Port Botany Post Construction Environmental Monitoring

Shorebird Off-Peak Season Summary Report September 2015

EL1112046

Double-banded Plover (key species) in breeding plumage prior to migration, Penrhyn Estuary
Photo by Chelsea Hankin
20/08/2014

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Table of Contents

1	**Introduction**	**1**
1.1	Background	1
1.2	Purpose of this report	1
2	**Monitoring Methodology**	**2**
2.1	Sampling Design	2
2.2	Field Procedures	6
2.3	Laboratory Procedures	6
2.4	Quality Control Procedures	7
3	**Monitoring Works**	**8**
4	**Preliminary Findings**	**9**
5	**References**	**13**

Tables

Table 1	Key species monitored and associated reference sites	2
Table 2	Timing, location and frequency of shorebird monitoring	8
Table 3	Species observed in Penrhyn Estuary April – August 2015	10

Figures

Figure 1 Penrhyn Estuary Shorebird Feeding and Roosting Sites 3

Figure 2 Shorebird Reference Site Monitoring: Southern Botany Bay and Boat Harbour Transects 4

Figure 3 Shorebird Reference Site Monitoring: Parramatta River Estuary Transect 5

Figure 4 Peak Count of Double-banded Plover at a) Low Tide and b) High Tide 11

Figure 5 Peak Abundance Trend of the Double-banded Plover, Penrhyn Estuary, During a) Low Tide and b) High Tide 12

Appendices

Appendix A Shorebird Surveys: Penrhyn Estuary and Reference Site Monitoring

1 Introduction

1.1 Background

Penrhyn Estuary is the most important feeding and roosting site remaining on the northern side of Botany Bay for both migratory and non-migratory shorebirds. Penrhyn Estuary is a small waterway located to the north of Brotherson Dock, which was artificially created during the reclamation of the Botany foreshore between 1975 and 1978. The Estuary was rehabilitated as part of the Port Botany Expansion Project to enhance the existing intertidal habitat and to expand the Estuary of approximately 30 ha as a long-term habitat for migratory shorebirds. Habitat enhancement may result in the return of some birds that previously used the area but are no longer found in the Estuary, and in some cases no longer found in Botany Bay. The aim of the shorebird monitoring program is to monitor numbers of shorebirds feeding and roosting on site to determine the success of the habitat enhancement works.

Penrhyn Estuary is considered a significant feeding and roosting site in Botany Bay for seven 'key' species (NSW Wader Study Group Data). Six of these species were selected to measure the success of the Penrhyn Estuary Habitat Enhancement Plan (PEHEP) throughout the pre-construction, construction and post construction phases. These species are Bar-tailed Godwit, Red-necked Stint, Double-banded Plover, Curlew Sandpiper, Red Knot and Pacific Golden Plover. The seventh key species, the Sharp-tailed Sandpiper, was unsuitable to include for monitoring because of its irregularity in numbers at coastal sites due to the variability of flooding of inland wetlands.

The abundance of the key species, compared with counts at reference sites, will indicate the success of PEHEP works. No decline in numbers of any of the key species compared with baseline data would indicate that the habitat enhancement has had no negative impacts. Any increase in the numbers of each of these species would be evidence of habitat enhancement success.

1.2 Purpose of this report

This report summarises the findings for the off-peak season shorebird monitoring (April- August 2015). This report outlines field procedures, provides details of the reference sites monitored and initial observations of raw data. Five of six key species are northern hemisphere migrants; therefore, analysis after the peak season shorebird monitoring (April 2016) will provide an indication of the success of the PEHEP works in the post-construction phase.

2 Monitoring Methodology

2.1 Sampling Design

Fortnightly surveys of shorebird abundance and diversity were carried out during low and high tides at the study site, Penrhyn Estuary, and at selected reference sites from April to August 2015. Where possible, local reference sites were chosen to ensure accuracy of data collection, with sites being surveyed on the same day by the same team of shorebird experts. However, as sites around Botany Bay did not support sufficient numbers of some species for analysis, some regional sites were selected outside of the Bay for these species (**Table 1** and **Figures 1-3**).

Table 1 Key species monitored and associated reference sites

Area	Sites	Habitats	Key species
Penrhyn Estuary	Transects 1 & 2	Tidal estuarine mudflats Tidal sand flats Sand spits Sandy beaches Stony substrate Sandy islands	Bar-tailed Godwit Red-necked Stint Pacific Golden Plover Red Knot Curlew Sandpiper Double-banded Plover
Southern Botany Bay	Quibray Bay	Tidal sand flats Sandy beaches Oyster lease structures	Bar-tailed Godwit
	Riverside Drive	Tidal estuarine mudflats Tidal sand flats Sand spit Sandy beaches	
	Woodlands Road	Tidal estuary mudflats Tidal sand flats Sandy beaches	
Parramatta Estuary	Hen and Chicken Bay	Tidal estuarine mudflats Tidal sand flats Sandy beaches Sand/rock spits Concrete jetty	Curlew Sandpiper
	Mason Park & Waterbird Refuge	Saltmarsh and lagoons	
Boat Harbour		Tidal rock platform Tidal sand flats Sandy beaches	Red-necked Stint Double-banded Plover
Hunter River Estuary*		Tidal estuarine mudflats Tidal sand flats Sandy beaches Rocky shores	Pacific Golden Plover

