PROPOSED PORT BOTANY EXPANSION

ASSESSMENT OF BIRD HAZARDS TO AIRCRAFT

Prepared for Sydney Ports Corporation

Avifauna Research & Services

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April 2003

Summary

This report looks at the need to minimise the creation of bird hazards to aircraft as a result of the construction of additional port land at Port Botany, Botany Bay. The report takes into consideration each bird species that may occur in the vicinity of Port Botany and whether they could pose a hazard to aircraft at Sydney Airport as a result of the construction and operation of additional port land at Port Botany and enhanced public and ecological areas around the Port.

Bird numbers occurring in the vicinity of Port Botany and movements of birds through various flight paths close to the Port and Sydney Airport have been examined.

The potential for the attraction of significant numbers of birds during the construction and subsequent operation of the additional port land at Port Botany and enhanced public and ecological areas is examined and recommendations made for management.

Conclusion:

With appropriate design and management the proposed additional port land at Port Botany and enhanced public and ecological areas on the north shore of Botany Bay are not likely to pose a significant change in bird hazard to aircraft operating from Sydney Airport.

The enhancement of habitat for migratory shorebirds may increase the potential of bird hazard currently posed by these birds should additional migratory birds be attracted to the area. However as these birds currently pose a minimal threat to aircraft the enhanced habitat should not significantly change the current bird hazard.

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1. Introduction

Sydney Ports Corporation (SPC) is proposing to create additional port land at Port Botany, in Botany Bay. The proposal involves the reclamation of approximately 60 hectares in Botany Bay to create additional port facilities for container handling including:

- * approximately 2 km of additional wharf face to create new berths for shipping;
- * the establishment of hardstand areas for container handling;
- * core road and rail network: and
- * utilities and services

In addition, an intermodal rail facility would be created within the additional port land extending the existing Botany Freight Rail Line into the terminal and to enable loading and off-loading of containers.

To minimise impacts on the shorebird-feeding habitat at Penrhyn Estuary the intertidal habitat in Penrhyn Estuary will be expanded, resulting in a total Estuary area of approximately 27 hectares including intertidal flats, saltmarsh and seagrass habitat.

A boat ramp at Penrhyn Estuary will be relocated to Foreshore Beach. Landscaping of the Foreshore Beach/Foreshore Road verge will include footpaths, a cycleway, beach access and a footbridge across Foreshore Road (see Figures A1- A6 in Appendix A).

An Environmental Impact Statement (EIS) is being prepared to assess the impacts of the construction and operation of the proposed additional port land, and to identify safeguards to mitigate any such impacts. One area of potential impact is the hazards posed by birds to aircraft using Sydney Airport.

The primary purpose of this commission is to undertake, on behalf of SPC, all work associated with a bird hazard study relating to the proposed additional port land at Port Botany, for inclusion in the EIS.

2. History of avifauna in Botany Bay

Bird species of special concern for aircraft safety at Sydney Airport are those that are likely to fly across runways or the flight paths of aircraft approaching or leaving the airport, either in sufficient numbers to be of concern or of a size large enough to pose a threat even if a single bird is hit by an aircraft. Table 1 includes a list of birds, their comparative sizes and their likelihood of being involved in a bird strike. An annotated list of birds and the risk factors is also included in Appendix B.

Since European settlement there have been some major changes to bird populations in and around Sydney that are now considered to be a risk to aircraft. It is likely that Silver Gulls originally nested in comparatively small colonies of several hundred birds either on headlands and foreshores around the Sydney area or on offshore islands. With the introduction of fishing in Botany Bay and the practice of discarding unwanted bycatch, food resources for gulls would have substantially increased with a corresponding increase in the numbers of gulls. In the Sydney region in the early 1940s, the number of Silver Gulls nesting at the main New South Wales colony at Five Islands, off Port Kembla, numbered less than 1,000. By the mid to late 70s the population had increased to an estimated 50,000 pairs (Gibson 1979). Five Islands provide a large nesting area free from disturbance and terrestrial predators such as foxes, feral cats and rats is the breeding ground for the majority of the Silver Gulls found in the Sydney region. This steep increase in numbers was attributed to the availability of food in Sydney leading up to the breeding season and at rubbish tips close to the nesting colony at Port Kembla and Wollongong. This enabled larger clutches of eggs and young to be reared.

A large proportion of the Five Islands Colony consists of birds that spend the nonbreeding season in metropolitan Sydney. This is evident by the marked fluctuation in numbers in Sydney during the breeding season (July to October), when the population declines, and the non-breeding season when these birds return to Sydney (see Figure 1). Other potential problem species that are now common in Botany Bay are the Australian Pelican and Australian White Ibis. Both of these species have been attracted in increasing numbers at beaches and parks in Sydney as a result of increased food provided by humans.

The Australian White Ibis has increased in numbers in recent years and now nest in large colonies within the Sydney metropolitan region including such areas as Centennial Park and Burwood Park (despite efforts to control nesting activities). The potential for this species to nest at or close to Sydney Airport was demonstrated recently when a colony became established at Mill Pond, Botany, before it was removed after intervention by NPWS (Geoff Ross pers. comm).

Australian Pelicans occur in Botany Bay in relatively small numbers (usually less than 30 birds). However due to their size they pose a significant threat to aircraft if they fly across Sydney Airport.

Gulls have a habit of following established flight paths between roost sites and dependable feeding sites (i.e. rubbish tips and public beaches and parks).

During these daily flights the gulls leave roost sites early in the morning and fly towards regular established feeding sites. Being opportunistic feeders gulls inspect potential food sources during these flights such as parks and recreational areas and will stop at any potential food source they see.



A major gull roost formed at the head of what is now Penrhyn Estuary during the period when the northern shores of the Bay were modified (leading up to the construction of Port Botany). The gulls later moved on to the paved surfaces of the Port as these became available. This roost remained in use until the birds were disturbed as port operations became busier, leaving no undisturbed open spaces for gulls to use day or night (Ray Lee pers. comm.). In recent years a smaller roost of up to 2000 gulls has been reported on sand spits associated with Penrhyn Estuary. However studies associated with this assessment have determined that most of these birds use the site as a brief staging area while moving between roost sites and foraging areas in the city's parks and sports fields.

A second large roost at Woolooware Bay was noted in 1989 where several thousand gulls roosted on oyster lease structures. This roost was identified by Smith and Dorfman (1992). The total number of birds using this site was in excess of 5,800 (number of birds observed flying from the roost past Dolls Point). Gulls travel between Woolooware Bay and Lady Robinsons Beach each morning many crossing Sydney Airport. Gulls congregating at Port Botany disperse in a westerly direction along Foreshore Beach as well as north-east to eastern suburbs beaches (Figure 2).

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3. Bird hazards

Large numbers of birds, or any number of large birds, flying close to or across an airport on a regular basis is considered to be a bird hazard. Port Botany is close to Sydney Airport therefore large numbers of birds attracted to the vicinity of the Port must also be considered to be a bird hazard due to the possibility of the birds flying across the Airport or across the approach and take off paths of aircraft. A list of birds occurring in the Botany Bay area and their potential as bird hazards are included in Table 1.

The risk to an aircraft involved in a bird strike is greatest during take off while the engines are operating at full power, when a sudden loss of power may cause serious consequences for the flight crew and safety of the aircraft. The current operational practices at Sydney Airport are for aircraft to take off at a steep rate of ascent (this is mainly as a noise reduction strategy for neighbours of the airport). This also reduces the period and distance over which an aircraft may encounter birds in flight. Aircraft approaching Sydney Airport, especially over Botany Bay, fly at a much lower altitude and are therefore more likely to encounter birds in flight than during take off.

3.1 Dangers to aircraft safety – "Bird Strike"

"Bird Strike" is defined as a collision between a bird and an aircraft and is referred to as an air safety incident under Civil Aviation Regulation 89. While most bird-strikes cause little or no damage to aircraft, some incidents can be fatal, or at least very costly in terms of aircraft damage, aircraft down time, passenger rescheduling, and cost of accommodation due to delayed departures etc.

Statistics show that 80% of bird strikes occur at airports, with 90% occurring at or near airports (Rao 1998). 60% of bird strikes occur during take-off or landing at less that 20m above ground level; 90% take place in the airport vicinity at less than 70m (Davidson 1997).

Sydney Airport

Gulls have been a notable hazard at Sydney Airport since the first runway (runway 16/34) was constructed across the shoreline and into Botany Bay between 1965 and 1972. The construction of this runway was across major flight paths of Silver Gulls foraging along the shoreline or moving between roost sites in the Bay and foraging sites in Sydney. It is therefore not surprising to find that Silver Gulls caused 46% of all bird strikes between 1969 and1980. Between 1981 and 1990 there were 18 incidents involving ingestion of gulls into aircraft engines with 9 of these causing 'substantial' damage. The estimated total number of bird strikes occurring at Sydney Airport since 1988 varies depending on the source of data. Hutchinson (1999) estimated 356 documented bird strikes between 1988 and 1999. However Davidson (1997) estimated 562 bird strikes between 1988 and 1996, of these 25 reportedly involved damage to aircraft, with 7 causing "substantial damage". A number of other incidents involving substantial damage have occurred since 1996 (Straw 1997,

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Dechaineux pers. comm.) including bird strikes involving feral pigeons and Black Swans.

