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Hunter Estuary & Worimi Conservation Lands Shorebird Site Action Plan

Prepared by

BirdLife Australia

for

Hunter Local Land Services

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More information on the National Migratory Shorebird Conservation Action Plan:
<http://birdlife.org.au/mscap> (Contact: shorebirds@birdlife.org.au)



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Native Title Recognition

We acknowledge the Awabakal and Worimi peoples as Traditional Owners of the land and pay our respects to the Elders past, present and future for they hold the memories, traditions, culture and hope for their people.

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Abbreviations

AWSG	Australasian Wader Study Group
BNB	Beach-nesting Birds
CAMBA	China-Australia Migratory Bird Agreement
EAAF	East Asian-Australasian Flyway
EAAFP	East Asian-Australasian Flyway Partnership
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FNS	Flyway Network Site
JAMBA	Japan-Australia Migratory Bird Agreement
MS CAP	Migratory Shorebird Conservation Action Plan
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
SAP	Site Action Plan
WCP	Wildlife Conservation Plan for Migratory Shorebirds



Preface

“The Hunter estuary is the largest coastal estuary in New South Wales and is connected to the north of the Hunter River to the Worimi Conservation Lands along the coast of Stockton Bight. Together, these two sites support the highest abundance and diversity of shorebirds in the state. This plan is aimed at supporting migratory shorebirds currently utilising these adjoining sites and outlines actions to improve habitat conditions and availability for migratory shorebirds in all three regions to help secure the role they play in global shorebird conservation.”

This document sets out a combined Shorebird Site Action Plan for the Hunter Estuary and Worimi Conservation Lands in New South Wales. As migratory shorebird species continue to decline globally and face many threats along the Flyway including in Australia, preserving key roosting and feeding habitat, like those in the Hunter and Worimi Conservation Lands is highly important. This plan identifies (1) the actions to be taken to ensure that the Hunter Estuary and Worimi Conservation Lands remain intact and are improved as secure sites for migratory shorebird species, and (2) the stakeholders that will be involved in implementing those actions.

This Site Action Plan has been prepared by BirdLife Australia with support from Hunter Local Land Services (LLS) through funding from the Australian Government’s National Landcare Program as part of the regional project, *‘Improving Saltmarsh Habitat and Reducing Threats to the Eastern Curlew’*. All actions listed have been developed in consultation with ecologists and representatives from a wide range of groups including volunteers, community groups, academic researchers, and local government and non-government organisations through two local workshops. The plan has substantially drawn from and reflects local workshop outcomes and stakeholder ideas. This plan is supported by the Migratory Shorebird Conservation Action Plan (Weller and Lee 2017), which offers a framework for the conservation of migratory shorebirds that regularly visit Australia. The overall responsibility to implement the plan is not specific to one agency, group or organisation, and a cross collaborative and coordinated approach will be required to enact individual actions.

The main objective of the Hunter Estuary and Worimi Conservation Lands Shorebird Site Action Plan is to protect, conserve and improve key roosting and feeding habitat at each of these sites for long-term use by migratory shorebirds. The plan is structured around the following objectives:

- (1) monitor and increase knowledge of migratory shorebird populations;
- (2) reduce or eliminate human and introduced threats;
- (3) maintain and protect key habitat values;
- (4) develop fast tracked management responses; and
- (5) increase Communication, Education, Participation and Awareness (CEPA) programmes about migratory shorebird conservation.



Taking the actions proposed in this plan will help to improve the situation for migratory shorebirds in the Hunter Estuary and Worimi Conservation Lands through monitoring and research, on-ground activities, applied restriction measures, targeted pest control measures, education and volunteer programs, and regular review of the plan's efficacy.

Achieving the overall objectives outlined in this plan will help to secure the important role that these two sites and the people connected to them play in global shorebird conservation.

Introduction

Migratory Shorebirds

Migratory shorebirds are the world's most endangered group of bird species. They are often referred to as 'waders' because they are commonly found wading in the shallow waters of swamps, tidal mudflats and beaches to feed. Shorebirds are not seabirds. Unlike seabirds, they lack webbed feet and cannot land on water. They also have precocial young capable of feeding themselves on hatching.

In Australia, there are more than 50 species of shorebirds and 37 of them are migratory. Most migratory shorebirds make an annual return journey of up to 25,000 kilometres between their breeding grounds in the northern hemisphere and their non-breeding grounds in the southern hemisphere. Migratory flight paths are referred to as 'flyways'.

There are eight recognised flyways in the world:

- Pacific Americas
- Central Americas
- Atlantic Americas
- East Atlantic
- Black Sea-Mediterranean
- East Asia-Africa
- Central Asia
- East Asian-Australasian

Australia is part of the East Asian-Australasian Flyway (EAAF), which extends southwards from breeding grounds in the Russian tundra, Mongolia, and Alaska through east and south-east Asia, to non-breeding areas in Indonesia, Papua New Guinea, Australia and New Zealand.

BirdLife Australia's Shorebird Site Action Plans focus on the 37 migratory shorebird species belonging to the EAAF that regularly and predictably visit Australia during their non-breeding season and are thus listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as "migratory species". Thirty-six of these species breed in the northern hemisphere. Only the Double-banded plover (*Charadrius bicinctus*), breeds in New Zealand and migrates to south-eastern Australia during the Austral winter.

Australia's coastal and freshwater wetlands provide important habitat for shorebirds to rest and feed, enabling them to build the energy reserves required to travel the long distance (up to 13,000 kilometres) back to their breeding grounds. In the month or two before migrating, migratory shorebirds need to increase their body mass by up to 70 per cent to sustain their journey. After their first southward migration, juvenile birds often remain in Australia until they reach approximately two years of age when they embark on their first northward migration (Weller and Lee 2017).



On southward migration, shorebirds that migrate from the northern hemisphere reach ‘staging areas’, such as Roebuck Bay and Eighty-mile Beach in north-west Western Australia and the Gulf of Carpentaria in Queensland, by September. From these staging areas, the birds disperse across Australia, reaching the south-eastern states by October. Smaller flocks—cumulatively numbering thousands of birds—take advantage of ephemeral wetlands across inland Australia, while others spread along the coastline. Migratory shorebirds are often gregarious, gathering in mixed flocks, but also occur in single-species flocks or feed and roost with resident shorebird species such as stilts, avocets, oystercatchers, and plovers. By March, the birds that have previously dispersed across the country begin to gather at staging areas, once again forming large flocks and feeding virtually round the clock to accumulate the energy reserves that are required for their northward migration.

Shorebird Conservation Challenges

Across the globe, migratory shorebird populations are declining rapidly. In the EAAF, significant regional declines have been identified in at least 18 species (Hansen et al. 2016). In May 2015, Eastern Curlew (*Numenius madagascariensis*) and Curlew Sandpiper (*Calidris ferruginea*) were listed as Critically Endangered under the EPBC Act. In May 2016, Bar-tailed Godwit (spp. *menzbieri*) and Great Knot (*Calidris tenuirostris*) were listed as Critically Endangered, Red Knot (*Calidris canutus*) and Lesser Sand Plover (*Charadrius mongolus*) as Endangered and Bar-tailed Godwit (spp. *baueri*) and Greater Sand Plover (*Charadrius leschenaultia*) as Vulnerable.