*Reference site only monitored during peak season

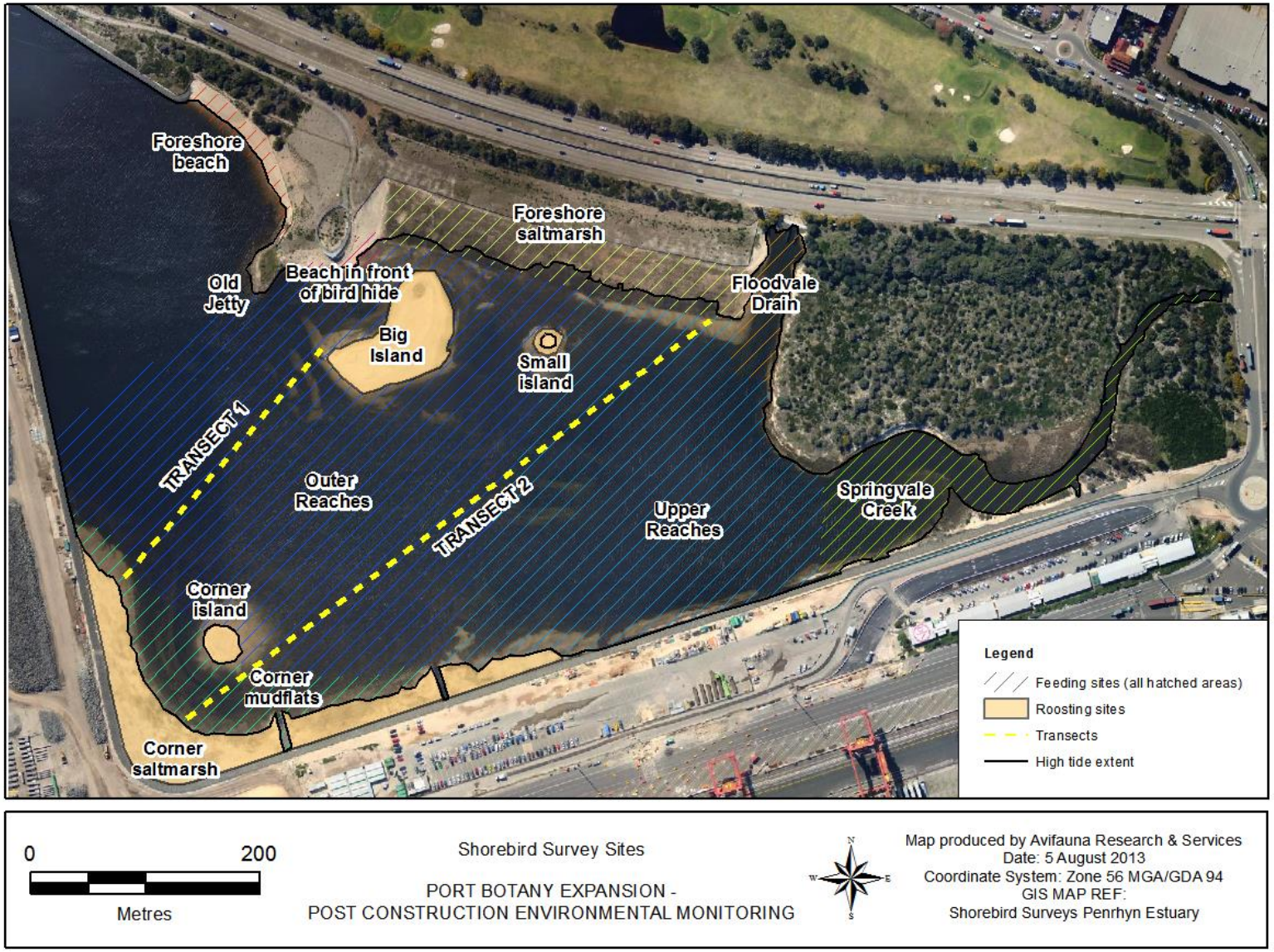


Figure 1 Penrhyn Estuary Shorebird Feeding and Roosting Sites