Bird strike reports include birds found dead on or next to runways by airfield security staff, reports from aircrew of planes hitting birds while in flight, or damage discovered during maintenance inspection. Birds hit by aircraft outside the perimeter fence of the airfield are not usually identified as having been involved in a bird strike unless parts of a bird are found during inspection after noticeable damage to the aircraft.



Figure 4 (From Hutchinson 1999)

Table 1:Bird species occurring in the vicinity of Port Botany and Sydney Airport
and their likelihood of impact

Species		Scientific name	Likelihood of impact ⁺	Body mass
			Abundance at Penrhyn	(grams)
	Anati	<u>dae – ducks, geese an</u>	d swans	
Black Swan	Cygn	us atratus	H*	6200 (m)
Australian Wood Duck	Chen	onetta jubata	Н	870
Pacific Black Duck	Anas superciliosa		Н	1114 (m)
Grey Teal	Anas	gracilis	H	508 (m)
Chestnut Teal	Anas	castanea	H	660 (m)
Hardhead	Aythya australis		H	900
		Podicipedidae – Greb	es	
Australasian Grebe	Tach	ybaptus novaehollandiae		220 (m)
Hoary-headed Grebe	Tach	ybaptus poliocephalus		258 (m)
		Procellariidae		
Shearwaters	variou	us species in Botany Bay	L	390-790
	Su	lidae – gannets and bo	obies	
Australasian Gannet	Moru	s serrator	L	2350
		Phalacrocoracidae		
Little Pied Cormorant	Phala	acrocorax melanoleucos	Н	684
Pied Cormorant	Phale	acrocorax varius	 H	2200 (m)
Little Black Cormorant	Phala	acrocorax sulcirostris	H	960 (m)
Great Cormorant	Phala	acrocorax carbo	H	2283 (m)
ereat comerant	Thate	Pelecanidae		2200 (11)
Australian Polican	Polor		\/*	5000
Australiant Felican	1 6/60	Ardoidao	v	3000
White feed Lleren	Farat		NA	500
Creat Egrat	Egrei			025
Cottle Egret	Ardea			930
Striptod Horon	Aluea	idoo otriotuo		212
Sinaled Heron	Bulli		L	212
	Thurs		\ /*	1000
Australian white ibis	Diata	skiomis molucca	V	1800
Royal Spoonbill	Plata		L	1800
	1414	Accipitridae	114	050
Black-shouldered	Kite E	zlanus axillaris	H [^]	250
White-bellied Sea-Eagle	Halia	eetus leucogaster	H [^]	5350 (f)
Swamp Harrier	Circu	s approximans	H [^]	760 (t)
Brown Gosnawk	Accip	nter fasciatus	M	510
		Falconidae		
Brown Falcon	Falco	berigora	M	625 (f)
Peregrine Falcon	Falco	peregrinus	H	952 (f)
Nankeen Kestrel	Falco	cenchroides	V*	186 (f)
	F	<u> Rallidae – crakes and r</u>	ails	
Crakes and rails	variou	us species recorded	L	33-180
Purple Swamphen	Porpl	hyrio porphyrio	L	840 (m)
Dusky Moorhen	Gallir	nula tenebrosa	L	547
Eurasian Coot	Fulica	a atra	L	
Scolopacidae				
Latham's Snipe	Gallir	nago hardwickii	L	156
Black-tailed Godwit	Limos	sa limosa	L	330 (f)
Bar-tailed Godwit Lim		sa lapponica	L	376 (f)
Whimbrel Nur		enius phaeopus	L	404 (f)
Eastern Curlew		enius madagascariensis	М	792

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Marsh Sandpiper	Tringa stagnatilis		
Common Greensbank	Tringa nebularia	<u> </u>	174
Terek Sandpiper	Xenus cinereus		72
Common Sandpiper	Actitis hypoleucos		52
Grev-tailed Tattler	Heteroscelus brevipes		107
Ruddy Turnstone	Arenaria interpres	 L	120 (f)
Great Knot	Calidris tenuirostris	 L	167
Red Knot	Calidris canutus		148 (f)
Sanderling	Calidris alba		57
Red-necked Stint	Calidris ruficollis		36 (f)
Sharp-tailed Sandpiper	Calidris acuminata	L	70
Curlew Sandpiper	Calidris ferruginea	L	67.8
Broad-billed Sandpiper	Limicola falcinellus	L	
· · ·	Haematopodidae		
Pied Ovstercatcher	Haematopus longirostris	Н	
Sooty Ovstercatcher	Haematopus fuliginosus	L	833
	Recurvirostridae		
Black-winged Stilt	Himantopus himantopus		176
	Charadriidae	L	110
Pacific Golden Ployer	Pluvialis fulva	1	153
Grev Plover	Pluvialis squatarola		220
Red-canned Plover	Charadrius ruficanillus	<u> </u>	35.2
Double-banded Plover	Charadrius hicinctus	н	57
Lesser Sand Plover	Charadrius mongolus	1	57 7
Greater Sand Plover	Charadrius leschenaultii	<u> </u>	91
Black-fronted Dotterel	Elsevornis melanons	<u>L</u>	33 (f)
Masked Lapwing	Vanellus miles	 	379
	Laridae	-	0.0
Pacific Gull	Larus pacificus		1135
Kelp Gull	Larus dominicanus		900
Silver Gull	Larus novaehollandiae	 	323
Tern sp	Sterna sp	L*	-
Crested Tern	Sterna bergii	M	342
Common Tern	Sterna hirundo	M	120
Species	associated with grasslands	and/or buildings	
Rock Dove or Feral Pigeon	Columba livia	V*	369 (m)
Galah	Cacatua roseicapilla	V*	314
Barn Owl	Tyto alba	L*	
Australian Raven	Corvus coronoides	 H*	675
Australian Magpie	Gymnorhina tibicen	H*	314
Magpie-lark	Grallina cyanoleuca	H*	89
Common Starling	Sturnus vulgaris	L*	85 (m)
Common Myna	Acridotheres tristis	L	110
Swallow	Hirundo neoxena	 L*	19
Skylark	Alauda arvensis	 L*	43 (m)
Richard's Pipit	Anthus novaeseelandiae	L*	24
House Sparrow	Passer domesticus	M*	28(m)

Body mass data from Dunning (1993).

 $\label{eq:metric} \begin{array}{ll} m = male, \ f = female. & V = very \ high; \ H = high; \ M = medium; \ L = low. \\ \ ^* \ species \ implicated \ with \ bird \ strike \ at \ Sydney \ Airport \end{array}$

3.2 Identification of bird flight paths

The majority of bird strikes at Sydney Airport occurred with aircraft using the north/south runways. These are the runways that have the most consistent bird flight paths crossing them used by Silver Gulls and other waterbirds flying along the shoreline of Botany Bay. A large proportion of the birds involved in bird strikes were likely to be flying between the City and roost sites to the south of Sydney Airport (for example Woolooware Bay) as can be seen by flight paths plotted by Kinhill (1990) as shown in Figure 3

These were similar to flight paths plotted by Smith and Dorfman (1992) Figure 2. Both Kinhill and Smith and Dorfman show flight paths across the middle and the end of the north/south runway (before the construction of the Parallel Runway). The flight path along Lady Robinsons Beach towards Mill Stream crossed approximately the middle of the runway. Gulls that flew across the southern end of the runway are shown flying towards Mill Stream from the south west, by Kinhill and towards Mill Stream and Foreshore Beach by Smith and Dorfman. In both models the gulls reversed this direction in the evening.

Since the construction of the Parallel Runway in 1992 movements of gulls at Foreshore Beach may have changed due to the fact that approximately 1km of foreshore and a small estuary at the mouth of Mill Stream were reclaimed as part of the airport expansion. This would have removed significant feeding and resting areas for gulls and other waterbirds at Foreshore Beach.

Davidson (1997) noted that "No significant flight path" across the airport was observed, nor was any significant flight path along Foreshore Beach. No distinct flight paths of birds across Sydney Airport towards the Penrhyn Road boat ramp were identified during the Bird Hazard Management studies at Sydney Airport between October 1997 and August 2001 (Birds Australia reports). These findings were supported by this study.

During this study small flocks of Silver Gulls were observed flying into Penrhyn Estuary from the south or west before sunrise (between 06:00 and 07:15) where they congregated into a flock of up to about 2000 birds before dispersing towards the suburbs of Matraville and Hillsdale. This process was reversed in the evening before dispersing to the south and west after sunset. It was not possible to discern whether any birds crossed the Parallel Runway to arrive at Penrhyn due to the poor light conditions. However if they did it would have been in small numbers.

No significant numbers of gulls were observed roosting overnight at Penrhyn Estuary. However, it would appear that gulls continue to use Penrhyn Estuary as a 'staging area' where they may have obtained fish from commercial fishermen in the past. However the recent cessation of commercial fishing has reduced the attraction to the Estuary.