*Note: While several species have two or more recognised subspecies or distinct populations in the EAAF, it is often difficult to identify different subspecies in the field (e.g. Bar-tailed Godwit [*Limosa lapponica*] ssp. *baueri* and *menzbieri*), which makes it very difficult to assign birds at a particular non-breeding site to the ‘population’ level. The Migratory Shorebird Conservation Action Plan (see below) and the associated Site Action Plans are therefore intended to be applied at the species level.*

Conservation of migratory shorebirds in the EAAF is a complex challenge involving a range of stakeholders across political boundaries, as well as cultural, economic, and social interests. Coastal development at staging and non-breeding grounds throughout Asia and Australia poses the most significant threat to the majority of the 37 species that regularly visit Australia. In the Yellow Sea - a bottleneck for migratory shorebirds on northward and southward migration - over 65 per cent of intertidal habitat has been lost over the past 50 years (Murray et al. 2014), significantly reducing the availability of feeding and roosting habitat for shorebirds. Other anthropogenic threats include climate change, pollution, human disturbance, hunting of shorebirds and shorebird prey, and fisheries by-catch.

Australia has implemented numerous measures domestically and with international partners to help support migratory shorebird populations and their habitats. These include:

- The EPBC Act, which includes four Matters of National Environmental Significance (i.e. migratory species, wetlands of international significance, threatened species and ecological communities and world heritage properties)
- The Wildlife Conservation Plan for Migratory Shorebirds (WCP)



- Conservation Advice for individually listed threatened species
- Bilateral migratory bird agreements with Japan (JAMBA), People's Republic of China (CAMBA) and the Republic of Korea (ROKAMBA)
- Party to international conventions including the Convention on the Conservation of Migratory Species of Wild Animals (CMS, Bonn Convention), the Ramsar Convention on Wetlands of International Importance and the Convention on Biological Diversity (CBD)
- The East Asian-Australasian Flyway Partnership (EAAFP), including relevant working groups and task forces (Shorebird Working Group, Monitoring Task Force, Far Eastern Curlew Task Force, Yellow-Sea Ecoregion Task Force) and a network of Flyway Network Sites (FNS)

The above agreements aim to conserve migratory shorebirds as an integral part of our ecosystems, to stop their population decline, and reverse the continuing trend of habitat loss. Since this is a transboundary international challenge, it can succeed only by taking appropriate measures both within and beyond Australia's territorial boundaries.

At the national level, the EPBC Act provides a framework for the protection of migratory shorebird species. The WCP lists all the high and very high priority actions and threatening processes relevant to migratory shorebirds in the EAAF. To ensure that the actions are implemented, the Australian National Migratory Shorebird Conservation Action Plan (MS CAP) has been developed as an extension of the WCP by a broad range of stakeholders who are working in shorebird conservation and management across Australia and the EAAF. Led by BirdLife Australia, stakeholders of the MS CAP have developed detailed plans, identified key delivery partners, resourcing opportunities, funding requirements and challenges across four strategies from the WCP:

1. Protection of important habitats throughout the EAAF.
2. Wetland habitats in Australia are protected and conserved.
3. Anthropogenic threats are minimised or eliminated.
4. Knowledge gaps in Australia are identified.

The implementation of the MS CAP is overseen by a Steering Committee made up of representatives from Commonwealth and State Governments, academic institutions, and key conservation bodies.

Important habitats in Australia for migratory shorebirds under the EPBC Act include those recognised as internationally or nationally important (see WCP strategy 1. above). The widely accepted and applied approach to identifying internationally important shorebird habitat is based on the criteria adopted from the Ramsar Convention. Further assistance in identifying important habitats and survey guidelines for migratory shorebirds is available in the EPBC Act and is also reiterated in the revised Wildlife Conservation Plan for Migratory Shorebirds. Currently, a site is considered of international importance for migratory shorebirds if it:

- meets or exceeds a threshold of 1% of the total Flyway population for a single species OR
- supports a total abundance of at least 20,000 shorebirds in any one survey

and considered of national importance if it:

- meets or exceeds a threshold of 0.1% of the total Flyway population for a single species OR

- supports a total abundance of at least 2,000 shorebirds in any one survey OR
- regularly supports more than 15 species of migratory shorebirds ([Appendix A](#), Commonwealth of Australia 2015a).

Sites are assessed using these criteria based on revised Flyway population estimates from Hansen *et al.* 2016. A list of Australian habitats that meet international or national significance criteria have been compiled in the National Directory of Important Migratory Shorebird Habitat. Using the Directory as a starting point, BirdLife Australia has selected a list of key sites in each state for the development of Site Action Plans. The aim of these SAPs will be to identify and implement priority actions outlined in the MS CAP that are relevant at a local level. This means high impact actions can be prioritised and fast-tracked for implementation specific to the important shorebird site in question. The steps in the SAP process are outlined in **Figure 1** below.



Figure 1. Steps in the Site Action Planning process from data collection to implementation at the local level.

Threats

In Australia and the EAAF, many of the current threats are linked to the changing availability of i) stopover sites during migration, ii) breeding habitat and iii) over-wintering sites in non-breeding



locations for immature and other birds that decide not to migrate (MacKinnon et al. 2012). The loss of key locations at any point on the migratory pathway will have significant consequences for several species. In a global review, Sutherland et al. (2012) identify 45 threats facing shorebird populations, including stochastic events, anthropogenic threats, climate change and microplastics.

Key threats to the migration and survival of Australian migratory shorebirds are identified and detailed in the WCP and in the MS CAP, and briefly listed here:

- Habitat Loss
 - Infrastructure / coastal development in Australia
 - Infrastructure /coastal development in staging and stop-over areas, particularly the Yellow Sea
- Habitat Modification
 - Chronic Pollution
 - Acute Pollution
 - Invasive Species
 - Altered Hydrological Regimes
- Anthropogenic disturbance
- Climate change and sea level rise
- Harvesting of shorebird prey
- Fisheries by-catch
- Hunting

The list is not exhaustive but identifies the main threats that are likely to affect shorebird populations significantly and adversely. Additionally, several issues that have indirect but negative effects on migratory shorebird populations include:

- Lack of data sharing and availability
- Limited scientific knowledge
- Lack of coordinated management at and across important habitat sites

The Site Action Planning process identifies and provides strategies for eliminating threats and issues from the above list at the local level for important shorebird habitats.

Why conserve shorebirds?

Shorebirds are one of the most mobile groups of animals on the planet and many species have high site fidelity. Their unique natural history attracts and inspires us but also makes these species vulnerable to natural and human-caused perturbations. Recent and future changes to wetland, grassland, beach, and tundra habitats require us to act now. Shorebirds are a visible component of fully functioning ecosystems, which can positively affect human health. Functional grasslands, wetlands, mangroves and estuarine habitats provide livelihoods for people and ecosystem services such as water filtration, flood protection and shoreline stabilisation. Shorebirds can serve as sentinels to changes in the environment—changes, such as climate variability that will ultimately affect human



lives. The stories of shorebirds and experiences of seeing these remarkable creatures in their natural environment fulfil human emotional, intellectual and spiritual needs, and it is no surprise that people from around the world gather at critical wetlands to watch the great spectacle of shorebird migration. Indeed, festivals celebrating the return of the shorebirds now make important contributions to the economies of many communities. For all these reasons, shorebirds need and deserve our attention, and it is only through a flyway-scale approach that we can ensure that a world with shorebirds is passed on to posterity undiminished in value.