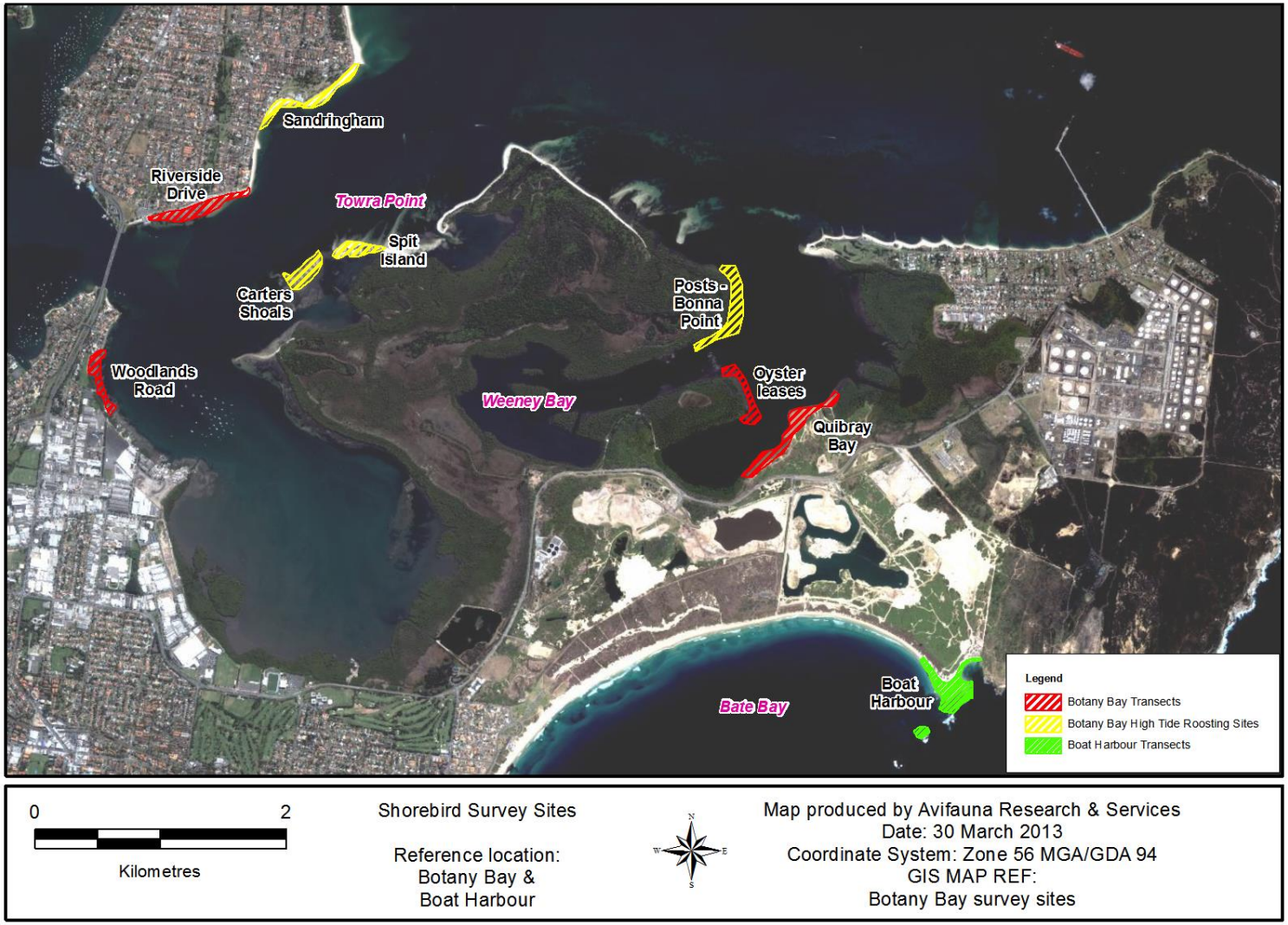


Figure 2 Shorebird Reference Site Monitoring: Southern Botany Bay and Boat Harbour Transects