Flight paths crossing Sydney Airport that are of major concern involve Australian White Ibis that appear to be flying between sites such as Centennial Park and unknown destinations to the west (Dechaineux pers. comm.). However none of these have been observed flying to the north shores of the Bay or Port Botany.

3.3 Bird association with specific habitats

An understanding of the habitat needs of any bird species that are likely to occur in the vicinity of Port Botany is imperative to be able to implement a management plan for potential bird strike hazards. Habitat types in the area include estuarine, beach, and scrubland as well as constructed environments consisting of sealed surfaces (roads, car parks and boat ramps) and buildings. Each of these 'habitats' tend to attract different species of birds from time to time.

3.3.1 Estuarine

Many bird species accumulate in estuaries to feed in the shallows and intertidal mudflats or roost on exposed sand spits. These include Silver Gulls, Australian White Ibis, Australian Pelican, Bar-tailed Godwits, Black-winged Stilts, Chestnut Teal, Pacific Black Duck and smaller numbers of other migratory and non-migratory shorebirds (refer to Table 1). Shorebirds and Ibis feed by probing in the muddy substrate, ducks feed by sifting through mud at the margins of the wetland, dabbling in shallow water or on the surface to obtain small aquatic animals or algae. Pelicans generally feed on fish but spend a lot of time waiting for an opportunity to take fish scraps or other food from people on the shore or in boats. Gulls are opportunistic feeders and feed on waste products discharged from drainage channels or discarded by beach users.

Penrhyn Estuary has become an important feeding and roosting site for migratory waders as a result of habitat loss across the northern shores of Botany Bay between 1954 and 1992. This has included the loss of extensive tidal flats at the former mouth of the Cooks River, the former Botany Beach tidal flats (land-filled to produce Foreshore Beach) and habitats at the former Mill Stream outlet.

Sydney Ports Corporation is committed to the retention of the wader habitat at Penrhyn Estuary and the creation of additional wader feeding habitat to reduce the potential impact on shorebirds as a result of the expansion of Port Botany. The potential threat of migratory shorebirds to aircraft is relatively low due to the fact shorebirds fly low over the water while they are in Botany Bay. In the past Penrhyn Estuary has attracted large numbers of gulls due to roosting activities in the nearby dunes or at Port Botany with flocks of 10,000 to 15,000 being recorded (Davidson 1997). Numbers have since been reduced with up to 2000 birds congregating while moving between roosting sites and suburban parks. Australian Pelicans have also been attracted to the boat ramp at this Estuary although in relatively small numbers. Gulls, Pelicans and Ibis are much more likely to pose a threat to aircraft safety due to their habit of moving in flocks and circling at relative high altitudes when disturbed. It is therefore important to minimise any attraction for these birds at the Estuary.

3.3.2 Beach

Beaches provide intertidal feeding habitat for a variety of shorebirds and Silver Gulls as well as roost sites for shorebirds, gulls, pelicans and cormorants. The area of beach on the north side of the Bay has been diminished since the construction of the Parallel Runway and will be divided into two by the proposed construction of a boat ramp along the beach. The proposed development includes the enhancement of the beach near the current outlet from Millstream. Due to the potential to attract birds the management of this beach, and of the proposed replacement boat ramp, will be important to minimise the attraction of gulls and pelicans. This entails education of the public about not feeding birds in the vicinity and the provision of bird-proof garbage bins (see Figures 6, 7 and 8 in this report).

3.3.3 Grassland

Grasslands tend to attract a variety of birds and the species attracted often relates to height of vegetation, species composition and whether grasses or weeds are seeding or in flower. Grasslands at Sydney Airport must be managed, by mowing to an appropriate height on a regular basis, to minimise attraction to birds that may pose a threat to aircraft. For the same reason any grasslands in the vicinity of the additional port land and the proposed replacement boat ramp should have minimal attraction to birds.

3.3.4 Sealed surfaces

Areas of infrequently used open flat ground can provide extensive loafing and roosting sites for species such as gulls that can be attracted to a convenient site in their hundreds or thousands. Such sites include car and truck parking areas or wharf surfaces. Birds should be discouraged from using this type of habitat if such areas are going to be left unused for long periods of time.

Open spaces may provide an added attraction if not properly drained causing pools of water to form after rain. Gulls in particular may be attracted in large numbers to such convenient bathing areas in which to preen and bathe.

3.3.5 Buildings

Birds may be attracted to buildings in large numbers if they provide nesting or roosting sites. Nest sites may be in the form of sheltered openings or crevices allowing birds such as starlings, mynas or pigeons take up residence often in quite large numbers. Roofs of buildings may also provide undisturbed roost sites for gulls and pigeons as has been observed at port facilities in Sydney and Melbourne. Roofs are also being used as nest sites in Melbourne and many cities overseas due to their undisturbed nature and because they are secure from many predators such as foxes and feral cats. Birds can cause major problems for the owners of buildings as well as posing significant hazards to aircraft if situated close to an airport.

4. Bird hazard issues to be addressed during construction

All dredging, reclamation, berth construction and major infrastructure works would be undertaken in a single construction campaign. The time to complete this phase of the port development will vary depending on dredging and construction techniques used. However it is likely that 15 months would be required to complete the dredging and reclamation from commencement of on-site works. It has been estimated that it would take more than 6 years from the date of the project approval to complete the construction and to bring the first berth of the new terminal into operation. Issues that will need to be addressed during the initial phase of construction include:

- * Attraction of birds that may pose a hazard to aircraft, as a result of the creation of feeding and roosting opportunities.
- * Disturbance of birds at Penrhyn Estuary that may fly into aircraft flight zones.

Migratory waders tend to fly low over the water and would normally pose little threat to aircraft. However some species may fly across the Parallel Runway or even attempt to roost at the airport if roosting sites at Penrhyn Estuary are disturbed (the Double-banded Plover for example).

Gulls, pelicans, ibis and pigeons are species that pose significant threats to aircraft safety if they fly between Port Botany or Penrhyn Estuary and Botany Bay across Sydney Airport or across the flight paths of planes landing and taking off from the airport.

4.1 The current situation

An inspection of Port Botany and interviews with long serving staff has revealed very few birds associated with the site in recent years. This appears to be largely due to the high rate of activity at the Port, the large container transporters that straddle rows of containers (scaring any birds inclined to land in the area) and lack of open space.

Birds attracted to Penrhyn Estuary include Silver Gulls, Australian Pelican, cormorants, migratory shorebirds and small numbers of other waterbirds as well as small bush birds. The main species of concern are gulls and pelicans that are attracted to food scraps at the boat ramp so close to Sydney Airport. While there are signs at Penrhyn boat ramp explaining the issues relating to feeding birds and the risk to aircraft safety they are not prominently displayed. Inadequate facilities for cleaning and disposal of fish scraps and little incentive not to feed birds pose a significant bird hazard.

4.2 Dredging for reclamation works and new ship manoeuvring channel

Dredging operations invariably expose large amounts of shells and other marine animals. If the dredge spoil forms into heaps or is spread over land it provides food for birds such as Silver Gulls and shorebirds. As the material spills into the water other species such as cormorants and pelicans may also be attracted to the site. During the construction of the Parallel Runway at Sydney Airport gulls and Bar-tailed Godwits were attracted to dredged material and were observed feeding on unknown benthic organisms. However there appear to be no records of the numbers of birds attracted to the site. At Port of Brisbane birds were similarly attracted to dredge spoil and up to 1,300 gulls were counted at any one time (Port of Brisbane data). However consideration must be given to the fact that Silver Gulls are less abundant in southern Queensland than south east Australia and the potential for the attraction for gulls in Sydney may be greater.

It is important to minimise the numbers of birds attracted during dredging operations due to the close proximity to Sydney Airport and the risks of flocks of birds flying to or from the site across the flight paths of aircraft.

Management strategies include regular monitoring and reporting of the presence of birds attracted to the site by the site managers. Attempts should be made to discourage birds from feeding or roosting at the site by using gas cannons or other deterrent methods (see Section 8, Bird Deterrents). If the site managers are not able to deter significant numbers of birds, for example more than 100 medium sized birds such as Silver Gulls, an appropriate contractor should be engaged to deter birds from the site. If large numbers of gulls are attracted to the site advice should be sought from a relevant expert before deterrent techniques are employed because a large number of birds frightened into taking flight at the same time could pose a greater danger to aircraft than if the birds are left undisturbed.

Recommendations:

It is recommended that the site manager ensure that any build up of birds attracted to dredging operations is reported to an appropriate consultant for deterrent action if required, at an early stage.

4.3 Other Terminal Construction Activities

During the construction of the additional port land large volumes of dredge spoil will be pumped in between retaining walls until the required ground levels are achieved. This will then provide a large expanse of level ground that may prove to be an attractive roost site for birds such as gulls. Species such as cormorants are likely to use the edges of the new structures as convenient roosting sites close to deep water. This undisturbed environment may remain in place for up to three years until the new port area is in full operation. During this time it is important to prevent bird numbers building up at these sites (see Section 8, Bird Deterrents).