Figure 2. Aerial photo of mangrove forests looking across Fullerton Cove in the Hunter Estuary towards Worimi Conservation Lands. *Credit: Doug Beckers*

Hunter Estuary & Worimi Conservation Lands Shorebird Site Action Plan

Site descriptions

Hunter Estuary

The Hunter Estuary is a wave-dominated barrier estuary located within the Sydney Basin Bioregion, formed by the deposition of sediments in swamps and mudflats lying between the inner and outer coastal barrier sands (Weller et al. 2019, NPWS 2020) (**Figure 3**). Within the estuary, the Hunter River supports over 19km² of mangroves and 5km² of saltmarsh (Creese et al. 2009). The Hunter Estuary shorebird area incorporates a BirdLife Important Bird Area (8543 Ha) that encompasses the Hunter Wetlands National Park and adjacent Ramsar site, as well as both the north and south channels of the Hunter River extending to the river mouth and along the beachfront (Weller et al. 2019). Within the Hunter Estuary shorebird area are 37 count areas, which include the internationally and nationally important wetlands of Hexham Swamp, Hunter Wetlands Centre Australia, Fullerton Cove, Ash Island, Tomago, Stockton Sandspit and Kooragang Dykes.

Most of the Hunter Estuary shorebird area falls within the boundary of the Hunter Wetlands National Park (NP), which is managed by the NSW National Parks and Wildlife Service (NPWS). Migratory shorebird conservation was a primary reason for the gazettal of Hunter Wetlands National Park in 2007 and its conservation values are protected under the *NSW National Parks and Wildlife Act (1974)*. The Hunter Estuary shorebird area is also located within the areas of the Awabakal and Worimi local Aboriginal Land Councils.



Figure 3. Map of the Hunter Estuary from BirdLife Australia’s Directory of Important Migratory Shorebird Habitat.



This unique mosaic of wetlands supports:

- internationally significant populations of Sharp-tailed Sandpiper (*Calidris acuminata*), Eastern Curlew (*Numeniensis madagascariensis*) and Red Knot (*Calidris canutus*);
- nationally significant populations of Bar-tailed Godwit (*Limosa lapponica*), Curlew Sandpiper (*Calidris ferruginea*), Pacific Golden Plover (*Pluvius fulva*), Black-tailed Godwit (*Limosa limosa*), Marsh Sandpiper (*Tringa stagnatilis*), Common Greenshank (*Tringa nebularia*), Whimbrel (*Numenius phaeopus*), Latham’s Snipe (*Gallinago hardwickii*) and Double-banded Plover (*Charadrius bicinctus*) (Table 1, see [Appendix A](#) for count data)

Table 1. State and Commonwealth conservation status of internationally and nationally significant migratory shorebird species in the Hunter Estuary.

Species	NSW Conservation Status	Commonwealth EPBC Conservation Status
Eastern Curlew <i>Numeniensis madagascariensis</i>	Not listed	Critically endangered
Red Knot <i>Calidris canutus</i>	Not listed	Endangered
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Curlew Sandpiper <i>Calidris ferruginea</i>	Endangered	Critically endangered
Pacific Golden Plover <i>Pluvius fulva</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Black-tailed Godwit <i>Limosa limosa</i>	Vulnerable	Migratory (CAMBA, JAMBA, ROKAMBA)
Marsh Sandpiper <i>Tringa stagnatilis</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Common Greenshank <i>Tringa</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Whimbrel <i>Numeniensis phaeopus</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)



Latham's Snipe <i>Gallinago hardwickii</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Double-banded Plover <i>Charadrius bicinctus</i>	Not listed	Migratory

Adjacent to the Hunter Estuary shorebird area is the city of Newcastle, home to the world's busiest coal port and one of the fastest growing regional cities in Australia. As such, land use surrounding the wetlands is a mix of industrial, residential and agricultural. Important vegetation and habitat types in the Hunter Estuary shorebird area include:

- Coastal saltmarsh
- Mangrove forest
- *Casuarina* and *Melaleuca* swamp forest
- Inter-tidal mudflats
- Sandy beaches
- Standing open water
- Rock training walls

Shorebird and waterbird monitoring at this site have been undertaken in the past by the AWSG. Monthly surveys of the Hunter Estuary are currently undertaken by the Hunter Bird Observers Club (HBOC) as part of BirdLife Australia's National Shorebird Monitoring Program.

Worimi Conservation Lands

The Worimi Conservation Lands (WCL) lie at the south-edge of the NSW North Coast Bioregion and within the Karuah Manning biogeographic sub-region. The WCL comprise a 25.5 kilometre stretch of coastline along Stockton Bight between Fern Bay immediately north of the Hunter River, to Anna Bay just south of Port Stephens (WCL Plan of Management, 2015) (**Figure 4**). The site makes up the outer barrier of the Stockton Bight Barrier System; a live dune system recognised as internationally significant. The Worimi Conservation Lands are owned by the Worimi Registered Owners and leased to the NSW government (NPWS) to be jointly managed with the Registered Owners through the WCL Board of Management.

The Worimi Conservation Lands cover 4029 hectares comprising 1812 hectares of national park, 881 hectares of state conservation area and 1336 hectares of regional park (WCL Plan of Management, 2015).



Figure 4. Map of the Worimi Conservation Lands from BirdLife Australia’s Directory of Important Migratory Shorebird Habitat.

This unique coastal dune system supports:

- nationally significant populations of Double-banded Plover (*Charadrius bicinctus*) and Pacific Golden Plover (*Pluvius fulva*) (**Table 2**, see [Appendix A](#) for count data)
- a breeding colony of Little Tern (*Sterna albifrons*), listed as endangered in NSW



Table 2. State and Commonwealth conservation status of nationally significant migratory shorebird species in the Worimi Conservation Lands.

Species	NSW Conservation Status	Commonwealth Conservation Status
Pacific Golden Plover <i>Pluvius fulva</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Double-banded Plover <i>Charadrius bicinctus</i>	Not listed	Migratory
Little Tern <i>Sterna albifrons</i>	Endangered	Marine and migratory (CAMBA, JAMBA, ROKAMBA)

Surveys of the area have been undertaken once a month by rangers from NPWS and the HBOC since 2009. These surveys have shown Worimi Conservation Lands to be one of the most important sites in NSW for Double-banded Plover, which is the most numerous migratory shorebird species at the site. WCL is also an important site for the resident shorebird species, Red-capped Plover (*Charadrius ruficapillus*), Pied Oystercatcher (*Haematopus longirostris*) and migratory species, Little Tern (*Sterna albifrons*), the latter two of which are both listed as endangered in NSW and have breeding colonies on WCL (Lindsey and Newman 2014).