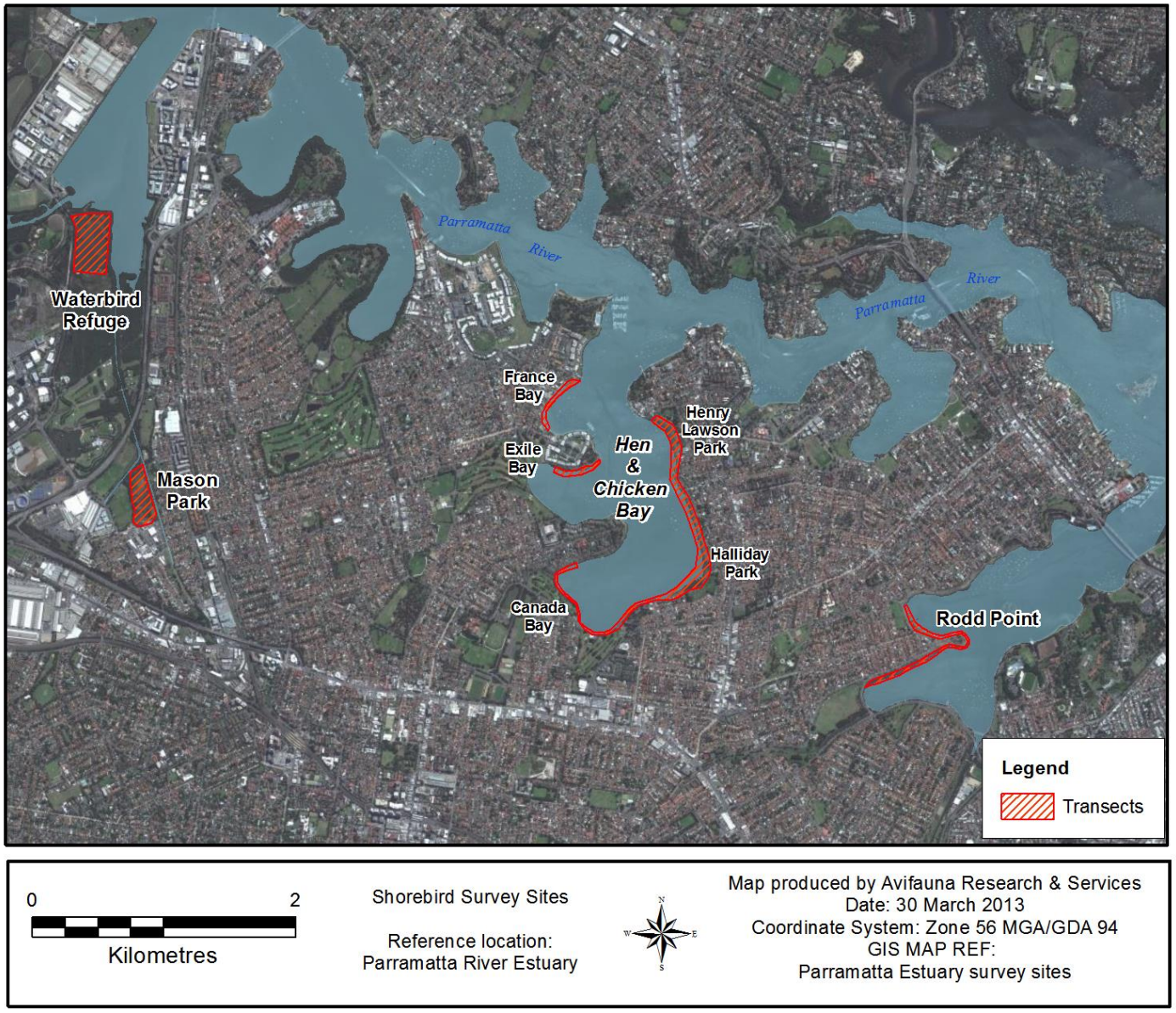


Figure 3 Shorebird Reference Site Monitoring: Parramatta River Estuary Transect

2.2 Field Procedures

Penrhyn Estuary

Shorebirds were observed for two hours at low and high tide, recording species present, abundance, behaviour and habitat usage. Weather conditions were also noted, as well as any disturbance or predation in the estuary.

At low tide, surveys were conducted on foot by walking along predetermined transects (**Figure 1**), with access via gates along the northern perimeter of Foreshore Road near the Bird Hide. High tide surveys required two observers to complete the survey by boat, with transects varying depending on the height of the tide. The boat was launched near the Bird Hide, with 4WD access via the gates on Foreshore Road. During neap tides, when it was too shallow to access the whole estuary by boat, surveys were conducted by walking through shallow water wearing chest waders.

Southern Botany Bay

Three reference sites were monitored by boat at high tide and on foot at low tide to measure relative abundance compared with Penrhyn Estuary, while additional high tide roost sites were counted to estimate the total population of Bar-tailed Godwits in the Bay (**Figure 2**).

Riverside Drive provides approximately 6 ha of tidal flats, with roosting areas confined to a beach and small sandspit at the outlet of a small creek at Scott Park. Previously, Bar-tailed Godwits regularly used the site at high tide. However, numbers have declined, probably due to wind and water erosion of the sandspit.

Woodlands Road Reserve provides approximately 5 ha of mudflats, providing feeding habitat for the Bar-tailed Godwit.

Quibray Bay supports a steady population of Bar-tailed Godwits, with roosting sites including small beaches and nearby oyster lease posts. However, data show that shorebirds move to other locations in Botany Bay depending on weather conditions. For example, in adverse conditions birds will avoid the exposed oyster leases and move to roost sites at Sandringham, Spit Island and Carters Shoals. These sites were also monitored to better monitor any changes to the Botany Bay population.

Boat Harbour

Boat Harbour is a medium-sized sandstone reef (approximately 3 ha), located on the northeast of Bate Bay (**Figure 2**). The survey area selected as a reference site provides valuable shelter for migratory shorebirds, such as Red-necked Stint, Double-banded Plover, Pacific Golden Plover and Ruddy Turnstone, which use the area for feeding at low tide and as a roost site at high tide.

Parramatta Estuary

Sites around Parramatta River Estuary were used as reference locations for the Curlew Sandpiper (**Figure 3**). The area also provides habitat for large numbers of Bar-tailed Godwits. Hen and Chicken Bay provides feeding and roosting sites with several small beaches, rocky outcrops and jetties. Alternative habitat for the Curlew Sandpiper and other shorebirds is available in tidal saltmarsh wetlands at Mason Park and the Waterbird Refuge at Homebush.

Further details of field procedures can be found in the Monitoring Services Management Plan (Cardno 2013).

2.3 Laboratory Procedures

Shorebird species were identified and recorded, noting the number of species present, behaviour, habitat usage and any disturbances. On occasions with two surveyors in the field, observations were recorded directly into a waterbird survey notebook, with one person observing while the other scribed. When a single observer was in the field, a digital voice recorder was used to note observations. Upon completion of field surveys, notebooks were returned to the office and data was entered immediately into the database. Voice recordings were uploaded onto the computer and notes then transferred into a waterbird survey notebook. Weather conditions were recorded from the Bureau of Meteorology online database (www.bom.gov.au), including temperature, wind speed and wind direction. Notebooks were stored once all information was entered, and the database was backed up onsite and to an offsite representative.

Significant disturbances or incidents that may have occurred while in the field were actioned after discussion with the director. Incidents requiring action may include, for example, pest control, unauthorised personnel within the estuary or reporting of pollution such as oil spills.

2.4 Quality Control Procedures

Shorebird identification was verified through photographic records where necessary. High quality digital photography was also used for count verification with large flocks of birds. Photography was also used to confirm the health condition of shorebirds.

Observers were responsible for entering their own field notes to minimise the handling of the data, reducing potential error. The director reviewed all observations and data before submitting into the database to ensure the accuracy of data collected.

3 Monitoring Works

Shorebird surveys were conducted at the study site and associated reference sites as outlined below.

