 days on average.

The AWI can be observed in all but the driest habitats. Traditional breeding locations for this species were inland wetlands such as the Macquarie Marshes, however modifications to the hydrology of these wetlands over the last two decades have resulted in dramatic reductions in populations in these areas and populations have increased in the Eastern seaboard. Natural preferred habitats include swamps, lagoons, floodplains and grasslands, but it has also become a successful inhabitant of urban parks and gardens.

The AWI traditionally diet on both terrestrial and aquatic invertebrates, however they are increasingly feeding on human food waste. Many AWI populations have learnt to exploit human food waste in urban environments. As a result AWI are becoming more common in urban areas and less common in their natural habitat.



Figure 1. Adult AWI and juvenile in nest

3. AWI Management

Since 2004 AWI have expanded their roosting and nesting sites in the Sydney Region. The large number of AWI in urban areas has affected public amenity, aircraft safety, water quality and biodiversity, creating conflict with local communities and prompting the need for management of AWI in the Sydney Region.

During 2009/10 relevant government organisations including local Councils, NSW NPWS and the Centennial Parklands Trust formed an AWI Regional Task Force with the aim of developing a Sydney Regional Ibis Management Plan. This document is now in the form of a working draft plan awaiting adoption by the NSW Government.

The working draft Sydney Regional Ibis Management Plan categorises colonies of AWI into three different types based on their population size with corresponding different management strategies and licensing requirements applicable for each colony category (see Table 1).

As AWI are a native species a licence is required under the *National Parks and Wildlife Act 1974* before any intervention can be undertaken. Where local government authorities, private organisations or landholders determine the need to manage breeding AWI colonies, a Section 121 Occupier's Licence to Harm Fauna in NSW must be obtained from NSW National Parks & Wildlife Service (NPWS). In addition a Section 120, General Licence must be obtained for anyone carrying out works resulting in harm.

For colonies of greater than 50 birds the landowner must also prepare a detailed site management plan.

Table 1. Licence requirements for AWI management

Colony Category	Population size	Management/licensing requirements
Small colony	<50 individuals	<ul style="list-style-type: none">• A Section 120 General Licence under the <i>National Parks and Wildlife Act 1974</i> for persons harming protected fauna (for contractors undertaking works)• A Section 121 Occupier's Licence under the <i>National Parks and Wildlife Act 1974</i> for landholders, authorising works to be undertaken on specific lands
Medium-large colony	>50 individuals	<ul style="list-style-type: none">• A Section 120 General Licence under the

		<p><i>National Parks and Wildlife Act 1974</i> for persons harming protected fauna (for contractors undertaking works)</p> <ul style="list-style-type: none"> • A Section 121 Occupier's Licence under the <i>National Parks and Wildlife Act 1974</i> for landholders, authorising works to be undertaken on specific lands • Development of a Site Management Plan for the species
Refuge colony	Specific colonies determined by the NSW Government eg Lake Annan, Lake Gillawarna	<ul style="list-style-type: none"> • A Section 120 General Licence under the <i>National Parks and Wildlife Act 1974</i> for persons harming protected fauna (for contractors undertaking works) • A Section 121 Occupier's Licence under the <i>National Parks and Wildlife Act 1974</i> for landholders, authorising works to be undertaken on specific lands • Development of a Site Management Plan for the species, specifying that at least 50% of active nests will be left undisturbed during control activities.

The working draft Sydney Regional Ibis Management Plan recommends that a Sydney Region population of at least 6,500 AWI individuals be maintained. If the population falls below this number the management strategies for colonies will be reviewed.

4. AWI Distribution

4.1 AWI in South-Western Sydney

Within the South Western Sydney Region large AWI colonies are present at:

- Spring Farm Advanced Resource Recovery Technology Facility
- Lake Annan in Mt Annan, Camden.
- Lake Gillawarna, Georges Hall
- Eastern Creek Advanced Resource Recovery Technology Facility, Eastern Creek.

As waste processing facilities close down or modify their practices the AWI move looking for sources of food and suitable habitat in different areas, thus establishing new colonies which commonly result in community and environmental conflicts.

4.2 AWI in Campbelltown

Within Campbelltown emerging colonies of AWI have been observed at Lake Mandurama Reserve, Ambarvale and Eagle Farm Reserve, Eagle Vale.