4.3.1 Sealed surfaces

Sealed surfaces often provide ideal roost sites for large numbers of birds especially Silver Gulls. Bitumen surfaces provide a warm surface for roosting and are particularly attractive where areas are not subject to regular traffic or disturbance. Constructed areas associated with the additional port land, and car and truck parks are likely to have expanses of level sealed surfaces. Some of these areas are likely to remain unused or undisturbed for a number of years until the new Port facilities reach full operating capacity. It is therefore essential that a management strategy be put in place. Discouraging birds from using such sites in the first place will be more effective than trying to discourage birds that have habituated to a site.

As surfaced areas are created suitable deterrents should be installed. The placement of flagging material may suffice if there is no other attraction to the site, such as food scraps. If this proves ineffective then other deterrent methods may be required. Keeping the unoccupied surface areas of the port extension clear of birds will possibly be the most difficult task addressed in this report, requiring regular inspection (and action if necessary) to deter birds, especially gulls, from the site (see Section 8, bird deterrents).

Recommendations:

It is recommended that the wharf site be patrolled on a daily basis after nightfall to determine whether birds are attracted to the site to roost. Immediate bird deterrent action should be implemented if roosting of birds is observed on site.

4.3.2 Illuminated areas

Areas that are illuminated at night are likely to attract birds, especially gulls. Such areas help to provide a secure roosting environment where potential predators, such as foxes or feral cats, can be seen. Lights may also attract insects, which in turn attract gulls, especially when relatively large insects such as moths and other large insects are attracted to the lights. Bird deterrents as discussed in Section 8 should be used and where possible a style of lighting to minimise the attraction of insects should be used, such as tinted lights similar to that used at Sydney Airport (van Tets *et al* 1972) where these are not likely to cause confusion with airport runway or

navigational lighting or impede construction works. The provision of illumination of the site while unoccupied will intensify the problems outlined in Section 4.3.1.

Recommendations:

It is recommended that lighting used during construction be tinted to minimise attraction by insects to the site and that deterrent strategies be employed if birds, especially gulls, start roosting on site.

4.3.3 Pooling of water

Pooling of water may result from uneven surfaces where birds, in particular Silver Gulls, may take advantage of the pools for bathing purposes, especially if close to a roost site or feeding area. Even sealed surfaces can provide significant sized pools attractive to birds. Pooling of water can result in birds congregating and forming large flocks. Flocks disturbed from such areas may fly close to Sydney Airport or across the flight paths of aircraft. For this reason it is essential that any depressions retaining freshwater after rainfall within the proposed port land should be filled and levelled to facilitate effective drainage. Any unavoidable ponds or pools, such as sedimentation ponds, where water is likely to be present over a prolonged period, should be covered with appropriate netting.

Recommendations:

It is recommended that the surface areas be constructed to avoid pooling of water and that any blockages of drains be remedied at the earliest opportunity. Where pooling of water must occur it is recommended that the area be covered with netting.

4.3.4 Construction Works Areas

The construction contractor(s) would require significant working areas to undertake various preparatory activities and to store materials for use in finished structures as outlined in the EIS. These will include parking for staff and construction vehicles, amenities for the work force and workshops and maintenance areas. Contractors need to be responsible for minimising the attraction of birds to the sites by informing all employees of the need to dispose of all food scraps, wrappers etc that may attract birds in an appropriate manner. This should include drivers entering and leaving the site as well as workers on site. Garbage bins should be provided at convenient locations at canteens and car and truck parking areas where people are likely to discard food items.

5. Birds hazard issues to be addressed by the terminal operator(s)

5.1 Building design

Buildings may provide roosting and or nesting sites for large numbers of birds. This can be in the form of large flat surfaces, such as roofs, providing suitable places for gulls to roost, or openings and ledges that may provide roosting and nesting habitat for Feral Pigeons, Common Starlings, Common Mynas and other bird species.

Examples of buildings providing roosting habitat for Silver Gulls have been the wharves at Millers Point, Darling Harbour where between 10,000 and 20,000 birds have been observed to roost on roofs over the past 15 years or more (pers.obs.). Nesting on roofs is becoming a major issue in many parts of the world including structures at ports (Cramp & Simmons 1983, Hoyo *et al* 1996). This is occurring at an increasing rate in Australia ((Higgins & Davies 1996, Temby 2002).

5.1.1 Roof Nesting

Silver Gulls are very flexible in their choice of nest sites and, in addition to their 'natural' sites on off-shore islands and inland swamps, have been recorded nesting on jetties, boats, buildings, and on the ground on the mainland on many substrates including rock, sand, grass and low bushes (Higgins and Davies 1996). Nesting at ports has been reported, including in Sydney, where action had to be taken to stop gulls from nesting on the edges of a Car Terminal wharf at Glebe Island (Leighton Llewellyn, Tracey Taylor pers. comm.). Rooftop nesting in the Silver Gull has been reported by Temby (2002) in two cities in Australia: on wharf buildings at Fremantle during the early 1990s and on roofs in the Melbourne area, where the earliest records are from 1982. It has been suggested that the expanding phenomenon of nesting on rooftops may be an indicator of increasing population. However this is not always the case, as in Great Britain, where numbers of roof-nesting Herring Gulls *Larus argentatus* have been increasing at 10% per year since 1976 while the overall population is in decline. Roof nesting is increasing in the Melbourne area, with several thousand pairs of Silver Gulls nesting in 2000 (Temby 2002).

In all, 66 locations were visited by Temby (2002) in Melbourne where gulls were found to be nesting on roofs. Of these at least three stevedores reported problems associated with gulls nesting on wharf buildings and even on functioning gantries and cranes. Gulls nesting on cranes used for unloading shipping containers have caused malfunction of automatic proximity sensors, and corrosion of the crane structure.

Due to the fact that habitual roosting on roofs often leads to nesting, it would seem that it is only a matter of time before roof-nesting occurs in Sydney on wharf buildings. An example is the Hickson Road wharves, Darling Harbour where up to

20,000 gulls have been observed roosting overnight and in smaller numbers on roofs during daylight hours (pers. obs.).

The build up in gull numbers at Port Botany would be of concern due to the fact they are likely to fly over Botany Bay and the main runways at Sydney Airport. For this reason every effort should be made to minimise the number of gulls attracted to the vicinity of Port Botany.

5.1.2 Roosting

Davidson (1997) describes nocturnal roost sites used by Silver Gulls in sand dunes on the northern side of Penrhyn Estuary where 10,000 to 15,000 gulls were observed to roost during the late 1970s and early 1980s. This was after the shoreline was reclaimed, using dredge spoil and before shrubs became established on the area. The gulls then utilised the wharves at Port Botany on which to roost. This was until the port became too busy with wharf traffic and started operating 24 hours a day leaving no areas undisturbed (Ray Lee pers comm.). No other species, other than Feral Pigeons have been noted in large numbers at Port Botany in the past or present (refer to section 11, Species Accounts).

The past roosting activities at Port Botany are strong indicators that the creation of additional port land may, in the short term, provide large areas of land suitable for roosting habitat of the Silver Gull. It is therefore important to initiate deterrent strategies prior to the construction of the additional port land and associated works (refer to Section 8 Bird deterrents).

Any ledges used by roosting or nesting birds should be bird-proofed at the earliest opportunity. It is easier to deter birds before they become accustomed to a particular site. Roosting on roofs, especially by gulls, should be managed at the earliest opportunity to prevent a build up in numbers and possible initiation of a nesting colony. Early action will prevent a bird hazard situation from developing and affecting aircraft safety at Sydney Airport. It could also save expensive damages to Port facilities as occurred in Melbourne where damages amounted to thousands, and in one case over \$1 million.

It is recommended that:

- * the site be monitored on a daily basis to determine whether birds, especially gulls, ibis, pelicans or pigeons are roosting at the site.
- * any bird roosting behaviour be referred to an appropriate consultant for action if required.

5.1.3 Site Management

It is important for any operator to be aware of the need to minimise the attraction of the site to birds and appropriate guidelines and training are required. These would incorporate the management of waste materials, spillages and the feeding of birds covered in this report. Any waste, including accidental spillages, should be contained as quickly as practical and remained covered while on site.

Management should include conditions of entry of anyone entering the port facilities, such as truck drivers, who should be instructed not to litter the premises or feed birds while on site.

Recommendation:

It is recommended that the site manager ensure that no sources of food are made available to birds on any of the wharves or access roads.

6. Construction and management of public and ecological areas

The construction of public and ecological areas such as a boat ramp and enhanced beaches will involve the placement of large amounts of dredged material which will be transported by trucks from dredged sand stockpiles. The initial placement of sand may expose marine life contained in the dredged material which could attract birds to the area in the short term. In such an event short-term deterrent action may be required as outlined in Section 8 Bird Deterrents.

6.1 Alternative boat ramp

Sydney Ports Corporation is proposing to relocate the existing boat ramp at Penrhyn Road, Botany to the end of the proposed Port expansion area off Foreshore Road. This ramp is currently located near the Penrhyn Estuary adjacent to the existing port facilities. The new facility would incorporate a boat ramp, car and trailer parking and a jetty for loading/unloading. The proposed location can be seen in Figure A5, appendix A.