Table 2 Timing, location and frequency of shorebird monitoring

Where	When	What
Penrhyn Estuary	Fortnightly, April- August	> Shorebird abundance, diversity and behaviour > Disturbance and predation > Shorebird health
Reference sites		
Southern Botany Bay	Fortnightly, April- August	> Shorebird abundance, diversity and behaviour
Parramatta Estuary	Fortnightly, April- August	> Shorebird abundance, diversity and behaviour
Boat Harbour	Fortnightly, April- August	> Shorebird abundance, diversity and behaviour

4 Preliminary Findings

Two of six key species were observed in Penrhyn Estuary throughout the off-peak season (**Table 3**). The Bar-tailed Godwit, Pacific Golden Plover, Red-necked Stint, Red Knot and Curlew Sandpiper are all northern hemisphere migrants, with only small numbers of Red-necked Stint and Bar-tailed Godwit remaining in their non-breeding grounds. The Double-banded Plover is a trans-Tasman migrant, spending its non-breeding season in Australia between February-August, returning to breed in New Zealand between August-March.

Small populations of Double-banded Plover arrived at Penrhyn Estuary and at Boat Harbour (reference site) in April and remained until mid August. Double-banded Plover has been recorded at Penrhyn Estuary more frequently at low tide, and using other locations around Botany Bay to roost at high tide. In contrast to the previous year's results for the same period, abundance of Double-banded Plover utilising Penrhyn Estuary was greater than that at Botany Bay for both feeding and roosting in the first month of its arrival (**Figure 4a, Figure 4b**). Double-banded Plover discontinued use of Penrhyn Estuary at high tide in June, July and August. Slightly more Double-Banded Plover used the Estuary for foraging than Botany Bay in April, May and June.

Numbers of Double-banded Plover declined during the construction phase of the Port Botany Expansion (**Figure 5**). Monitoring in the first couple of years in the post-construction phase revealed a gradual increase of Double-banded Plover in the Estuary, returning to pre-construction conditions. However, a slight decline was again observed in 2014 (**Figure 5a**). This is the fifth year of the post-construction phase and the peak abundance of Double-banded Plover shows a very similar result to last year for both high and low tides (**Figure 5a, Figure 5b**). These findings demonstrate that Penrhyn Estuary continues to provide suitable foraging and roosting habitat for the Double-banded Plover. The peak abundance of Double-banded Plover at high tide was significantly greater this season compared to recent years in the post-construction phase (**Figure 5b**). This is a positive result for the PEHE works, indicating Penrhyn Estuary is providing suitable habitat for feeding and roosting Double-banded Plover.

Pacific Golden Plovers were observed on one occasion in early April just before migration, showing typical pre-breeding plumage and increased body mass. Pacific Golden Plover was absent from the Estuary, whilst numbers persisted throughout the off-peak season in the Hunter River Estuary reference site. Red-necked stints were also absent from the Estuary, however up to 29 remained at Boat Harbour throughout this period and a large number were present in the Hunter early in the season before migrating to the Northern Hemisphere. Low numbers of Bar-tailed Godwits were present in Penrhyn Estuary on three occasions this period in contrast to last year in which no Bar-tailed Godwits were observed in the Estuary.

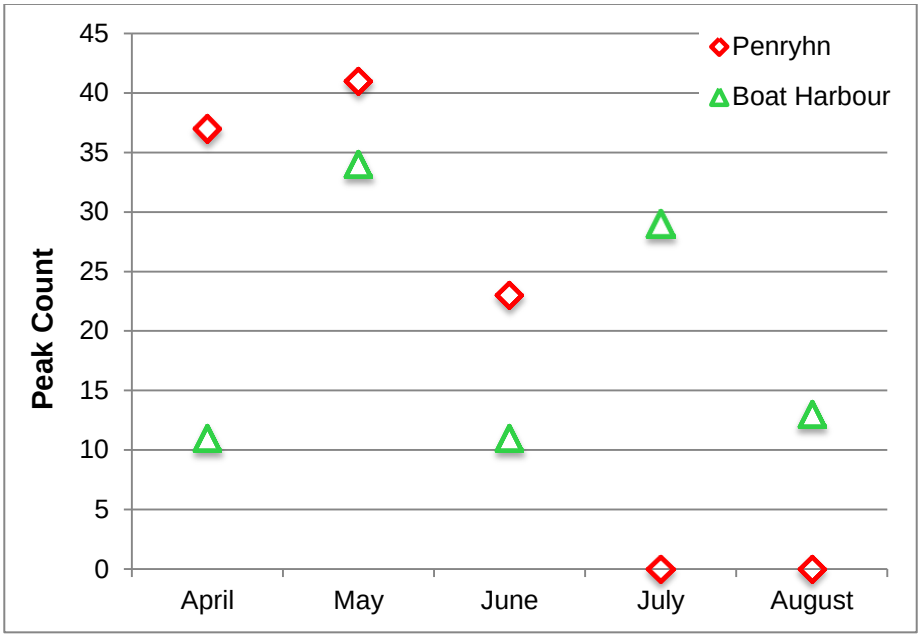
Statistical analyses after the peak season counts for 2015- 2016 will provide an assessment of the success of the PEHEP works in the post-construction phase with the return of the key migratory species.