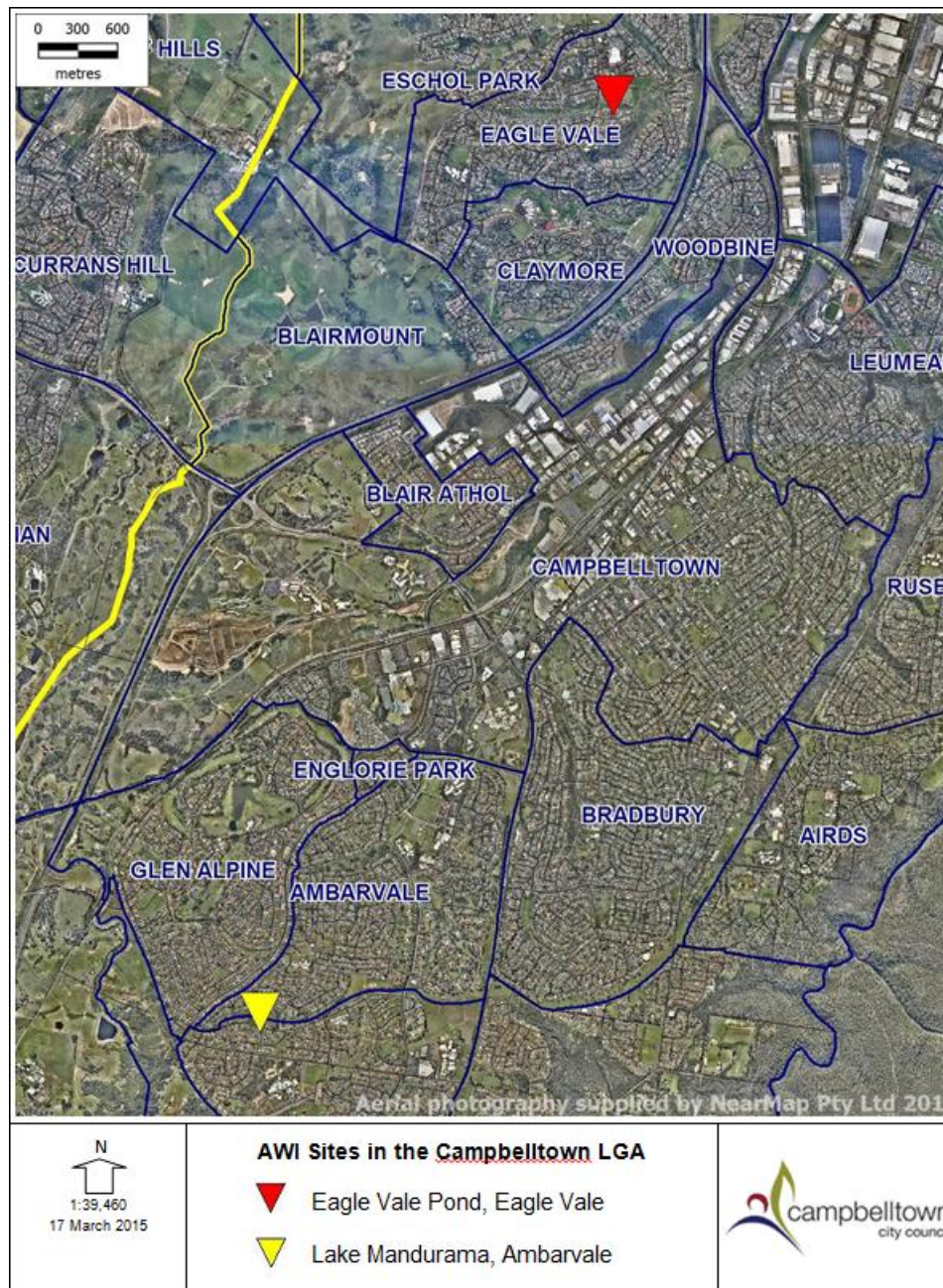


Figure 2. AWI sites in the Campbelltown LGA

AWI have been known to roost within Lake Mandurama Reserve, Ambarvale in small numbers alongside a range of other bird species over the past few years. Until 2014 there have been no recorded effects on the environment, surrounding residents and park users.

However during 2014 population numbers were observed to significantly increase, prompting concern from local residents and park users regarding the damage to vegetation in the area, the loud noises emanating from the nesting birds and the odours generated from concentrated fouling in nesting areas.

5. Site Description

This Management Plan applies to the area of Lake Mandurama and the surrounding reserve (Lot 1552 DP 709072). A map identifying the area covered by the Plan is provided in Figure 3 below. The area covered by the Plan encompasses 35,900m² and is herein referred to as Lake Mandurama Reserve.