Issues associated with potential bird hazards to aircraft from relocating the boat ramp to Foreshore Beach include:

- management of litter and food scraps;
- management of fish remains;
- pest control; and
- landscape vegetation, to a lesser extent.

The attraction of birds to the site has the potential to draw birds along flight paths that may take them over the main runways of Sydney Airport.

Boat ramps are a well-known source of food for many birds especially species such as Silver Gulls and Australian Pelicans. There is a long association with boats and food, especially commercial fishing boats that tend to throw away any catch that is not legal size. Birds have also learnt from the amateur angler's habit of cleaning fish at boat ramps and throwing fish remains onto the shores or into the water. The congregation of birds at such sites attracts other birds that may be in the vicinity.

6.1.1 Design

The proposed boat ramp facilities will include a parking area for over 100 cars and boat trailers, an amenities building, fish cleaning facilities and a boat launching ramp. A jetty will be constructed parallel to the boat launching ramp to allow passengers to board and disembark. A public viewing area will be provided at the end of the tug berth, as shown in the illustrations in Appendix A.

The design of the proposed Foreshore Beach boat ramp and associated facilities should take into consideration the need to minimise the attraction of all species of birds that may pose a threat to nearby Sydney Airport. This includes all species listed in Table 1. Design considerations are discussed below.

□ Fish cleaning facilities

Fish cleaning facilities have been provided at the Penrhyn Road boat ramp in an effort to keep the area clean and tidy and discourage people from cleaning fish on the boat ramp or beach (Figure 5). A visit to the site during a Sunday, when a large number of boat owners had used the ramp, did not reveal any signs of fish remains being left in the open. However fishers were observed on a number of occasions feeding birds with fish scraps despite signs asking the public not to feed birds. It was not clear how successful these facilities were in the reduction of feeding fish scraps to birds.

It is proposed to provide fish cleaning facilities at the new boat ramp. It is intended that the area will enclosed to reduce the likelihood of people feeding birds and to prevent birds from entering the facility. Due to the importance of excluding birds from the site the facilities should be kept clean and tidy at all times to provide an acceptable place for people to use, to facilitate cleaning and scaling of fish and the disposal of fish remains. This would require the provision of a hose (non-detachable to prevent theft of the hose) to wash the work area after use.



Figure 5

Fish-cleaning facilities at Penrhyn Estuary boat ramp showing bins used to collect discarded fish remains and rubbish disposal.

The facility should be well ventilated and lit while being bird proof. Such a facility would require effective management including frequent (possibly daily) emptying of rubbish bins and cleaning of the facilities to make them attractive for the public to use.

□ Boat-washing facilities

Boat washing facilities i.e. taps at the edge of a washing bay, are provided for use of boat users at the Penrhyn Road boat ramp. Washing boats down at the proposed boat ramp may result in fish remains, food scraps and other rubbish being washed onto the ground or the beach or into nearby waters. This is likely to attract birds to the site as well as fish if fish remains are washed into the water. An increase in the number of fish at the site is likely to attract cormorants and pelicans to the site. It is therefore recommended that boat-washing facilities not be provided at the proposed Foreshore Beach boat ramp.

□ Bird roosting structures

The boat ramp and associated facilities should be designed so as to discourage birds from using the site for roosting. Large numbers of birds such as gulls or any large birds such as pelicans roosting at the site could become disturbed by people or dogs, causing them to fly across the nearby runway at Sydney Airport and pose a threat to aircraft safety. Posts such as those existing at the derelict pier near Penrhyn Estuary provide roosting sites for cormorants, pelicans and gulls. Such structures should be kept to a minimum and/or designed to prevent birds from roosting on them by using 'bird spikes' similar to those used by Waterways Authority on channel markers and navigation beacons.

□ Drainage

Drainage from the car parking areas should be designed to include pollution traps and swales to minimise fish remains, oils and other pollutants from entering the sea in the immediate vicinity of the boat ramp. Drainage from the fish cleaning facilities will be directed into a sewer therefore preventing fish remains and blood from entering the Bay. This will require careful design to prevent blockages, and overflows, due to less than careful users of the facilities.

□ Landscaping

Landscaping will play an important role in determining bird species that will be attracted to the site. Shrubs will tend to attract small insectivorous or nectivorous birds that pose little risk of bird strike. Grassland on the other hand may attract larger species of birds that feed on grass seeds and roots or hunt for insects and other small animals that may take refuge in the grass. Such species include Galahs, Australia Raven and birds of prey such as Nankeen Kestrel and Black-winged Kite, all of which are high-risk bird strike species.

It is therefore recommended that the proposed boat ramp and car and trailer parking area be hard surfaced, with no landscape plantings. If grassed areas are incorporated into the trailer parking area these should be mown on a regular basis and should be combined concrete lattice/grass in order to maintain a hard surface and minimising the formation of pools of water. This would also prevent erosion of soft surfaces by vehicles, which may otherwise form pools of water after rain and drainage of water from boats.

Hard surfaces with neat curbing and tidy borders would be desirable for the boat ramp, the car and trailer parking area and the approaches to the site. The adjacent land should be planted with dense shrubs, with a protective fence to allow the area to become established. This will reduce open areas that tend to attract litter.

□ Lighting

Adequate lighting may be required to allow safe use of the boat ramp after dark. Any lighting used should be designed to minimise the attraction of insects on which birds are likely to feed.

It is recommended that all lights be of low intensity and diffuse in nature and the structures be kept low in preference to high poles. Lights should be fitted with appropriate deflectors to ensure light is deflected onto the site and is less attractive to insects and birds that prey on them.

6.1.2 Fishing exclusion zone

The bay formed by the Parallel Runway and Foreshore Beach provides a relatively sheltered site for many birds, especially during adverse weather conditions. This situation may improve in the birds' favour with the construction of the proposed boat ramp. It is therefore important to minimise anything that may attract birds.

Fishing and feeding birds anywhere in the vicinity of Sydney Airport may attract birds that could present a potential threat to aircraft safety. Any such activities should be discouraged by providing appropriate signage. A map showing a desirable "exclusion zone" for fishing is recommended. This may also point out that NSW Fisheries regulations prohibit the cleaning of fish at sea.

6.1.3 Signage

Appropriately designed and placed signs are essential to inform the public about the potential dangers of attracting birds close to Sydney Airport. The message needs to be 'positive' for the birds' welfare, as well as aircraft safety, because people intrinsically like to feed birds believing that hand feeding is beneficial to birds. This two-fold approach is more likely to be effective in stopping people from feeding birds

than the safety issue alone. On the other hand the message must be short and to the point otherwise people tend to ignore signs.

A sign has been erected next to the Penrhyn Road boat ramp to tell people about the problems associated with feeding birds close to the airport as well as ecological issues relating to birds' health. However the sign is too small and is poorly placed to attract the attention of the public. A similar sign as shown in Figure 6 should be erected in a prominent position at the proposed Foreshore Beach boat ramp.

Please do not feed the birds

Birds are a danger to aircraft operations Please do not encourage them near the airport Feeding birds unnatural food could lead to poor health of the birds and could lead to an unnatural dependence on hand feeding

Do not feed birds \$ 000 Maximum penalty (xx Act)

Figure 6: Possible wording of sign to prevent feeding birds

6.1.4 Management

□ Vermin control

Keeping the facilities clean and clear of food scraps will help to reduce vermin such as mice and rats and therefore bird species that prey on them such as birds of prey and owls that may pose a threat to aircraft.

Refer to litter management in Section 6.7.

□ Patrols

It is important that the site be inspected at regular intervals to make sure it is kept clean and tidy and that birds are not attracted to the site as a result of people feeding them or leaving food scraps or fish remains at the site. The frequency of visits to the site may be determined after the construction and commencement of operation of the boat ramp. Initially this may require short daily visits in the morning to determine whether birds are using the site as a roost and then towards the middle of the day when fishers and other boat users may be returning to the ramp by boat. An occasional evening visit will help to determine whether gulls or any other species are tempted to roost at the site. Weekends and public holidays will be an especially important time to patrol the boat ramp and car parking area. In the long term random weekly visits may suffice.

Duties should include a count of the numbers of birds and an indication of species within a broad category such as gulls, pelicans, ravens or waders is the minimum

knowledge required. Gull, pelicans and ibis are of concern if their numbers increase at the site.

Patrols would be most effectively carried out by an appropriately qualified law enforcement officer, such as a council ranger. Law enforcement may become necessary in order to be able to enforce penalties if people consistently feed birds or leave food scraps or fish remains at the site.

□ Reporting

Regular reports should be prepared by the authority with responsibility for managing the boat ramp. These reports should periodically be referred to an avian ecologist for comment. However if birds are attracted to the site, i.e. gulls and/or pelicans on a regular basis an avian ecologist should be called in as soon as possible. Dealing with a build up of birds, before birds become habituated or build up in large numbers will be easier if addressed at an early stage rather than later when remedial action may be more difficult.

6.2 Beach areas

Beach enhancement will be carried out as a component of the port expansion . It is proposed to retain and enhance two main beach areas, from the current outlet of Mill Stream as far as the western end of the boat ramp car park, and from the Tug Berth Depot to the road access bridge. A small beach may be retained between the road access bridge and the rail viaduct as shown in the illustrations in Appendix A.