Table 3 Species observed in Penrhyn Estuary April – August 2015

	EPBC	TSC
Australasian Darter		
Pacific Black Duck		
Little Pied Cormorant		
Great Cormorant		
Little Black Cormorant		
Pied Cormorant		
Australian Pelican		
Eastern Great Egret		
Striated Heron		
White-faced Heron		
Little Egret		
Cattle Egret		
Australian White Ibis		
Royal Spoonbill		
Eastern Osprey	M	V
Australian Pied Oystercatcher		E
Black-winged Stilt		
Red-capped Plover		
Double Banded Plover*	M	
Masked Lapwing		
Bar-tailed Godwit*	M	
Grey-tailed Tattler	M	
Silver Gull		
Caspian Tern		

* Key species for Penrhyn Estuary
EPBC Species protected under the Environment Protection and Biodiversity Conservation Act 1999 (Migratory species)
TSC Species protected under the Threatened Species Conservation Act 1995 (Vulnerable, Endangered)

a)



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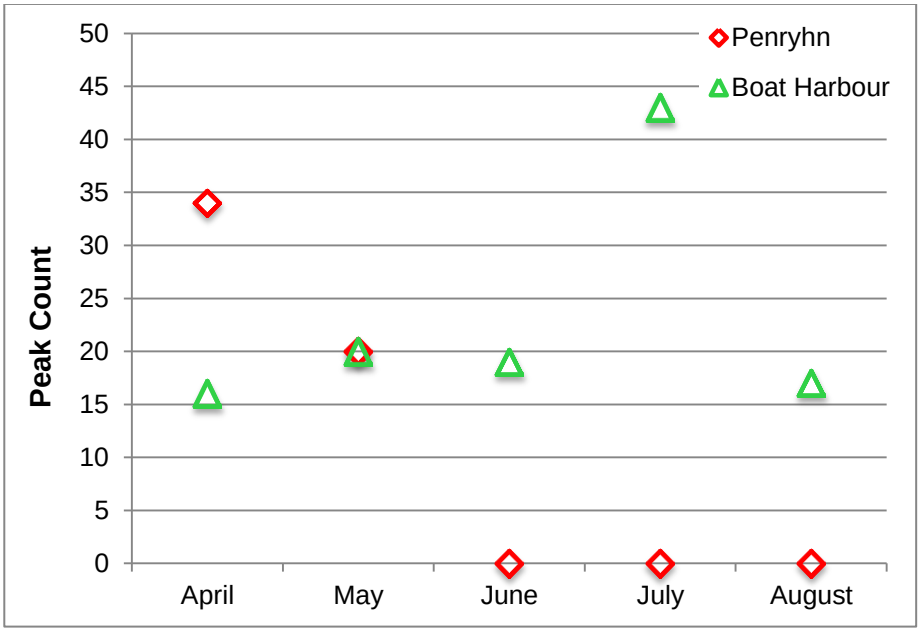
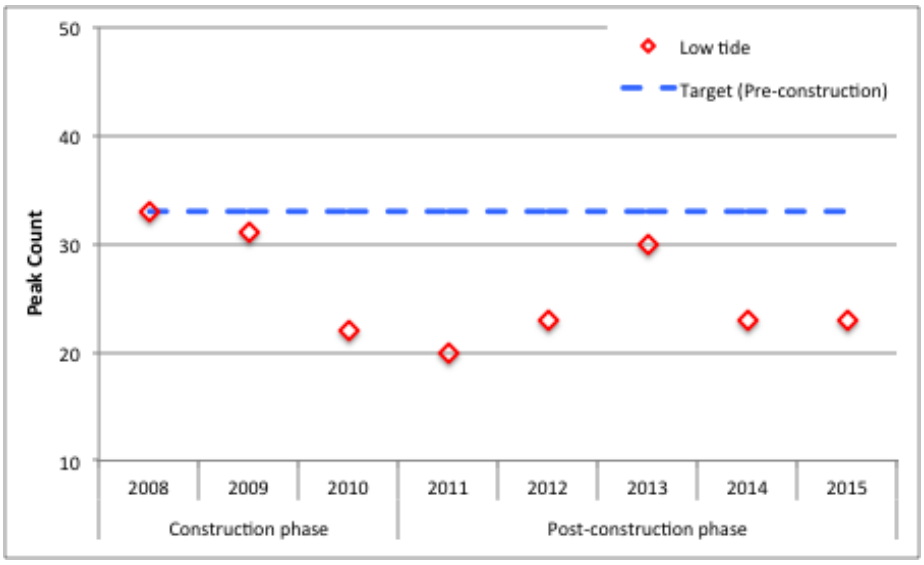


Figure 4 Peak Count of Double-banded Plover at a) Low Tide and b) High Tide

a)



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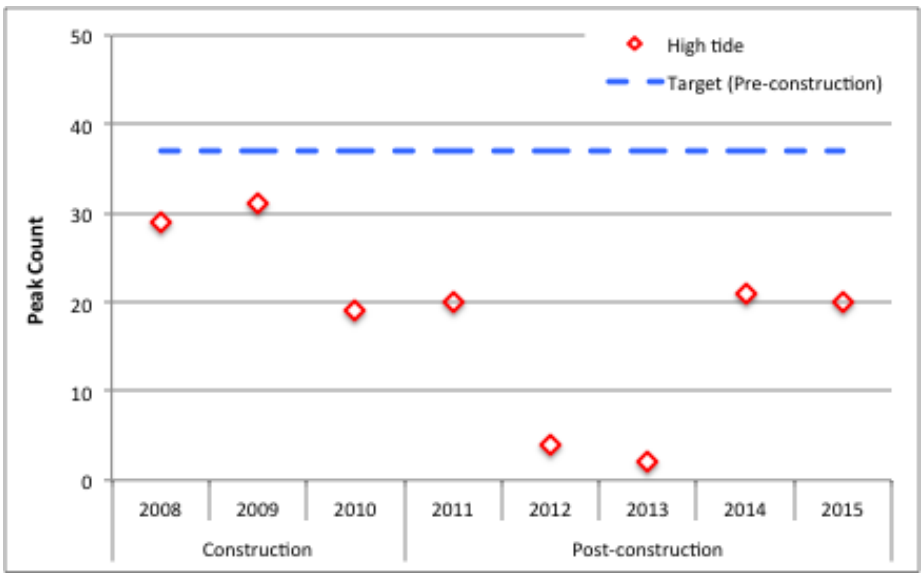

Figure 5 **Peak Abundance Trend of the Double-banded Plover, Penrhyn Estuary, During a) Low Tide and b) High Tide**

5 References

Avifauna Research & Services (2013). *Port Botany Post Construction Environmental Monitoring: Shorebirds Monitoring Off-Peak Summary Report*. EL1112046 Prepared for Sydney Ports Corporation. Period ending August 2013.