Lake Mandurama Reserve is located in the suburb of Ambarvale approximately five kilometres from the Campbelltown CBD. The lake was constructed in or around the 1950s as a farm dam. In the early 1990s it was converted into water quality control pond, in-line with Spring Creek, to capture run-off from construction in the surrounding suburb. The lake is 1.5 hectares in size and contains a refuge island which is approximately 1000m² in area.

The lake is adjacent to a passive recreational space which is part of the reserve, which includes a small playground and park area. The site is in close proximity to residences and is bordered by Cleopatra Drive, Crisparkle Drive, Haredale St, Darnay Place and Jasper Place.

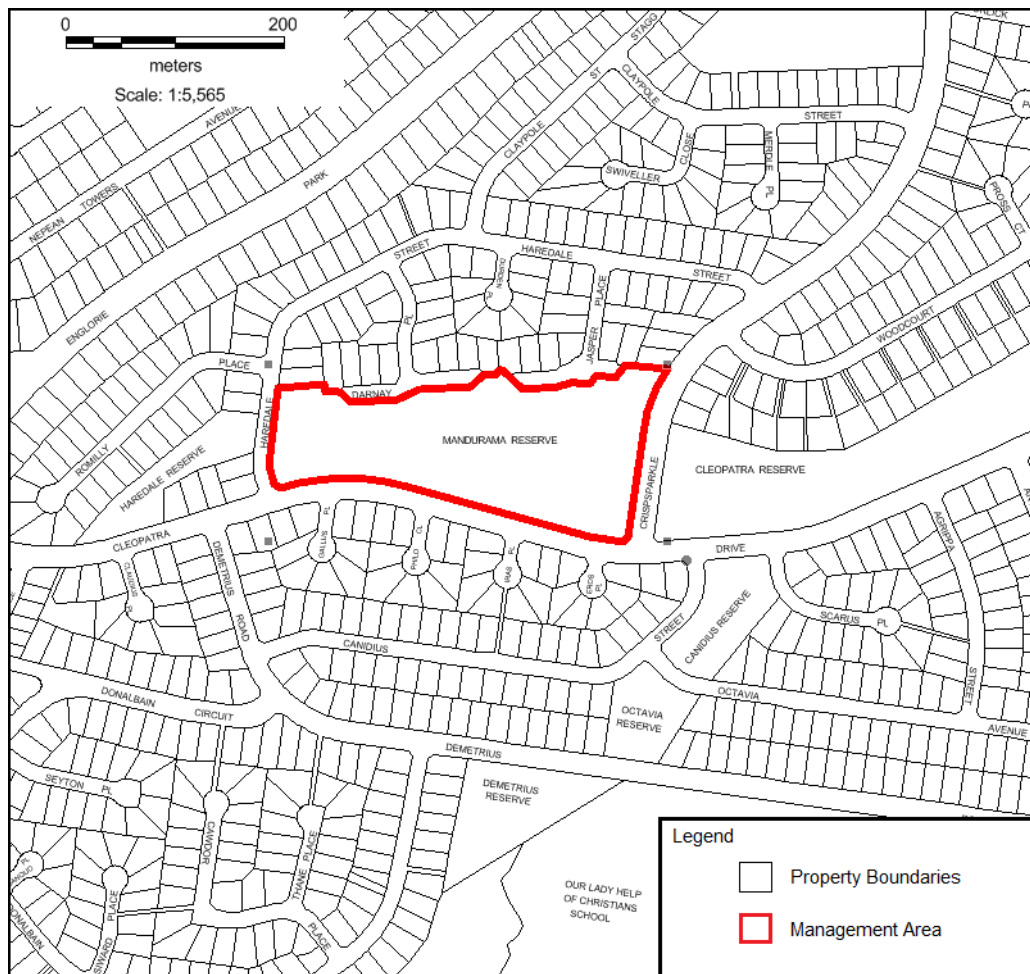


Figure 3. Management area covered under this plan

6. Site Significance

6.1 Historical

The waterbody now known as Lake Mandurama was constructed in or around the 1950's to serve as a farm dam for Bishop's Farm (see Figure 4), which encompassed the area.