There is therefore no reason to suppose that bird numbers will initially increase with the reconfiguration of the beach as shown in the illustration in Appendix A. However as demand for recreational beaches is likely to increase over time it would be wise to ensure that vermin-proof litter bins, similar to the ones illustrated in Figures 7 and 8, are provided at the reconfigured Foreshore Beach and that signs be erected to educate the public about not feeding birds close to an airport (see Figure 6).

Management strategies

Although the numbers of shorebirds using the beach area will decrease, a more concentrated usage of the beach (due to a reduction in beach area) may result in an increase in the numbers of birds, such as gulls, as a result of discarded food scraps and litter if litterbins are not regularly spaced along the waterfront. It is also important that some authority take responsibility for maintaining the site and emptying litterbins on a regular basis.

Litter management and signage in accordance with Section 6.7.

6.3. Mill Stream/groyne

As part of the reconfiguration of the beach areas at Foreshore Beach it will be necessary to construct a groyne projecting out from the outlet of Mill Stream. The main purpose of this groyne will be to prevent sand from drifting across the outlet of the creek from Foreshore Beach. This groyne, as well as public viewing area at the end of the Tug Berths, is likely to attract amateur fishers, which may in turn attract gulls and pelicans.

Management measures

Landscaping between Mill Stream and Foreshore Road should be done in such a way so that access to the bank of Mill Stream is not opened up to the public (the area is currently fenced). The nutrients flowing from Mill Stream, especially after heavy rainfalls and sewer overflows will tend to attract fish (as well as birds such as gulls) and therefore fishers. Due to the fact that the Mill Stream embankment and groyne are especially close to the Parallel Runway there must be some concern about accessibility to the site by fishers and the attraction of birds, especially gulls and pelicans.

It may be necessary to fence off the groyne area if it becomes a problem area for attracting birds such as gulls and pelicans.

6.4. Boardwalk and bird observation structure

Visitors to the boardwalk and bird observation structure should be encouraged to take any litter home with them when they leave the site. The importance of not feeding birds in the area should also be stressed.

For the benefit of other users of the site, as well as for the welfare of the birds, visitors should be encouraged not to unduly disturb the birds. For a similar reason the boardwalk and observation structure should be screened from the Estuary to minimise disturbance of the birds.

The issue of securing the site, especially at night will need to be addressed during the design phase.

6.5 Cycleway/footpath

It is proposed to construct a cycleway/footpath between Foreshore Road and Foreshore Beach and extending between Mill Stream and Penrhyn Road. This corridor will also be landscaped and planted with appropriate shrubs and trees.

Landscaping should include tall dense vegetation and exclude areas of grassland that may be used by picnickers. On the other hand litter bins may be required to minimise the likelihood of litter or food scraps being discarded in the area.

Lighting structures along the pathway should be kept low to minimise illumination of beaches in the area that might be used as a roost site by Silver Gulls.

6.6. Management Issues

□ Litter control

Strict litter control using adequate litterbins and/or adequate signage and enforcement will help to ensure that food items or fish remains are not left at the site. Litter left lying on the ground will tend to reduce the incentive for people to place litter in the bins provided or take it home for disposal. Litter bins must be emptied on a regular basis and may need to be emptied on a more regular basis during warm calm weather and during public holidays, to ensure the bins do not overflow. Time tables for emptying bins cannot be accurately predicted. These will need to be established based on usage patterns over time to ensure the area is kept clean and tidy.

Litter bins need to be:

- Bird proof
- Easy to use
- Kept clean and tidy
- Emptied on a regular basis

Signs should be erected to encourage people to put any litter into the bins provided or take it home for disposal.

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Figure 7

Lidded rubbish bins recommended for use at the proposed boat ramp or beach area

Figure 8

Alternative bird proof bin (used to exclude ibis at Burwood Park)





Figure 9: Open bins allow access to birds, dogs or vermin and are not appropriate for use at the proposed boat ramp or beach area

Litter bins need to be designed so that access by birds and vermin is prevented. Birds, especially Australian White Ibis, gulls and ravens have a remarkable ability to access open rubbish bins to obtain food. In the process of pulling items from the rubbish bins food is scattered over the ground attracting larger numbers of birds as well as vermin. A build up of birds and vermin such as rats and mice tend to attract birds of prey such as falcons, hawks and eagles.

Rubbish bins must be easy to use if they are to be effective. Prominent positioning and ease of access are two important aspects. The only truly bird and vermin proof bins are closed with lids. The rubbish bins should be kept clean (in particular the lids where people have to touch in order to deposit rubbish). Bins could either be the 'wheelie bin' style with a cross bar preventing the lid being left open (Figure 7), or with access through a hinged self-closing door similar to the one designed to exclude ibis at Burwood Park (Figure 8). Rubbish bins currently provided at the Penrhyn Road boat ramp are positioned next to fish cleaning tables so that fish remains can be scraped directly into the bins (Figure 5). However these are open bins and would allow relatively easy access to birds, especially Australian White Ibis that are able to reach right into the bins with their long necks and bills. They are also inadequate to cope with discarded rubbish at the site, as shown in Figure 5.

□ Foreshore Road

While it may not seem that the maintenance of the Foreshore Road verge should be part of the management of the site it is clear that this section of the road has attracted substantial quantities of litter in the past (pers. Obs.). Allowing litter to accumulate near the boat ramp and car park will be a disincentive to keep the site clean and tidy. Contractors should be assigned to empty rubbish bins on a regular basis and to remove any litter accumulating close to the site.

□ Signage

Appropriately designed and placed signs are essential to inform the public about the potential dangers of attracting birds close to Sydney Airport. The message needs to be 'positive' for the bird's welfare, as well as aircraft safety, because people intrinsically like to feed birds believing that hand feeding is beneficial to birds. This two-fold approach is more likely to be effective in stopping people from feeding birds than the safety issue alone. On the other hand the message must be short and to the point otherwise people will tend to ignore signs (refer to Figure 6).

7. Shorebird habitat in Penrhyn Estuary

The retention and enhancement of habitat for migratory shorebirds will have to be carried out with due consideration to the potential to attract large numbers of gulls, pelicans and ibis. The design and construction of this area will require a specialist approach and is subject to a separate report. However the main objective is to provide intertidal mudflats suitable as foraging habitat for migratory shorebirds that probe into the mud for food. This habitat is not highly attractive to gulls and pelicans that feed visually and not by probing, or by catching fish. They are not expected to be attracted to the area unless food sources are available to them such as food discarded or given to the birds by members of the public, rubbish from stormwater drainage or fish or fish remains from fishers.

It is therefore recommended that:

- * Viewing platforms should be provided to enable the public and birdwatchers to clearly see the intertidal mudflats and the birds without disturbing the birds (for the sake of the birds and aircraft safety)
- * No fishing should be allowed within the Estuary
- * The facilities around the Estuary should be along the same guidelines of the landscaped area and those recommended for the proposed replacement boat ramp (Straw 2001).

The design of the Estuary should provide sufficient roosting habitat for migratory shorebirds to minimise the need for these birds to leave the site to roost at high tide. Structures, such as posts, that would provide roost sites for cormorants, pelicans and gulls should be avoided or fitted with deterrents such as bird spikes (these are commercially available).

Site construction

Any dredging and earthworks may attract birds if invertebrates are exposed. The precautionary procedures outlined in Section 4 should applied to reduce possible bird hazards.

8 Bird deterrents

Over the years birds have caused extensive damage to, among other things, crops, fish stocks, buildings, aircraft and power transformers. Some of the problems associated with crops stem back hundreds, if not thousands of years and people have been trying to control bird 'pests' for just as long. Many of the modern day problems have stemmed from an imbalance with the natural population of birds, usually an over abundance of food which allows a particular bird species to rear more young than would normally be possible in a 'naturally' balanced environment. Most of the bird species concerned in this study have increased dramatically in numbers due to the availability of food thrown away or deliberately fed to 'wild' birds. These include the feral pigeon, Silver Gull, Australian Pelican and the Australian White Ibis.

Countless deterrent techniques have been tried to scare birds away from valuable resources that are damaged by birds. Techniques that have been tried include shooting, fire crackers, gas cannons, light strobes, scare crows, falcons (live and images), streamers, fishing line, bird spikes, poisons etc. In the long term no one method has proven successful against the most persistent bird species all of the time.

There are a variety of bird deterrent techniques that will frighten birds away - for a while. Birds seem to become habituated to most forms of deterrent over time if the attraction to food, nesting site or roosting area is great enough.

Once birds have become accustomed to an attraction, whether it is food or a secure roost or nest site they will become more difficult to persuade to leave or stay away from the source of attraction. It is therefore important to apply deterrent procedures early, before the birds become habituated, and with a variety of procedures on hand in case the birds become persistent.

Types of bird deterrents available

This section examines various deterrent techniques used to keep birds away from a defined area. Some of these techniques may be appropriate for use by SPC in deterring birds from roosting or nesting at the Port Botany extension or associated developments. However, at the first signs of a deterrent system failing to work an alternative method should be at hand to supplement or replace it.