Overview of objectives

The Hunter Estuary and Worimi Conservation Lands Site Action Plan aims to ensure that these three sites remain available and their habitat features are improved as roosting and feeding sites for migratory shorebirds over the long-term. This will be achieved by implementing the actions set out in this Site Action Plan that minimise threats through implementing an on-ground focused management plan and increasing public awareness.

This Site Action Plan sets out the following objectives to protect the roosting and feeding habitat of migratory shorebirds in the Hunter Estuary and Worimi Conservation Lands:

- (1) monitor and increase knowledge of migratory shorebird populations;
- (2) reduce, or eliminate human and introduced threats;
- (3) maintain and protect key habitat values;
- (4) develop fast-tracked management responses;
- (5) increase Communication, Education, Participation and Awareness Programme about migratory shorebird conservation.

Under each objective, a list of strategies, issues and their corresponding actions and intended outcomes are provided. These actions will be implemented by various key stakeholders through the formation of two working groups (see [Appendix C](#) for list of stakeholders).

Note: We acknowledge that Hunter Estuary and Worimi Conservation Lands support a wide diversity of resident shorebirds and waterbirds, many of which rely on these sites for critical breeding habitat. Although some of the objectives outlined in this plan will benefit resident shorebirds and waterbirds, resident species may require additional management actions, particularly where nesting birds are concerned.

Action prioritisation

Actions identified for the Shorebird Site Action Plan for the Hunter Estuary and Worimi Conservation Lands are described below. It should be noted that some of the objectives are planned for long-term and may only be achieved over several years post-publication and implementation of the Site Action Plan. Some of the objectives are planned for short-term and require fast-tracked actions that aim to be achieved in the first wintering season post-publication of the Site Action Plan. The actions are also listed separately according to priority ranking in a table at the end of the 'Objectives, Strategies & Actions' section. Priorities assigned to actions should be interpreted as follows:

Priority high: Taking prompt action is necessary to mitigate key threats to migratory shorebirds.

Priority medium: Taking action is desired for the long-term management and protection of migratory shorebirds.

Priority low: Taking action is desirable, but not critical to the management of the migratory shorebirds.



Objectives, strategies & actions – Hunter Estuary & Worimi Conservation Lands

Objective 1: Monitor and increase knowledge of migratory shorebird populations

1.1 STRATEGY: Increase scientific knowledge about migratory shorebirds in the Hunter Estuary and Worimi Conservation Lands

Conservation efforts to appropriately manage habitats and mitigate threats facing shorebirds are often hampered by significant knowledge gaps in shorebird ecology. For example, there are significant parts of northern and inland Australia that have either insufficient data for conservation purposes or have not been surveyed at all.

Standardised monitoring is the core activity for comprehensive understanding of seasonal migratory shorebird demographics at important feeding and roosting sites. Furthermore, the data collected are the foundation of research that is crucial for increasing the currently limited scientific knowledge about migratory shorebirds. Without comprehensive baseline knowledge specific to important sites, it will not be possible to assess the ongoing health of migratory shorebird populations.

Knowledge gaps relevant to migratory shorebird conservation in the Hunter Estuary and Worimi Conservation Lands need to be identified to inform avenues for future research. Key knowledge gaps identified through this Site Action Plan process and its consultations include:

- Lack of data on the movement of shorebirds within the estuary and exchange with other shorebird sites in NSW during and outside of migration periods. Current survey methods do not provide evidence of interchange.
- Limited knowledge of roosting and feeding sites, particularly night-time roosting, and greater knowledge of daytime roosting sites than feeding sites. Current survey methods are constrained by daylight hours, tides and access (i.e. access to feeding sites around Fullerton Cove requires use of a hydrofoil; access to areas behind the sand dunes on Worimi Conservation Lands is restricted to prevent damage to cultural sites). Ideally survey areas would be expanded to include these areas to increase our understanding of interspecific differences in day- and night-time roosting and feeding locations, and behavioural ecology but would need to be done so in consultation with the WCL Board of Management..
- Current surveys target *known* shorebird roosting and feeding sites. New shorebird sites are appearing west of Hexham Swamp, which raises questions regarding habitat quality and trophic value and whether all shorebird areas have been identified.
- Lack of understanding of the diversity of feeding needs across species and the resource limitations at each site. Need to measure diversity, quality and quantity of benthic and aquatic fauna and feeding substrate, including a comparative analysis of long-established shorebird feeding areas, and areas to which tidal regimes have been restored to estimate the efficacy of rehabilitation (i.e. Hexham Swamp, Tomago Wetlands, Ash Island and Stockton



Sandspit). Need to gain knowledge of inter-species variation in feeding substrate, feeding zone relative to water level, diet selection, and feeding behaviours to measure exploitation of different niches within the same habitat and predict which species will be impacted more negatively by beach erosion and sea level rise.

- Limited knowledge of the impacts of predation and predation rates. Presence of predators is known but not the extent and intensity of predation on migratory shorebirds.
- Lack of data on the levels of different types of human disturbance and the response of migratory shorebirds to these disturbances at different times of the year.
- Limited understanding of how saltwater inundation due to climate change induced sea level rise will affect existing shorebird feeding and roosting habitats, and whether some species will be more affected than others due to, for example, more specialised feeding and roosting needs. Need to undertake climate change modelling specific to migratory shorebird to predict habitat migration and transition and identify priority areas for future planning measures.

1.1.1 ACTIONS

1. Continue monthly surveys of Hunter Estuary and Worimi Conservation Lands.
Priority: high
2. Consult with the Worimi Board of Management and collaborate with NPWS rangers to explore potential to expand current surveys along the beachfront of Worimi Conservation Lands to include the area behind the sand dunes. Investigate potential to conduct these surveys using alternative less-invasive technologies, such as drones.
Priority: high
3. Develop a hub to facilitate information and data sharing between stakeholders, reporting of events, and sharing of resources and educational materials used for community engagement and shorebird management to motivate conscientious social behaviour change toward shorebirds.
Priority: high
4. Undertake research into spatial and temporal distribution of interspecific shorebird foraging and roosting behaviour using camera traps and MOTUS radio telemetry. Compare these data with sites in Port Stephens and Manning River Estuary.
Priority: high
5. Undertake a substrate analysis and explore opportunity to expand data on movement, feeding and roosting behaviour to using stable isotopes to track predator-prey dynamics to ensure the Hunter Estuary meets and supports the needs of a diverse range of species. Compare these data with sites in Port Stephens and



Manning River Estuary.

Priority: high

6. Trial use of a drone in collaboration with existing/planned Australasian Bittern survey initiatives to survey difficult to access areas of Hexham Swamp.

Priority: high

7. Identify and quantify levels of disturbance of and threats to shorebirds at roosting and foraging sites.

Priority: high

8. Collaborate with researchers to update existing forecast maps of potential changes to mudflat, saltmarsh and mangrove habitat distributions due to climate change induced sea level rise.