The suburb itself was named after the old Ambarvale farm which despite popular belief, actually stood on the other side of Appin Road where the suburb of St Helens Park is now. Still, as Ambarvale was one of the oldest property names to be used south of Campbelltown, the Council decided to apply to use the name and the Geographical Names Board approved it in 1976. It was March 1972, that the state government had first approved the farm land for urban development and, by the end of 1975, the first homes were under construction.

Figure 4. Lake Mandurama as a farm dam as pictured in aerial photography from 1956



In the early 1970's a series of three dams was established on the site and surrounds, in line with what is now called Spring Creek. Council's photography from 1972 shows three dam walls with the largest occurring adjacent to what is now known as Crisparkle Drive (see Figure 5).

Figure 5. The series of three dams in the area as pictured in aerial photography from 1972



In the early 1990's the lake was utilised to ameliorate impacts from construction of the surrounding suburb, to trap sediment and assist in protecting water quality of the creek and downstream river. The refuge island was installed at this time to provide a refuge for fauna and to add additional lake edge for macrophyte plants to assist in preventing erosion and to aid water purification.

6.2 Environmental

Lake Mandurama Reserve is home to a significant variety of plants and animals. Plant species found within the area include: She-Oak (*Casuarina Glauca*), Spiny Headed Mat Rush (*Lomandra longifolia*), Honey Myrtle (*Melaleuca decora*), Sydney Green Wattle (*Acacia parramattensis*), Water Gum (*Tristaniopsis laurina*), various Eucalyptus spp as well as exotic species such as Willow Spp and African olive. Within the lake there are naturally occurring pockets of reeds (*Juncus*, *Baumea*) which provide ideal roosting habitat for birds. Additionally in 2013 Council constructed floating reed beds within the lake to assist in water filtration, species planted include: *Baumea articulate*, *Phragmites australis*, *Schoenoplectus validus*, *Eleocharis sphacelata*, *Cyperus exaltus* and *Carex appressa*.

In regard to fauna, the area is predominately populated by bird species, including: Black Swans (*Cygnus atratus*), Purple Swamp Hens (*Porphyrio porphyrio melanotus*), Masked Lapwing Plovers (*Vanellus miles*), Domestic Goose (*Anser anser domesticus* or *Anser cygnoides*), Australian Wood Duck (*Chenonetta jubata*) and Little Black Cormorants (*Phalacrocorax sulcirostris*).

The small refuge island within the lake is vegetated with a range of trees and shrubs and offers protection from predators to a range of birds particularly during breeding season for roosting. The

island was strategically placed at the inflow of the dam in a central location to disperse the flow of water and reduce short circuiting of the water movement around the lake.

The lake forms part of the highly modified headwaters of Spring Creek, it now serves as a stormwater quality improvement device for the surrounding catchment (60 hectares). Overflow water from the lake immediately proceeds downstream through two water quality improvement devices (one currently under construction), to a modified channel and ultimately to Spring Creek and the Georges River. Water quality monitoring is undertaken routinely within the lake and the results indicate that water quality within the lake is variable but is generally indicative of a small waterbody in an urban catchment.

6.3 Landscape

The site is surrounded by residential housing, suburban roads and a series of detention basins downstream. The natural soil at the site has been highly disturbed, particularly at the time the lake was constructed. Plantings on the refuge island are representative of the Ecological Community of River Flat Eucalyptus Forest, however noxious and exotic weed species have become established on the island also. The surrounding landscape of the site is open parkland with the dominant tree species of the areas bordering the lake being *Eucalyptus Spp* and *Casurina Glauca*. A small remnant of Cumberland Plain Woodland ecological community has been mapped approximately 180 metres upstream of the lake.

6.4 Aboriginal significance

Council is still awaiting confirmation of the aboriginal cultural and heritage significance of the site from the Tharrawal Aboriginal Land Council. As outlined previously, this area has been heavily developed for residential purposes and associated landscaping. However, it is not intended as part of this plan to disturb the soil. If in the future soil disturbance is required consultation and guidance will be sought from the NSW government.

A search of the OEH Aboriginal Heritage Information Management System was undertaken on Tuesday 10 March 2015, it was noted that no aboriginal sites or places were recorded or declared in or near Lake Mandurama Reserve, Ambarvale (Lot 1552 DP 709072).

6.5 Community and Recreation

Recreational use of the reserve is limited to the boardwalk and the perimeter of the lake for passive activities including walking, sitting, and bird watching. There is children's playground equipment within the reserve and a concrete path around the southern and eastern perimeter of the lake. Due to the relative inaccessibility of the refuge island from the mainland there is no recreation activity on the island. The area is predominately used by local residents within walking distance. Aspect depictions of the lake and reserve are provided in Figure 6.