Some of the deterrent techniques that may harm birds protected under the National Parks and Wildlife Act 1974 (all native species) may need a licence from NPWS.

The use of 'bird frite' requires the operator to have a firearms licence.

The use of bird deterrents to keep birds away from a site must be weighed against the possibility of causing birds to fly across the nearby runways and Sydney Airport. This might be the case if large numbers of birds are allowed to congregate before deterrent action is taken.

Flagging or streamers.

Material flapping in the wind has a degree of success in deterring birds from landing close by and in many instances it may be all that is required to keep birds away. This technique is often seen on moored boats in an effort to prevent gulls from fouling the deck or in gardens to deter birds from landing on the ground and finding the seeds that have been sown. This system is inexpensive and relatively easy to install. Flagging material or streamers can be attached to posts in the ground or from wires or ropes strung between structures.

Wires, fishing line, humming lines.

Fishing line is often used to string across areas where birds might land. It can be placed along ledges fixed to the tops of nails or pegs fixed vertically into the surface. The idea is that the bird becomes frightened when it attempts to land and comes in contact with an 'invisible' force. Similar strands can be stretched over the ground either close to the ground or, if people need to access the site, above head height. The use of fishing line can be a hazard where people are likely to go.

"Humming' lines are a variation on the fishing line but material is twisted or woven to produce a noise when the wind passes over it.

Perch 'spikes'

Many birds that could pose a bird hazard threat, such as pelicans and cormorants take advantage of convenient posts or wharf piles on which to perch or roost. To discourage these birds from roosting in the area it is recommended that vertical wires or spikes, similar to those used by the Waterways Authority to discourage birds from landing on channel markers and navigation lights, be used where roosting places exist, for example on the remains of the old Government Pier.

Distress Calls

There have been a variety of products on the market that broadcast various forms of distress calls and are designed to scare birds away. By themselves most of these devices are not effective over the long term, in fact they may attract birds (i.e. gulls) to the device to determine the source of danger. Trials of various devices have been carried out by Sydney Airport security section. However there have been no obviously successful products trialled so far.

'Bird Frite' (or cracker shells)

'Birdfrite' cartridges can be fired from a 12-gauge shotgun or 'Verey' pistol. A shell is ejected from the gun and explodes in mid-air if fired up into the air frightening the birds. This device is very effective in most situations if used at random but may need to be used in combination with other devices if a long-term solution is needed.

The person using this device requires a firearms licence from the NSW Police Department. If this system is required it may be possible to hire a contractor or one of the security staff from Sydney Airport.

Strobes

Strobe lights, or moving spotlights, have been used in a variety of situations and seem to be quite effective in keeping ducks away from rice fields in the Riverina district. Gulls responded quickly to lights used at roosts in the Hunter estuary (pers obs). However these lights work best in a dark environment and may be less effective in areas where there is a lot of light in the area from other sources (such as nearby wharves that are illuminated all night).

'Avitrol'

'Avitrol' is the trade mark of Phillips Petroleum Co., Delaware, USA. It is a white powder containing a chemical hallucinogen known as 4, amino-pyridine. This product is sometimes mixed with food that is then fed to the birds. Its ingestion produces tremors, erratic flight or loss of flight, fluttering on the ground and generally acting in a distressed state while giving out distress calls. It is difficult to regulate the dose if feeding more than one or two birds because of the competitive nature of the birds and an overdose will kill the birds.

The idea of using Avitrol is to frighten any birds that witness the distressed bird. However, as with recorded distress calls, gulls in particular will often be attracted to the bird/s in distress instead of flying away.

Hawk kites

Trials using a Balinese kite were successful in preventing gulls from landing at a rubbish tip near Wollongong where 6,000 gulls had been visiting the site per hour to feed and carry food to the nearby nesting colony at Five Islands, off Port Kembla. This method can be used if there is sufficient breeze but requires a person to fly the kite while it is being used.

Hawk silhouettes/models

Hawk silhouettes and static hawk models have been tried at rubbish tips with little or no effect.

9. Conclusion

With appropriate design and management the proposed additional port land at Port Botany and enhanced public and ecological areas on the north side of Botany Bay are not likely to pose a significant change in bird hazard to aircraft operating from Sydney Airport. The new boat ramp provides an opportunity to improve management of the boat ramp in this area and potentially reduce the attraction to the ramp by birds that pose a hazard to aircraft.

The enhancement of habitat for migratory shorebirds may increase the potential of bird hazard currently posed by these birds should additional migratory birds be attracted to the area. However as these birds currently pose a minimal threat to aircraft the enhanced habitat should not significantly change the current bird hazard.

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Appendix A

Figure A1 to A6 illustrating the Port Botany Expansion Public Domain Area





Proposed Port Botany Expansion – Assessment of Bird Hazards to Sydney Airport



Proposed Port Botany Expansion – Assessment of Bird Hazards to Sydney Airport



Proposed Port Botany Expansion – Assessment of Bird Hazards to Sydney Airport

insert Figure A4

Avifauna Research & Services



Proposed Port Botany Expansion – Assessment of Bird Hazards to Sydney Airport

Insert Figure A5



Proposed Port Botany Expansion – Assessment of Bird Hazards to Sydney Airport

Insert Figure A6

Appendix B

Bird Species Accounts

Species accounts

A full list of birds recorded in the area that might pose a bird hazard appear in Table 1 including the likelihood of bird strike. Populations of each species are detailed below.

Black Swan (High risk)

The Black Swan occurs in parts of Botany Bay and the Botany Wetlands during all seasons. Flocks in excess of 100 birds have been observed on a regular basis in Weeney Bay (pers. obs.). Small numbers frequent most of the ponds within the Botany Wetlands and are usually restricted to one pair at each pond due to the territorial behaviour of the birds occupying the water body. Due to its large size this species is potentially a serious threat to aircraft if involved in a bird strike. This species has been involved in a collision with aircraft at Sydney Airport resulting in serious damage to parts of the aircraft wing, engine and a landing light.

The proposed activities are unlikely to increase bird hazard threats by this species because the likelihood of this species being attracted to the waters or mudflats in the vicinity of the Port is relatively low, there being no records of observations at the site.

Ducks (High risk)

Ducks are potentially a serious threat to aircraft due to the their relatively heavy weights, ranging from 500 to 1114 grams mean weights. Ducks tend to fly in flocks ranging from a few individuals to 100 or more.

The Australian Wood Duck occurs close to most of the wetlands in the vicinity of Botany Bay as well as on grasslands associated with parks.

The Pacific Black Duck and the Grey Teal occur in most of the freshwater wetlands in the vicinity of Botany Bay and are also occasionally seen in small numbers feeding in open water or the shallows at Penrhyn estuary. Due to its large body weight the Pacific Black Duck is potentially a serious threat

The Chestnut Teal is more prevalent in the marine environment and is frequently present in small numbers at Penrhyn estuary feeding in open waters, shallows or dabbling in wet mud.

The Hardhead is largely restricted to freshwater wetlands and often occurs in small flocks in the Botany Wetlands close to Sydney Airport. This species is not likely to occur in the vicinity of Port Botany.

The proposed activities are unlikely to increase bird hazard threats by ducks.

Grebes (Low risk)

Only two species of grebes are observed in the region of Botany Bay, the Australasian and Hoary-headed Grebes. These small, relatively heavy bodied, birds occur largely in the freshwater wetlands but the Hoary-headed Grebe is known to occur occasionally in relatively large flocks in marine waters. Neither of these species have been recorded in waters at Port Botany. The proposed activities are unlikely to increase bird hazard threats by these species.

Shearwaters (Low risk)

Shearwaters are generally pelagic in nature but during adverse weather conditions may enter Botany Bay in large numbers. These birds generally forage by flying close to the surface of the water and never fly at altitudes that threaten aircraft. The proposed activities are unlikely to increase bird hazard threats by these species.

Australasian Gannet (Low risk)

The Australasian Gannet is an offshore foraging species that is encountered along the coast of NSW in varying numbers from single individuals to several hundred birds. These large bodied birds would pose a threat if hit by an aircraft. However this species infrequently enters Botany Bay and would normally not fly at altitudes to pose a threat to aircraft. The proposed activities are unlikely to increase bird hazard threats by this species.

Cormorants (High risk)

Cormorants forage for fish by swimming, partly submerged, looking frequently below the surface for fish, which they pursue by swimming underwater. Cormorants fly from one site to another singly or small groups but may on occasion fly in large flocks, especially the Little Black Cormorant, of more than 100 birds. Because of their heavy body mass (see Table 1) cormorants potentially pose a serious threat to aircraft.

Cormorants roost in several locations in or near Penrhyn Estuary, along Foreshore Beach and on moored vessels in the bay between the Parallel Runway and Foreshore Beach. There are frequent movements of cormorants flying from site to site along the shoreline and between other parts of Botany Bay and the waters close to Port Botany. Cormorants generally fly relatively low following shorelines but occasionally fly at altitudes that could pose a threat to aircraft.