Priority: medium

1.2 STRATEGY: Recruit and train a diverse range of shorebird monitoring participants

Standardised monitoring of shorebirds can be complicated and requires a high level of expertise. Engaged volunteers are crucial for current monitoring efforts through Birdlife Australia's National Shorebird Monitoring Program. However, there is a need ensure survey participants are adequately trained in shorebird identification and data collection, including the use of equipment and relevant technology. There is also a need for volunteers to be from a range of backgrounds, fitness levels and abilities, and to be available during survey periods.

Volunteers from the HBOC currently coordinate monthly surveys of the Hunter Estuary, preferably on the same day at all count areas at high tide. Worimi rangers initiated surveys of the Worimi Conservation Lands beachfront in 2008 and have collaborated with the HBOC to conduct monthly surveys since 2008. NPWS provide access to 4WD vehicles to conduct these beachfront surveys. However, the number of sites that need monitoring is growing. The HBOC do not actively recruit volunteers and although initial interest is high, retention rates are low, and monitoring relies on long-term volunteers to donate their spare time.

1.2.1 ACTIONS

1. Provision of shorebird identification and monitoring workshops run by a paid professional for local communities, including Indigenous communities.

Priority: high

2. Continue to support HBOC's ongoing monthly migratory shorebird monitoring through Birdlife Australia's National Migratory Shorebird Monitoring Program.

Priority: medium



3. Engage a regional (and NSW state-wide if possible) 'Shorebird Monitoring and Community Engagement Coordinator' to ensure consistent data collection is undertaken for migratory and beach-nesting shorebirds at key estuaries across NSW including the training of volunteers and set up of standardised monitoring regimes.
Priority: medium
4. Hold two training workshops yearly to recruit new volunteers/counters into the monitoring program (run one beginner, general introduction workshop for recruiting new bird counters and one advanced bird identification workshop for current bird counters). As part of these workshops, encourage data sharing and increase the capacity of current volunteers to enter data into BirdLife's online data portal, Birdata, and to collect additional data on threats to migratory shorebirds.
Priority: medium
5. Increase support for current volunteers to mentor new ones through increased communication with BirdLife's Migratory Shorebird Team, and the creation and sharing of specialised outreach materials.
Priority: medium
6. Secure funding for procuring shorebird survey equipment (i.e. telescopes, binoculars) and develop a procedure to lend this equipment to volunteers during surveys and retrieve it from them afterwards.
Priority: medium
7. Continue data sharing agreement between the HBOC and BirdLife Australia to manage survey data.
Priority: medium
8. Reach out to members of stakeholder groups to participate in surveys and university students. Promote volunteering and Work Integrated Learning (WIL) opportunities through existing stakeholder community engagement programs.
Priority: low

1.3 Outcomes

- The number of shorebird counters from the local community has increased through growing involvement in BirdLife Australia's National Shorebird Monitoring Program in the Hunter Estuary and Worimi Conservation Lands.



- Monthly shorebird counts continue and data are uploaded into Birdata. The number of survey areas increases through the adoption of new survey methods (i.e. drones and radio telemetry).
- A comprehensive understanding of shorebird behavioural and foraging ecology and their habitat is achieved, and findings are made accessible to all stakeholders.
- There is a commitment to ongoing data collection to address research needs as they arise. Scientific research is obtained and applied to support the policy and management of the site.
- Data sharing is increased between researchers and managers to ensure that critical uncertainties that are preventing appropriate intervention are addressed.
- Mapping is produced to track the effect of actions and document outcomes.



Objective 2: Reduce, or eliminate human and introduced threats

2.1 STRATEGY: Reduce impacts from human disturbance

Recreational use of the Hunter Estuary and Worimi Conservation Lands varies across different areas within each site and at different times of the year. The highest visitation rates occur at Worimi Conservation Lands during peak holiday periods and Stockton Sandspit / Kooragang Dykes. Activities with the potential to cause disturbance to roosting and feeding migratory and resident shorebirds within the Hunter Estuary and Worimi Conservation Lands are as follows:

Ash Island: Recreational fishing, boating, illegal access of 4WDs on saltmarsh, wildfires.

Hexham Swamp: Low-level flying recreational aircraft (i.e. microlights, ultralights, gyrocopters, paramotors), tyre pollution, proposed cycleway.

Stockton Sandspit / Kooragang Dykes: Recreational fishing, boating, pipi collectors and yabby pumpers, birdwatchers / photographers, kayaks, illegal vehicle access, overflying aircraft.

Tomago Wetlands: Military and commercial aircraft flying overhead from nearby Williamstown and RAAF base.

Worimi Conservation Lands: Quad bikes in recreational vehicle access (RVA) areas (Lavis Lane to southern boundary) and 4WDs on the beachfront and in RVA areas, people walking, dogs off leash, swimming, horse riding, kite surfing, recreational fishing, camping. Arboreal Stockton sand dredging facility is also in an area where Little Terns have bred successfully in previous years.

Ash, Island, Hexham Swamp, Stockton Sandspit, Kooragang Dykes and Tomago Wetlands all fall within the boundary of Hunter Wetlands National Park. Therefore, any actions within these areas need to be consistent with the Hunter Wetlands National Park Plan of Management. Additionally, any actions within the Worimi Conservation Lands need to be in line with the Worimi Conservation Lands Plan of Management and undertaken in consultation with the Worimi Conservation Lands Board of Management (see [Appendix B](#) for full list of relevant management plans).

2.1.1 ACTIONS

Priority: high

1. Continue to manage impacts of quad bikes and 4WDs on dune erosion with fencing and vegetation rehabilitation on Worimi Conservation Lands.

Priority: high

2. Consult with the Worimi Conservation Lands Board of Management to increase signage on Worimi Conservation Lands to raise awareness of the impacts of discarded fishing line on shorebirds. Install specialised bins for fishing gear to be safely disposed of.

Priority: high



3. Continue to install fencing to protect Little Terns on Worimi Conservation Lands during the breeding season.
Priority: high
4. Continue current management strategies and compliance measures in the Hunter Estuary outlined in the Hunter Wetlands National Park Plan of Management.
Priority: medium
5. Consult with NPWS to explore potential to increase shorebird signage at Stockton Sandspit and Kooragang Dykes to notify waterway users to maintain their distance, and at Stony Point to facilitate compliance for dogs off leash.
Priority: medium
6. Continue public education program to manage people traffic at Stockton Sandspit led by NPWS. Organise a community walk and talk session to educate locals and visitors about maintaining their distance from roosting and feeding shorebirds.
Priority: medium
7. Consult with the Worimi LALC and Worimi Conservation Lands Board of Management for access to Worimi LALC lands from the beachfront to expand current survey area to include the lagoon in the Tongue.
Priority: medium
8. Source funding to support a regular Dog's Breakfast event during peak times of the year at the northern end of WCL and Stockton Sandspit to educate beach goers about the importance of keeping their dog on a leash to minimise disturbance to shorebirds.
Priority: medium
9. Expand Discovery Rangers program in Port Stephens to include the Hunter Estuary and incorporate migratory shorebirds. Explore potential to include migratory shorebirds as part of the online educational package 'Animals in Your Backyard' created by HLLS.
Priority: low
10. Continue to consult with the owner of Smithy's property to discuss aircraft disturbance and removal of tyres on property.
Priority: low
11. Engage with 4WD clubs to educate 4WD users about the importance of protecting migratory shorebird habitats as part of driver training activities. Provide information on shorebirds at point of sale for beach permits to 4WD users.
Priority: low



12. Continue to monitor impacts of sand dredging facility on Little Tern breeding attempts.
Manage as necessary.
Priority: low

2.2 STRATEGY: Reduce impacts from pest animals

Pest plant and animal species present a threat to shorebirds through habitat modification, disturbance and possible predation. The pest animal species most prevalent all throughout the Hunter Estuary and on Worimi Conservation Lands are feral cats (*Felix catus*) and the European red fox (*Vulpes vulpes*). European rabbits (*Oryctolagus cuniculus*) are also an issue on Ash Island and Tomago Wetlands, wild dogs and Sambar deer (*Rusa unicolor*) on Tomago Wetlands, and domestic cattle at Tomago Wetlands and Hexham Swamp. To date, there is insufficient evidence on predation impacts of these species on shorebirds. Fox baiting has been sporadic and limited by funding in the Hunter Estuary.