Figure 6 Lake Mandurama as pictured from Cleopatra Drive from wooden boardwalk

7. Site Issues

As stated previously, until 2013 AWI inhabited Lake Mandurama Reserve in small numbers (<10). Since 2013 this number has steadily increased, with counts of around 75 birds recorded on some occasions (see section 8 - Colony Composition).

A significant number of nests have been observed in the trees on the refuge island, particularly in *Willow spp.* AWI have also been observed on the mainland around the perimeter of the lake and in particular foraging through the bins at the reserve and on the floating reedbed, which has been decimated over the last 12 months.

AWI appear to be attracted to the area as it provides safe roosting opportunities, on the refuge island and the floating reed bed as well as ample food sources.

Since AWI numbers have increased at the site recreational activities have been detrimentally impacted by the damage caused to the general appeal of the reserve including aesthetics of vegetation and grassed areas within the reserve and foul smells associated with defecation and breeding. Whilst water quality results do not presently indicate any recent adversarial impacts from the AWI it is anticipated that over time nutrient levels will increase. Community feedback about the AWI has been negative, Council has received a significant number of complaints from park users and local residents either not wanting to use the reserve or concerned about the direct and indirect impact to their properties.

The following table outlines issues that have been identified as associated with AWI and their current applicability to Lake Mandurama Reserve.

Table 2. AWI issues identified at Lake Mandurama Reserve

Potential issues with AWI	Relevant to site?	Comments
Smell	✓	Offensive odours have been experienced at the site, assumed to be associated with bird defecation and decaying organic matter from rotting carcasses/eggs.
Noise	✓	Noise levels have increased at the site. Calls from the birds are observed primarily around sunrise and sunset.
Water quality	✗	Water quality monitoring is undertaken on a monthly basis. To date no impacts attributed to the bird population have been observed.
Fauna displacement	✗	Avifauna such as Cattle Egret, Little Black Cormorant, Black Swans and Purple Swamp Hens and Masked Lapwing Plovers still co-exist and breed on the island and in the reed pockets within the lake.

		Previous numbers are unknown.
Vegetation destruction	✓	Vegetation on the island is being intensively used by AWI to make nests. Many of the larger trees have been stripped bare of foliage. Some residents have reported that AWI have collected large quantities of twigs from their gardens to aid nest building.
Public nuisance	✓	AWI have been observed foraging in local bins. Their presence has been a deterrent to the public using recreational facilities based on perceived aggressiveness and threatening size, particularly towards young children.
Public health	✓	Faecal matter and decaying organic matter poses a risk to public health, in particular children. Increase in nutrients within the lake may result in blue-green algae blooms.
Public image	✓	The presence of AWI (and associated problems) is contributing to a declining image of Lake Mandurama and its public amenity.
Ecological sensitivity	✓	The site is located approximately two kilometres upstream of the natural waters of Spring Creek. At this location the creek is bordered by Shale Sandstone Transition Forest (a critically endangered ecological community). A remnant patch of Cumberland Plain Woodland is also mapped approximately 150 metres upstream. It is possible that water quality impacts from the colony could negatively impact on these ecological assets however given the distance and opportunities for water quality treatment it is unlikely.

8. Colony composition

AWI colony counts are designed to determine the number of AWI colonising at a given site. Council commenced colony counts in September 2014 at Lake Mandurama Reserve. All counts were undertaken from the perimeter of the lake due to WHS restrictions and available equipment. The results of colony counts undertaken to date are provided in Table 3.

Table 3. Results of AWI colony counts undertaken at Lake Mandurama Reserve

Date	Time started	Time finished	Total chicks on-site (a)	Total adults on-site (b)	# AWI flying in (c)	# AWI flying out (d)	Total adults (b+c-d=e)	Colony population (a+e)
18/9/14	4.30pm	6.00 pm	12	42	nr	nr	42	54
3/10/14	1.30pm	2.30pm	11	47				58
15/10/14	3.30pm	4.30pm	11	51				62
4/11/14	6.00pm	7.30 pm	9	39	19	4	54	63
19/11/14	11.30am	12.30pm	13	46				59
4/12/14	11.30am	12.30pm	11	52				63
23/12/15	6.30pm	8.00pm	15	44	18	6	56	71
12/1/15	6:45pm	8.15pm	12	48	18	5	61	73
28/1/15	11.30am	12.30pm	11	61				72

nr = not recorded / not observable

9. Site Management & Actions

Council recognises that the AWI colony at Lake Mandurama Reserve is not a geographically isolated issue but part of a South-Western Sydney region-wide AWI population. The working draft Sydney Regional Ibis Management Plan did not acknowledge the Lake Mandurama colony, however based on the colony categorisation under the plan, the colony would be considered a medium colony (greater than 50 individuals).