Some of the roost sites in the vicinity of Port Botany will be lost during the proposed port expansion, such as structures associated with the Penrhyn Road boat ramp.

It is important to minimise the creation of potential cormorant roost sites during the proposed activities.

Australian Pelican (Very high risk)

Due to its large size and the fact that they spend lengthy periods in flight or soaring at relatively high altitudes the Australian Pelican poses a serious threat to aircraft safety. One (suspected) bird strike involving an Australian Pelican has been reported between 1988 and 1999 (Hutchinson 1999).

Small numbers of Australian Pelicans occur at Penrhyn Estuary where they feed on handouts from fishers and members of the public and occasionally roost on posts and rails associated with the existing boat ramp.

It is important to minimise the creation of potential pelican roost sites during the proposed activities and discourage people from feeding birds.

White-faced Heron (Moderate risk)

The White-faced Heron has been recorded as being involved in one bird strike incident in the period 1988/1999 (Hutchinson 1999). This species is present at most freshwater wetlands in the vicinity of Port Botany and Sydney Airport usually as single individuals but may be present in numbers up to six or more individuals (pers obs). One or two White-faced Herons are often present at Penrhyn Estuary and are likely to continue to use the site after the creation of additional port land. The shorebird habitat in Penrhyn Estuary is not likely to significantly increase bird hazard involving this species. The proposed activities are unlikely to increase bird hazard threats by this species.

Great Egret (Moderate risk)

Single birds have been observed occasionally at Penrhyn Estuary including one bird during this study as well as freshwater wetlands in the vicinity of Sydney Airport. Due to low numbers and the fact they spend most of their time foraging or roosting at the margins of wetlands they appear to be a low threat to aircraft safety and Sydney Airport. This species is likely to continue to use the Penrhyn wetlands in low numbers after the construction of the additional port land. The proposed activities are unlikely to increase bird hazard threats by this species.

Cattle Egret (High risk)

Cattle Egrets visit the Botany Bay area, usually during the non-breeding season when individual birds have been observed infrequently in flocks of up to 11 at Penrhyn Estuary. This species spends much of its time foraging in grasslands (Straw 2001). It is considered a high risk at Sydney Airport due to the likelihood of visiting grasslands and its habit of flying in flocks. However it is not expected to be a frequent visitor in the region of Port Botany during or after the expansion or the Port. The proposed activities are unlikely to increase bird hazard threats by this species.

Striated Heron (Low risk)

A skulking bird that forages on the margins of wetlands taking flight only when disturbed and then usually only short distances. The proposed activities are unlikely to increase bird hazard threats by this species.

Australian White Ibis (Very high risk)

The Australian White Ibis occurs over much of Sydney, having expanded its breeding range and increased in numbers in recent years (Hoskin 1991). Relatively few Australian White Ibis have been observed at Penrhyn Estuary with a maximum of 7 birds being observed in 1996 (Straw 2001). The potential for these birds to increase was demonstrated when a colony established at the nearby Botany Wetlands, posing a serious threat to aircraft using Sydney Airport.

This species has become a pest at a number of public parks and outdoor food outlets and restaurants. Due to its long neck and beak this species readily feeds from rubbish bins pulling rubbish out and making it available to other birds and vermin.

There is potential for these birds to build up in numbers at any food source. It is therefore important that any waste food is covered and that feeding of birds be strongly curtailed in the vicinity of Port Botany.

Black-shouldered Kite (High risk)

The Black-shouldered Kite is a small bird of prey that spends much of its time hovering looking for small reptiles, mammals or large insects. It occurs in pairs or singly in the region of north Botany Bay. Although there has been one incidence of bird strike involving this species any birds in the vicinity of Port Botany would be considered of low risk to aircraft safety.

White-bellied Sea-Eagle (High risk)

The White-bellied is one of the largest birds occurring in the Botany Bay area. Due to its size it must be considered a potential bird hazard to aircraft. One bird strike involving this species has been recorded between 1988 and 1999 (Hutchinson 1999). This species has not often been associated with the waters near Port Botany or at Penrhyn Estuary, although one was observed flying over the Estuary during this study. The Port expansion and habitat in Penrhyn Estuary is not expected to increase the frequency of occurrence of this species in the area.

Swamp Harrier (High risk)

The Swamp Harrier is a moderately large bird that is occasionally observed flying low over freshwater wetlands in the region of north Botany Bay. It has been observed occasionally flying low over Sydney Airport where it is a significant threat to aircraft safety. This species has not been associated with the wetlands at Penrhyn Estuary and is not likely to be attracted to the Estuary following the proposed works.

Brown Goshawk (Moderate risk)

Brown Goshawks are fast moving birds that stalk other bird species by taking advantage of the cover of trees to get close to potential prey without being seen. Not often seen at Port Botany and has no particular attraction to the site or Penrhyn Estuary. The proposed activities are unlikely to increase bird hazard threats by this species.

Brown and Peregrine Falcons (Moderate and High risks)

The Brown and Peregrines rely on speed of chase to catch other bird species but will feed opportunistically on other animals. Although a potential threat to aircraft safety when flying across an airfield these species are not frequently associated with Port Botany or Penrhyn Estuary. The proposed activities are unlikely to increase bird hazard threats by this species.

Nankeen Kestrel (Very high risk)

The Nankeen Kestrel has been involved in the second highest number of bird strikes at Sydney Airport. This is largely due to the fact that this species nests on or close to the airfield and forages for insects and small reptiles and mammals in the grasslands associated with the Airport. The proposed activities are unlikely to increase bird hazard threats by this species.

Crakes and rails (Low risk)

These skulking birds are rarely seen and usually dart for cover if disturbed. Being relatively weak flyers these species fly infrequently and are therefore considered a low threat to aircraft safety. The proposed activities are unlikely to increase bird hazard threats by these species.

Purple Swamphen, Dusky Moorhen and Eurasian Coot (Low risk)

These three species of waterbirds are associated with freshwater wetlands and would rarely be observed at tidal wetlands such as Penrhyn Estuary. They are also reluctant flyers and are therefore considered relatively low risk to aircraft safety. The proposed activities are unlikely to increase bird hazard threats by this species.

Migratory shorebirds (waders) (Low risk)

Fifteen species of migratory shorebirds regularly occur in Botany Bay. Of these only seven are likely to occur on the north shore or at Penrhyn Estuary in significant numbers or are large enough for concern as individuals or in small numbers. When disturbed shorebirds take off as a flock and fly rapidly to another destination or circle and return to near where they left from. When moving from one part of Botany Bay to another they generally fly low over the water. Some species such as the Double-banded Plover and Red-necked Stint are known to occasionally roost on the ground close the Parallel Runway at Sydney Airport. During the period 1988 – 1999 two 'plovers' and one 'sandpiper' were implicated in bird strikes out of 356 reported

incidents (Hutchinson 1999). It is likely that these birds were some of the individuals that roost at the airport.

Bar-tailed Godwit (Low risk)

The Bar-tailed Godwit is currently the most abundant species of shorebird occurring at Penrhyn Estuary and nearby beaches. In the past flocks of up to 200 have been observed (NSWWSG data) but numbers have declined in recent years and only about 130 have been counted during the past two seasons. However if compensatory habitat is created the numbers may increase again.

A flock of Bar-tailed Godwits flying across the runways at Sydney Airport would pose a significant threat if hit by an aircraft. However there have been no incidents of bird strike involving Bar-tailed Godwits at Sydney Airport and none have been observed flying across the airport by the bird hazards team (SACL data). When disturbed Bartailed Godwits take off as a flock and fly rapidly to another destination or circle and return to near where they left from.

Red-necked Stint (Low risk)

The Red-necked Stint is the smallest of the shorebirds occurring at Botany Bay. This species has been observed regularly at Sydney Airport since its traditional roosts were reclaimed as part of airport expansion over the past forty to fifty years. Flocks have been observed roosting at the end of the end of runway 34L/16R (prior to the construction of the Parallel Runway) after feeding at various locations including Penrhyn Estuary. Generally these birds fly low over the end of the runway and water, hence there is a low incidence of bird strikes. Their small size would provide minimal risk to aircraft unless a large flock were ingested at the same time. The proposed activities are unlikely to increase bird hazard threats by this species.

Latham's Snipe (Low risk)

The Latham's Snipe is a migratory shorebird that, unlike most species of shorebird, spends most of its time during daylight hours in rank grassland or vegetated margins of wetlands. When disturbed the bird flies to another location in which to hide which is generally relatively close by. This species would not normally fly across Sydney Airport and is therefore considered of minimal threat to aircraft. The proposed activities are unlikely to increase bird hazard threats by this species.

Galah (Very high risk)

Once only associated with grasslands of inland Australia, Galahs have increased in numbers in recent years in the Sydney area. It is thought that these populations originated from escaped birds from aviaries that have since found suitable conditions in which to breed and multiply (Hoskin 1991). The birds associated with bird strikes at Sydney Airport appear to be those attracted to the grassland on or near the airport where they feed on seeds of grasses and weeds. Galahs have not been observed on a regular basis at Penrhyn Road or Foreshore Beach. The proposed activities are unlikely to increase bird hazard threats by this species.