Wild dogs are also an issue on Worimi Conservation Lands. However, there is also concern of having negative impacts on native dingo populations. A baiting program for wild dogs and foxes is currently implemented at the northern end of Worimi Conservation Lands with potential for fox baiting at the southern end where there is a dog exclusion zone. Fox baiting programs in this area need to consider domestic dogs from nearby Fern Bay and Fern Bay Seaside Village Estate.

2.2.1 ACTIONS

1. Investigate impacts of foxes, cats and wild dogs at shorebird feeding and roosting sites through the use of camera traps and MOTUS radio telemetry tracking. Collaborate with planned Australasian Bittern project activities and NPWS to achieve these aims and share data. Use these data to support long-term baiting programs if found necessary.
Priority: medium
2. Continue exclusion control measures for deer and cattle at Tomago wetlands to protect saltmarsh habitat.
Priority: medium
3. Continue wild dog baiting program on Worimi Conservation Lands and explore potential to include fox baiting at the southern end of the site.
Priority: medium

2.3 STRATEGY: Minimise impact of vegetation encroachment

The Hunter Estuary wetlands are a dynamic, constantly changing system comprising a mosaic of habitats including mangroves, saltmarsh, open water, mudflats and *Phragmites*. This mosaic varies



with tides, weather (e.g. rainfall, flooding, drought, climate change), geophysical factors (e.g. erosion, subsidence, sea level rise) and land use (draining, filling and dredging).

Mangrove encroachment is an ongoing problem for the maintenance of migratory shorebird habitat in the Hunter Estuary. The HBOC have been working with DPI Fisheries and NPWS since 2002 to undertake regular mangrove removal to maintain mangrove-free roosting and feeding areas for shorebirds within the Hunter Estuary under a DPI Fisheries permit. The current permit (valid until June 2025 at the time of this plan development) allows the removal of up to 450Ha of mangroves on Ash Island, Stockton Sandspit, Tomago Wetlands and areas near the entrance to Fullerton Cove and Kooragang Dykes.

Other plant species of concern as their presence could result in less available habitat for shorebirds to feed and roost include native *Phragmites australis* in Hexham Swamp, and exotics groundsel bush (*Baccharis halimifolia*), pampas grass (*Cortaderia selloana*) and Spiny rush (*Juncus acutus*). A large area of *Phragmites* is expected to be retained naturally in the west of Hexham Swamp due to freshwater inputs and elevation and provides important habitat for Australasian Bittern (*Botaurus poiciloptilus*). Elsewhere, *Phragmites* is in decline and expected to continue to slowly reduce. Results of bird monitoring at Hexham Swamp are overall positive with the creation of estuarine conditions, tidal mudflats and standing pools of water providing valuable habitat that complements the foraging and roosting areas at Fullerton Cove, Stockton Sandspit and Ramsar wetlands on Ash Island within the Hunter Estuary (HLLS in prep).

2.3.1 ACTIONS

Priority: high

1. Continue collaboration between NPWS, DPI Fisheries and the HBOC to manage mangrove encroachment in the Hunter Estuary within saltmarsh and other known mudflats.

Priority: high

2.4. Outcomes

- Disturbance to migratory shorebirds is minimised through the assessment and ongoing monitoring of recreational activities and implementation of a community engagement and compliance program.
- Impacts of predation from foxes, cats and wild dogs on migratory shorebirds are understood and a control program put in place where needed if necessary using a cross-tenure multi-agency approach. Baiting on Worimi Conservation Lands is continued, and the impacts of wild dogs and foxes are minimised and where possible, eliminated.
- Vegetation encroachment is managed, and areas of open water for feeding and roosting are maintained or increase in extent.



Objective 3: Maintain and protect key habitat values

3.1 STRATEGY: Improve and monitor hydrological regimes

The Hunter Estuary has a long history of altered hydrological regimes due to the presence of heavy industry, agriculture and residential development. Tidal water flows at Hexham Swamp have been reinstated following the sequential reopening of flood gates between 2009-2013. This has seen large areas of saltmarsh rehabilitated. Saltmarsh at Tomago Wetlands has also been restored following the installation of smart gates to reinstate tidal flushing in 2012. However, opening of these gates has been intermittently interrupted due to complaints from adjacent private land holders of salt water on their property. Large increases in the numbers of Sharp-tailed Sandpiper, a feeding generalist, have coincided with the regulation of these tidal regimes. It is unknown why more specialised species are rarely sighted. Conversely, a lack of drainage has been identified as an issue at Deep Pond, Pambalong Nature Reserve and Market Swamp, which has resulted in the abatement of muddy edges where shorebirds like to feed. More evidence is needed regarding nutrient run-off and pollution to determine if there are detrimental effects to shorebirds at key feeding and roosting sites in the Hunter.

On Worimi Conservation Lands, the main threat for shorebirds is from storm events, which lead to beach erosion and large amounts of rubbish washing up on the beach.

3.1.1 ACTIONS

1. Investigate areas that can be set aside for conservation of saltmarsh through acquisition, incentives to modify title, conversion to saltmarsh, fencing, weed removal and other tools.
Priority: high
2. Continue to support private land holders to minimise the amount of nutrient and sediment runoff flowing into waterways from their properties (i.e. fencing, grazing practices, effluent and drainage management, bank erosion protection) and protect shorebird saltmarsh feeding areas from grazing following spiny rush removal.
Priority: high
3. Undertake a comparative analysis of shorebird prey diversity and quality in restored versus long established feeding areas to understand the effects of tidal restoration on shorebird populations and behaviour.
Priority: high
4. Restore drainage at Market Swamp by opening a culvert under the railway line. Explore options to improve drainage at Deep Pond and Pambalong Nature Reserve.
Priority: medium



5. Encourage private land holders and community groups to monitor shorebirds on their property through inclusion in shorebird training and monitoring workshops.
Priority: medium
6. Continue marine debris clean-up activities in the Hunter Estuary and Worimi Conservation Lands. Explore opportunity to collaborate with community organisations and not-for-profits and continue to engage Local Aboriginal Land Councils or indigenous groups to achieve this work.
Priority: medium
7. Explore potential to collaborate with researchers to measure nutrient run-off in Fullerton Cove and potential impacts on invertebrate fauna.
Priority: low

3.2 STRATEGY: Future planning for potential impacts of climate change

Climate change has the potential to affect migratory shorebirds and their habitats by reducing the extent of coastal and inland wetlands. Climate change projections for Australia suggest likely increased temperatures, rising sea levels and an overall drying trend for much of the continent, together with more frequent and/or intense extreme climate events resulting in likely species loss and habitat degradation. Climate change modelling has been done for parts of the Hunter Estuary by the UNSW Water Research Lab, DPI Fisheries, University of Newcastle and the Hunter Valley Flood Mitigation Scheme. However, there is limited understanding of how climate change will affect migratory shorebirds in the Hunter Estuary and Worimi Conservation Lands. Expected impacts include changes to erosion and sedimentation due to sea level rise, and limited range for shorebird habitat migration.