Due to the environmental damage, public health and nuisance issues arising from the AWI colony at Lake Mandurama, the 'do nothing' approach is not considered adequate. Moreover, as indicated above, the population dramatically increased in one season, it is uncertain if this trend will continue, particularly as a result of changes and reductions in other food resources. If an increase in population does continue it would most likely result in even more significant environmental and social impacts.

9.1 Past Management Actions

In response to resident's feedback Council has undertaken regular colony population counts of the AWI population at Lake Mandurama. Council has also consulted with other affected Council's such as Bankstown, Camden and Fairfield to assist in determining the most effective management actions.

Council's outdoor staff undertake regular maintenance activities of the reserve and grassed areas surrounding Lake Mandurama which also includes the collection of any dead birds, however the data regarding numbers of carcasses removed is unavailable. Once collected the dead birds are taken to a Council facility for collection and disposal by a specialised contractor.

9.2 Site Management Objectives

This site specific management plan aims to enable Council to effectively mitigate site specific negative impacts associated with AWI by providing comprehensive and clear guidelines for on-site management. Objectives of this plan are:

1. Manage the AWI colony within Lake Mandurama Reserve, in order to achieve/ restore a sustainable balance between the environment, recreational users, and local residents.
2. Increase community understanding of AWI.
3. Address environmental impacts to Lake Mandurama Reserve from AWI.
4. Manage public health impacts of the AWI colony at Lake Mandurama Reserve.

5. Monitor the AWI colony at Lake Mandurama Reserve to ensure appropriate and effective management practices are employed for the colony.

9.3 Site Management Action Plan

With the above objectives in mind a series of management strategies and corresponding actions have been developed to assist in achieving these objectives. These actions will be delivered over the three year life of the management plan and their effectiveness will be monitored and reviewed on an ongoing basis.

These strategies and actions are specified in the action plan in Table 4 below. Further details about each of the actions are provided in Section 10.

Table 4. AWI Action Plan for Lake Mandurama Reserve

Objective #	Management Strategy	Management Action	Timeframe	Responsibility	Comment
1	Reduce breeding success	Undertake egg oiling program during breeding season	Fortnightly during breeding season (August –January)	Council to engage contractor	Section 120 and 121 licences to be obtained. Ensure chicks are not present or adjacent to nests.
		Undertake nest burning outside breeding season	March – June each year	Council to coordinate RFS and SES to undertake pile burns on the island.	Application to be made to EPA for an ecological burn. Ensure animals are not present in nests
2	Reduce exotic vegetation	Undertake bush regeneration and weed treatment, particularly on refuge island	April – Dec 2015	Council to engage contractor	To be removed during non-breeding season
3	Reduce odours	Remove decaying egg/ carcasses routinely	Fortnightly inspections and removal during breeding season (August –January)	Council to engage contractor	

		Undertake nest burning outside breeding season	March – June each year	Council to coordinate RFS and SES to undertake pile burns on the island.	Application to be made to EPA for an ecological burn. Ensure animals are not present in nests
4	Maintain site and surrounds	Manage litter and food waste within the area through inspections, rubbish removal, bin clearing and grass mowing	Bins are emptied on a daily basis and park maintenance (mowing) undertaken on a monthly basis.	Council	
5	Control AWI feeding opportunities	Replace bins within Lake Mandurama Reserve with steel caged, covered waste bins	April – Dec 2015	Council	
		Encourage residents not to over-fill household bins	Ongoing	Council	Through comprehensive education campaign
6	Revegetation of native species	Removal of exotic vegetation.	April - Dec 2015	Council to engage contractor	To be removed during non-breeding season
		Planting of native species	Spring and Autumn as needed annually	Council or Council Contractor	Using species representative of River Flat Eucalypt Forest