Cardno (2013). *Port Botany Expansion Environmental Enhancement Works – Post Construction Environmental Monitoring. Monitoring Services Management Plan*. EL1112046 Prepared for Sydney Ports Corporation. August 2013.

Shorebird Off-Peak Season Summary Report September 2015

APPENDIX A

SHOREBIRD SURVEYS: PENRHYN ESTUARY AND REFERENCE SITES

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Appendix A: Shorebird Surveys: Penrhyn Estuary and Reference Sites

A-1: Diurnal Shorebird Surveys: Penrhyn Estuary (Key Species)

Subsite	Common Name	Count	Behaviour	Habitat	Date	Tide
Corner Island	Bar-tailed Godwit	8	Roosting	Shallow water	02/06/2015	High
Outer Reaches	Bar-tailed Godwit	4	Feeding	Shallow water	12/05/2015	Low
Outer Reaches	Bar-tailed Godwit	6	Feeding	Shallow water	18/05/2015	Low
Big Island	Double-banded Plover	17	Roosting	Exposed mud/sand	16/04/2015	High
Big Island	Double-banded Plover	17	Roosting	Exposed mud/sand	28/04/2015	High
Big Island	Double-banded Plover	20	Roosting	Exposed mud/sand	18/05/2015	High
Corner Mudflats	Double-banded Plover	17	Feeding	Exposed mud/sand	16/04/2015	Low
Outer Reaches	Double-banded Plover	20	Feeding	Exposed mud/sand	28/04/2015	Low
Outer Reaches	Double-banded Plover	20	Feeding	Exposed mud/sand	12/05/2015	Low
Outer Reaches	Double-banded Plover	21	Feeding	Exposed mud/sand	18/05/2015	Low
Outer Reaches	Double-banded Plover	23	Feeding	Exposed mud/sand	02/06/2015	Low

A-2: Reference Site Monitoring: Botany Bay (Bar-tailed Godwit)

Subsite	Common Name	Count	Behaviour	Habitat	Date	Tide
Spit Island	Bar-tailed Godwit	133	Roosting	Bank or beach	01/04/2015	High
Riverside Drive	Bar-tailed Godwit	9	Roosting	Bank or beach	01/04/2015	High
Spit Island	Bar-tailed Godwit	32	Roosting	Exposed mud/sand	17/04/2015	High
Riverside Drive	Bar-tailed Godwit	4	Roosting	Shallow water	17/04/2015	High
Quibray Bay	Bar-tailed Godwit	30	Roosting	Shallow water	27/04/2015	High
Carters Shoals	Bar-tailed Godwit	7	Roosting	Sandspit	27/04/2015	High
Spit Island	Bar-tailed Godwit	26	Roosting	Exposed mud/sand	19/05/2015	High
Spit Island	Bar-tailed Godwit	2	Roosting	Sandspit	16/06/2015	High
Riverside Drive	Bar-tailed Godwit	5	Roosting	Shallow water	16/06/2015	High
Woodlands Rd	Bar-tailed Godwit	20	Roosting	Rocks	16/06/2015	High
Woodlands Rd	Bar-tailed Godwit	22	Roosting	Rocks	03/07/2015	High
Carters Shoals	Bar-tailed Godwit	16	Roosting	Sandspit	20/07/2015	High
Riverside Drive	Bar-tailed Godwit	4	Feeding	Shallow water	20/07/2015	High
Carters Shoals	Bar-tailed Godwit	21	Roosting	Sandspit	03/08/2015	High
Carters Shoals	Bar-tailed Godwit	25	Roosting	Sandspit	18/08/2015	High
Quibray Bay	Bar-tailed Godwit	17	Feeding	Beach	01/04/2015	Low
Woodlands Rd	Bar-tailed Godwit	2	Feeding	Beach	01/04/2015	Low
Riverside Drive	Bar-tailed Godwit	14	Feeding	Beach	01/04/2015	Low
Riverside Drive	Bar-tailed Godwit	3	Feeding	Exposed mud/sand	17/04/2015	Low
Quibray Bay	Bar-tailed Godwit	5	Feeding	Exposed mud/sand	17/04/2015	Low
Riverside Drive	Bar-tailed Godwit	1	Feeding	Exposed mud/sand	27/04/2015	Low
Quibray Bay	Bar-tailed Godwit	4	Feeding	Exposed mud/sand	27/04/2015	Low
Riverside Drive	Bar-tailed Godwit	3	Feeding	Exposed mud/sand	13/05/2015	Low
Woodlands Rd	Bar-tailed Godwit	4	Feeding	Shallow water	13/05/2015	Low
Quibray Bay	Bar-tailed Godwit	9	Feeding	Exposed mud/sand	13/05/2015	Low
Quibray Bay	Bar-tailed Godwit	6	Feeding	Exposed mud/sand	19/05/2015	Low
Riverside Drive	Bar-tailed Godwit	3	Feeding	Exposed mud/sand	19/05/2015	Low
Riverside Drive	Bar-tailed Godwit	6	Feeding	Exposed mud/sand	03/06/2015	Low
Woodlands Rd	Bar-tailed Godwit	2	Feeding	Exposed mud/sand	16/06/2015	Low