3.2.1 ACTIONS

1. Continue to investigate plots of lands around existing park estates at Tomago and Hexham Swamp that could be purchased by NPWS to add to Hunter Wetlands National Park to anticipate future sea level rise.
Priority: high
2. Create a repository of all climate change mapping and modelling of the Hunter Estuary and Worimi Conservation Lands to prevent duplication of effort. Use mapping and modelling data to identify potential limits on habitat migration for coastal saltmarsh and intertidal mud flats due to residential, commercial and industrial infrastructure.
Priority: medium



3. Continue with current plans to modify and repair Kooragang Dykes to reduce the impact of climate change induced sea level rise.
Priority: medium

3.3 Outcomes

- A comprehensive understanding of how different water conditions affect migratory shorebird species has been reached. This information is accessed easily by different land managers.
- Marine debris is effectively managed at all sites and its impact on migratory shorebirds kept to a minimum.
- Shorebird roosting and feeding habitat is maximised for a diverse range of species and/or alternatives explored based on future climate change and sea level rise mapping and modelling of the estuary.
- Mapping tracks the change in area and function of migratory shorebird habitat relative to baseline data, SAP actions and prevailing conditions.



Objective 4: Develop fast tracked management responses

4.1. STRATEGY: Inclusion and coordination of stakeholders

A lack of coordination across responsible agencies can be a challenge for effective environmental management. Protection of migratory shorebirds and their habitat in the Hunter and Worimi Conservation Lands critically depends on support by all stakeholders and people using the area. Without support from the stakeholders involved managing the site and from the community of the locals, it will not be possible to protect migratory shorebirds at Hunter Estuary and Worimi Conservation Lands.

4.1.1 ACTIONS

1. Identify land authorities and owners, with emphasis on who has jurisdiction over each area.
Priority: high
2. Create an online hub to act as a centralised location for storing and disseminating information from the working group.
Priority: high
3. Establish separate working groups for the Hunter Estuary and Worimi Conservation Lands to oversee actions for migratory shorebirds from this plan modelled on Manning Beach Nesting Birds Working Group.
Priority: high
4. Ensure communications regarding shorebird monitoring, Little Tern breeding, and estuary management actions are distributed to all stakeholders, relevant private land holders and community groups through the working group once established.
Priority: medium
5. Ensure the protection of indigenous values in the area when undertaking any management actions for migratory shorebirds.
Priority: medium

4.2. STRATEGY: Identify and manage conflicts of land use

Activities associated with tourism, industry and recreation can all conflict with conservation objectives if they are not managed appropriately. Many conflicts occur because people are unaware that their activity is harmful to migratory shorebirds. Issues also occur because areas are zoned to keep different user groups apart, which can result in a larger area being impacted. In the Hunter Estuary, conflicts of land use associated with actions to improve migratory shorebird habitat have arisen with



landowners who perceive adjacent wetlands as putting their property at risk of inundation from stormwater and saline tidal flows. Objectives of industry also often conflict with shorebird conservation efforts. Northbank Enterprise Hub at Tomago currently has approval to fill floodplain adjacent to the Hunter Wetlands National Park and Port Waratah Coal Services offset land, which would be a suitable area for saltmarsh migration if development plans do not go ahead. There are also plans to remove Area-E on Ash Island from the industrial corridor and make it part of the National Park as part of the Hunter Wetlands National Park Plan of Management (NSW NPWS 2020). In Hexham Swamp, a development application was released for public comment in August 2020 for the construction of the Richmond Vale Rail Trail bicycle path, which may also cause an increase in disturbance to migratory shorebirds with increases in foot and bicycle traffic and presence of dogs ([link to application](#)).

4.2.1 ACTIONS

1. Continue to monitor the development of plans to move forward with building of the Richmond Vale Rail Trail through Hexham Swamp.
Priority: medium
2. Apply to extend the current boundaries of the Hunter Estuary Wetlands Ramsar site to include previously excluded lands set aside for industry that have not been developed with a focus on prioritising those that are shorebird habitat or can be restored as such.
Priority: medium

4.3 Outcomes

- Land managers and site boundaries are identified, and roles and responsibilities are agreed on.
- Communication and coordination of management actions is improved through the establishment of working groups made up of representatives from all stakeholder and community groups.
- Reduced resistance to the need for wetlands adjacent to private property.



Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation.

5.1. STRATEGY: Create and implement an effective CEPA strategy

Many threats to migratory shorebirds can be effectively address by raising awareness. To achieve this objective, a range of community education, participation and awareness (CEPA) activities will need to be implemented. Existing information about migratory shorebirds can be difficult to access and restricted to stakeholders with specialist knowledge. A community education program run collaboratively between NPWS, HLLS and Hunter Regional Landcare Network currently exists on the Hunter Estuary and extends into Worimi Conservation Lands, Port Stephens and Manning River Estuary. However, there is currently no strategic communication plan in place aimed specifically at migratory shorebirds in these areas. Additionally, a sister wetland affiliation was formed between the Kooragang Wetland and surrounding wetlands in the Hunter Estuary and wetlands in the Kushiro area of Japan (i.e. Kushiro-shitsugen, Akkeshi-ko and Bekanbeushi-shitsugen, and Kiritappu-shitsugen) in November 1994, which continues to focus on Latham’s Snipe.