		Protection of vegetation on floating reed bed	June – August 2015	Council	Explore deterrence options such as bird spikes, cages
7	Undertake community education campaign	Design and install signage around the perimeter of lake discouraging litter and feeding of birds	June – Dec 2015	Council	
		Design and distribute brochures for community on AWI, their impacts and appropriate behavioural practices	June – Dec 2015	Council	
		Update Council's website to include information about AWI, their impacts and appropriate behavioural practices	June 2015	Council	
8	Monitor AWI population	Undertake population counts of AWI colony at Lake Mandurama Reserve	Population counts undertaken fortnightly during breeding season (August –January) and monthly during the rest of the year	Council Council contractor	

		Participate in statewide surveys to assist in national management of species	October/ November annually	Council	Survey of Lake Mandurama Reserve colony undertaken annually in conjunction with statewide survey
9	Support research opportunities	Investigate research opportunities to achieve a better understanding of AWI.	Ongoing	Council	Participate in proposed University of Wollongong “Waterbird parasites and pathogens: disease threats in urban wetlands project” if project proceeds

10. Description of Management Actions

A detailed description of each of the management actions is provided below. These should only be performed by adequately trained personnel wearing the necessary personal protective equipment (PPE) and in accordance with protocol and procedures to be developed under an operational plan.

If at any time, an AWI (of any age) is harmed while performing any of these management actions, they must be immediately taken to a wildlife carer or a registered veterinary.

10.1 Reduce breeding success

Egg oiling - involves the coating of unhatched eggs with household cooking oil. The oil blocks air exchange through the pores of the egg preventing it from hatching. Egg-oiling is viewed as an environmentally safe and socially preferable to culling adult birds. Studies have shown that egg-oiling is 98-100% effective at preventing eggs hatching. Oiling can be conducted at any time during the 23 day incubation period and in 30% of cases parent AWI continued to brood the eggs for up to 54 days longer than the normal incubation period. This time spent brooding on unviable eggs reduces the opportunity for further egg laying.¹

Egg-oiling is considered to be a humane method of euthanasia and has been deemed an acceptable method by ecological authorities both nationally and internationally. Locally, egg oiling has been previously undertaken by both Bankstown, Camden and Fairfield Councils and they found it to be an effective management strategy. Thus far each council has engaged the services of a qualified contractor to undertake the oiling exercise.

Nest Burning - burning of AWI nests aims to reduce the availability of nesting habitat by destroying unused nests outside of the breeding season with all material piled in strategic locations on the island for pile burning in accordance with the RFS Guidelines for Pile Burning. Nest burning also reduces the amount of odour that is generated from the area, which will provide long term benefit to local residents. The nests that are heavily contaminated with faecal material and abandoned will be targeted as a priority.

Due to the disturbance and loss of nesting materials (once an ecological burn has been implemented), the AWI are likely to disperse and look for food and nesting materials in nearby locations.

¹ Martin et al. 2007, p319

To assist residents in this regard, an education campaign will be implemented simultaneously to provide residents with simple ideas how they can discourage AWI from visiting their properties, cleaning up vegetation debris from their front yards and making them less attractive to the AWI. This is described in more detail within Section 10.7 – Community Education.

10.3 Reduce Exotic Vegetation

Regular inspections and surveys at Lake Mandurama have identified AWI to be predominately nesting within exotic vegetation such as *Willow Spp*. Removal of exotic vegetation including *Willow Spp*, African Olive and African Boxthorn from the refuge island will assist in promoting native biodiversity and reducing favourable nesting habitat.

Vegetation removal and weed treatment will be undertaken in a mosaic pattern to ensure that habitat remains for the AWI and other avifauna and to promote the resilience of the remaining native vegetation. Any exotic tree species supporting active AWI nests will be left in situ to ensure that they have the best chance of survival. All exotic species larger than 100mm in diameter that are not in risk of falling into the water will be drilled and injected with Glyphosate herbicide to ensure that they can still provide habitat for fauna species in the short term whilst native species are encouraged to fill the void. All weed species less than 100mm diameter will be cut and painted using Glyphosate herbicide and left on island as habitat piles or placed in open locations for pile burning whilst nest burning is undertaken.

10.4 Reduce Odours

AWI nests are associated with foul odours as they are heavily contaminated with decaying organic material (eg eggs) and faecal matter. In addition when AWI breeding colonies reach high densities, on-site mortality of individuals of any age is inevitable. The resulting carcass decomposition adds to the odour associated with AWI breeding colonies.

Nest burning will assist in removing organic material and faecal matter thereby reducing odours. Prompt removal of decaying carcasses will help to reduce these odours and can be performed while on-site for other activities such as breeding restriction.