Riverside Drive	Bar-tailed Godwit	5	Feeding	Exposed mud/sand	16/06/2015	Low
Woodlands Rd	Bar-tailed Godwit	1	Feeding	Exposed mud/sand	03/07/2015	Low
Woodlands Rd	Bar-tailed Godwit	4	Feeding	Exposed mud/sand	20/07/2015	Low
Riverside Drive	Bar-tailed Godwit	4	Feeding	Exposed mud/sand	20/07/2015	Low
Woodlands Rd	Bar-tailed Godwit	3	Feeding	Shallow water	03/08/2015	Low
Woodlands Rd	Bar-tailed Godwit	2	Feeding	Shallow water	18/08/2015	Low
Riverside Drive	Bar-tailed Godwit	6	Feeding	Exposed mud/sand	18/08/2015	Low

A-3: Reference Site Monitoring: Parramatta River Estuary (Curlew Sandpiper)

Not recorded

A-4: Reference Site Monitoring: Boat Harbour (Double-banded Plover)

Site	Common Name	Count	Behaviour	Habitat	Date	Tide
Boat Harbour	Double-banded Plover	16	Feeding	Shallow water	14/04/2015	High
Boat Harbour	Double-banded Plover	4	Roosting	Rocks	04/05/2015	High
Boat Harbour	Double-banded Plover	1	Roosting	Rocks	11/05/2015	High
Boat Harbour	Double-banded Plover	15	Roosting	Rocks	20/05/2015	High
Boat Harbour	Double-banded Plover	10	Roosting	Rocks	05/06/2015	High
Boat Harbour	Double-banded Plover	9	Roosting	Rocks	20/06/2015	High
Boat Harbour	Double-banded Plover	18	Roosting	Rocks	04/07/2015	High
Boat Harbour	Double-banded Plover	25	Roosting	Rocks	24/07/2015	High
Boat Harbour	Double-banded Plover	9	Roosting	Rocks	04/08/2015	High
Boat Harbour	Double-banded Plover	8	Roosting	Exposed mud/sand	19/08/2015	High
Boat Harbour	Double-banded Plover	11	Feeding	Rocks	14/04/2015	Low
Boat Harbour	Double-banded Plover	15	Feeding	Rocks	04/05/2015	Low
Boat Harbour	Double-banded Plover	8	Feeding	Rocks	11/05/2015	Low
Boat Harbour	Double-banded Plover	11	Feeding	Rocks	20/05/2015	Low
Boat Harbour	Double-banded Plover	11	Feeding	Rocks	05/06/2015	Low
Boat Harbour	Double-banded Plover	8	Feeding	Rocks	10/07/2015	Low
Boat Harbour	Double-banded Plover	21	Feeding	Rocks	24/07/2015	Low
Boat Harbour	Double-banded Plover	6	Feeding	Rocks	04/08/2015	Low
Boat Harbour	Double-banded Plover	7	Feeding	Rocks	19/08/2015	Low

A-5: Reference Site Monitoring: Boat Harbour (Red-necked Stint)

Site	Common Name	Count	Behaviour	Habitat	Date	Tide
Boat Harbour	Red-necked Stint	31	Feeding	Shallow water	14/04/2015	High
Boat Harbour	Red-necked Stint	19	Roosting	Rocks	04/05/2015	High
Boat Harbour	Red-necked Stint	10	Feeding	Rocks	11/05/2015	High
Boat Harbour	Red-necked Stint	12	Roosting	Rocks	20/05/2015	High
Boat Harbour	Red-necked Stint	3	Feeding	Shallow water	05/06/2015	High
Boat Harbour	Red-necked Stint	11	Roosting	Rocks	20/06/2015	High
Boat Harbour	Red-necked Stint	4	Roosting	Rocks	04/07/2015	High
Boat Harbour	Red-necked Stint	22	Roosting	Rocks	24/07/2015	High
Boat Harbour	Red-necked Stint	26	Roosting	Rocks	04/08/2015	High
Boat Harbour	Red-necked Stint	29	Roosting	Exposed mud/sand	19/08/2015	High
Boat Harbour	Red-necked Stint	12	Feeding	Rocks	14/04/2015	Low
Boat Harbour	Red-necked Stint	14	Feeding	Rocks	04/05/2015	Low
Boat Harbour	Red-necked Stint	11	Feeding	Rocks	11/05/2015	Low
Boat Harbour	Red-necked Stint	10	Feeding	Rocks	20/05/2015	Low
Boat Harbour	Red-necked Stint	13	Feeding	Rocks	05/06/2015	Low
Boat Harbour	Red-necked Stint	9	Feeding	Rocks	10/07/2015	Low
Boat Harbour	Red-necked Stint	14	Feeding	Rocks	24/07/2015	Low
Boat Harbour	Red-necked Stint	16	Feeding	Rocks	04/08/2015	Low
Boat Harbour	Red-necked Stint	18	Feeding	Rocks	19/08/2015	Low