Inspection for carcasses and subsequent removal will be undertaken on a fortnightly basis, whilst other management activities are conducted.

10.5 Maintain Site and Surrounds

Council will endeavour to manage litter and waste at Lake Mandurama Reserve and surroundings to ensure that the availability of unnatural food sources for AWI is kept to a minimum. This includes ongoing regular mowing of grassed areas and regularly emptying bins to prevent overflow.

10.6 Control AWI Feeding Opportunities

One of the main sources of food and attraction to the site for AWI is human food waste. Currently the bins provided for the public at Lake Mandurama Reserve are not enclosed allowing birds (especially AWI) to forage for food in the bins. The current general waste bins at the reserve will be replaced with steel caged, covered waste bins to reduce access to the bins from animals other than humans.

10.7 Community education

Community education is an integral part of successful AWI management as many common practices such as feeding wildlife and incorrect disposal of rubbish greatly contribute to increased feeding opportunities. The community education campaign developed under the management plan will address community understanding of the species, human relationship and behavioural change. Education around conservation of native species is also important as many members of the general community may not be aware that AWI are a native species and may not understand why they have taken refuge in urban areas similar to Lake Mandurama Reserve within the Sydney Basin.

A public education campaign will be developed to address issues including:

- Biology of the species
- Impacts of the species
- Council's management actions
- Overfilling of household bins
- Bird feeding and rubbish dumping
- Management of vegetation on private property, to reduce foraging for nesting material.

Actions implemented through the education campaign will include:

- Development and distribution of education material such as brochures, stickers for bins, schools packages and media articles
- Installation of signage around the reserve area
- Update of Council's website with recommended behavioural practices for the public to discourage the presence and breeding of AWI
- Issue of a media release an annual basis prior to the breeding season to encourage residents to report AWI breeding sites and to increase awareness of the issues associated with urban AWI populations.

Creating community awareness of public feeding and general AWI issues can also be integral in communicating important and useful information about foraging, roosting and breeding sites within the area. It will also aid in community acceptance of this Management Plan.

10.8 Monitoring of AWI population

Monitoring of the Lake Mandurama Reserve AWI colony and reporting to the NPWS is required under the conditions of the Section 121 Occupier's Licence under the *National Parks and Wildlife Act 1974*. In addition it is appropriate to evaluate and assess the effectiveness of management actions prescribed within this management plan.

As indicated in the action table Council will engage a contractor to undertake egg oiling and decaying egg and carcass removal on a fortnightly basis during breeding season. The contractor will also collect and record data relating to their activities including roost counts, egg counts, the number of eggs oiled, number of carcasses removed and general population counts. This will be supplemented by monthly population counts by Council staff throughout the year.

An annual census of the colony is to be undertaken in conjunction with the OEH annual community survey of the AWI population across Australia to be held October/November each calendar year. This helps to accurately calculate the population within the Sydney Basin and guide statewide management direction which may impact on licence conditions.

10.9 Support Research Opportunities

Council will endeavour to support research opportunities through local schools, TAFE and universities as they arise. This will greatly assist in better understanding the species whilst also helping to guide appropriate management actions into the future.

11. Review of AWI Management Plan

This AWI Management Plan for Lake Mandurama Reserve, Ambarvale will be reviewed annually to ensure that it remains relevant as management techniques, knowledge and ability advance in management of the species. This will also include a review of the efficiency and effectiveness of the management actions specified within Section 9 of this plan.

Significant legislative or policy changes affecting the management of native species and/or changes in recommended practices for the management of native species will also trigger a review of this plan.

12. Glossary

Phrase/Word	Definition
AWI	Australian White Ibis
Dispersal	The moving of individuals away from each other or away from a particular site.
Foraging	The process of searching for and obtaining food or materials for nests.
Roosting	The process of birds congregating overnight at a specific place for rest and protection from predators.
NPWS	NSW National Parks and Wildlife Service
OEH	Office of Environment and Heritage

13. References

Eco Sure (2009), *Sydney Basin Australian White Ibis Regional Management Plan*, Prepared for NSW National Parks and Wildlife Service.

Camden Council (2013), *Australian White Ibis Management Plan for Australian White Ibis at Lake Annan, Mt Annan*.

Martin, JM, French, K, Major, RE (2007), 'The pest status of Australian white ibis (*Threskiornis molucca*) in urban situations and the effectiveness of egg-oil in reproductive control', *Wildlife Research*, 34(4), pp319-324.