5.1.1 ACTIONS

1. Develop a regional shorebirds communications strategy.
Priority: high
2. Use the working group and online hub as a means to compile and distribute existing education materials and create new ones to raise the profile of migratory shorebirds (e.g. distribution of Shorebird ID booklets to local schools, community groups and Council). Provide links to all of BirdLife’s resources on migratory and resident shorebirds, and waterbirds.
Priority: high
3. Continue the Discovery Ranger program for environmental education (linked to the school curriculum) in collaboration with the Hunter Wetlands Centre Australia and Wetlands and Awabakal Environmental Education Centre. Target caravan parks, tourist visitor centres and tourism bodies/destinations to reach visitors to the Hunter Estuary and Worimi Conservation Lands. Schools visit topics to include migratory as well as beach-nesting shorebirds.
Priority: medium
4. Utilise existing social media channels through the working group to develop and implement a targeted social media strategy to promote awareness of migratory shorebirds to visitors and residents of Hunter estuary and Worimi Conservation Lands.
Priority: medium



5. Explore opportunities for community shorebird events as part of ongoing Flyway efforts (e.g. Threatened Species Day, World Migratory Bird Day, sister schools / sister wetlands programs, Welcome/Farewell Shorebirds events, etc.).
Priority: low
6. Add information on migratory shorebirds to the existing communication products handed out to visitors to Worimi Conservation Lands.
Priority: low
7. Implement a training program for Landcare coastal groups and volunteers to become shorebird ambassadors through the National Shorebird Monitoring Program. Use existing outreach materials to engage beach goers.
Priority: low
8. Provide information on shorebirds at point of sale for beach permits to 4WD users and dog/cat registrations. Distribute information on the importance of keeping your dog on a leash for migratory shorebirds through vet clinics to pet owners (e.g. information postcards).
Priority: low
9. Build on existing sister wetlands connection with Japan for the EAAF in the Hunter Estuary to encompass all migratory shorebirds.
Priority: low

5.2 Outcomes

The following outcomes may indicate successful implementation:

- An effective community education and awareness program has been implemented. The program increases the level of general awareness about the importance of migratory shorebirds, as well as changes behaviour resulting in less disturbance to migratory shorebirds.



Summary of Key Knowledge Gaps – Hunter Estuary & Worimi Conservation Lands

Knowledge gaps relevant to migratory shorebird conservation in the Hunter Estuary and Worimi Conservation Lands need to be identified to inform avenues for future research. Key knowledge gaps identified through this Site Action Plan process and its consultations include:

- Lack of data on the movement of shorebirds within the estuary and exchange with other shorebird sites in NSW during and outside of migration periods. Current survey methods do not provide evidence of interchange.
- Limited knowledge of roosting and feeding sites, particularly night-time roosting. Greater knowledge of daytime roosting sites than feeding sites. Current survey methods are constrained by daylight hours, tides and access (i.e. access to feeding sites around Fullerton Cove requires use of a hydrofoil; access to areas behind the sand dunes on Worimi Conservation Lands is restricted to prevent damage to cultural sites). Ideally survey areas would be expanded to include these areas to increase our understanding of interspecific differences in day- and night-time roosting and feeding locations and behavioural ecology but would need to be done so in consultation with the WCL Board of Management.
- Current surveys target *known* shorebird roosting and feeding sites. New shorebird sites are appearing west of Hexham Swamp, which raises questions regarding habitat quality and trophic value and whether all shorebird areas have been identified.
- Lack of understanding of the diversity of feeding needs across species and the resource limitations at each site. Need to measure diversity, quality and quantity of benthic and aquatic fauna and feeding substrate, including a comparative analysis of long-established shorebird feeding areas, and areas to which tidal regimes have been restored to estimate the efficacy of rehabilitation (i.e. Hexham Swamp, Tomago Wetlands, Ash Island and Stockton Sandspit). Need to gain knowledge of inter-species variation in feeding substrate, feeding zone relative to water level, diet selection, and feeding behaviours to measure exploitation of different niches within the same habitat and predict which species will be impacted more negatively by beach erosion and sea level rise.
- Limited knowledge of the impacts of predation and predation rates. Presence of predators is known but not the extent and intensity of predation on migratory shorebirds.
- Lack of data on the levels of different types of human disturbance and the response of migratory shorebirds to these disturbances at different times of the year.
- Limited understanding of how saltwater inundation due to climate change induced sea level rise will affect existing shorebird feeding and roosting habitats, and whether some species will be more affected than others due to, for example, more specialised feeding and roosting needs. Need to undertake climate change modelling specific to migratory shorebird to predict habitat migration and transition and identify priority areas for future planning measures.



Summary of Actions – Hunter Estuary & Worimi Conservation Lands

Actions are listed under each priority level according to achievability score.

Priority is defined as: **high** = taking prompt action is necessary to mitigate key threats to migratory shorebirds; **medium** = taking action is desired for the long-term management and protection of migratory shorebirds; **low** = taking action is desirable, but not critical to the management of the migratory shorebirds.

Achievability is defined as: **most achievable** = low effort / low cost (dark blue); **moderately achievable** = low cost / high effort OR high cost / low effort (light blue); and **least achievable** = high cost / high effort (white).

High Priority

Objective	Action	Reference Link
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Continue monthly surveys of Hunter Estuary and Worimi Conservation Lands.	Action 1.1.1-1
	Consult with the Worimi Board of Management and collaborate with NPWS rangers to explore potential to expand current surveys along the beachfront of WCL to include the area behind the sand dunes. Explore potential to conduct these surveys using a drone.	Action 1.1.1-2
Objective 2: Reduce, or eliminate human and introduced threats	Continue collaboration between NPWS, DPI Fisheries and the HBOC to manage mangrove encroachment in the Hunter Estuary within saltmarsh and other known mudflats.	Action 2.3.1-1
Objective 4: Develop fast tracked management responses	Identify land authorities and owners, with emphasis on who has jurisdiction over each area.	Action 4.1.1-1
Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation	Use the working group and online hub as a means to compile and distribute existing education materials and create new ones to raise the profile of migratory shorebirds (e.g. distribution of Shorebird ID booklets to local schools, community groups and Council). Provide links to all of BirdLife’s resources on migratory and resident shorebirds, and waterbirds.	Action 5.1.1-2
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Develop a hub to facilitate information and data sharing between stakeholders, reporting of events, and sharing of resources and educational materials used for community engagement and shorebird management to motivate conscientious social behaviour change toward shorebirds.	Action 1.1.1-3
	Trial use of a drone in collaboration with existing/planned Australasian Bittern survey initiatives to survey difficult to access areas of Hexham Swamp.	Action 1.1.1-6
	Identify and quantify levels of disturbance of and threats to shorebirds at roosting and foraging sites.	Action 1.1.1-7
	Provision of shorebird identification and monitoring workshops run by a paid professional for local communities, including Indigenous communities.	Action 1.2.1-1
	Continue to manage impacts of quad bikes and 4WDs on dune erosion with fencing and vegetation rehabilitation on Worimi Conservation Lands.	Action 2.1.1-1



Objective 2: Reduce, or eliminate human and introduced threats	Consult with the Worimi Conservation Lands Board of Management to increase signage on Worimi Conservation Lands to raise awareness of the impacts of discarded fishing line on shorebirds. Install specialised bins for fishing gear to be safely disposed of.	Action 2.1.1-2
	Continue to install fencing to protect Little Terns on Worimi Conservation Lands during the breeding season.	Action 2.1.1-3
Objective 3: Maintain and protect key habitat values	Investigate areas that can be set aside for conservation of saltmarsh through acquisition, incentives to modify title, conversion to saltmarsh, fencing, weed removal and other tools.	Action 3.1.1-1
	Continue to support private land holders to minimise the amount of nutrient and sediment runoff flowing into waterways from their properties (i.e. fencing, grazing practices, effluent and drainage management, bank erosion protection) and protect shorebird saltmarsh feeding areas from grazing following spiny rush removal.	Action 3.1.1-2
	Undertake a comparative analysis of shorebird prey diversity and quality in restored versus long established feeding areas to understand the effects of tidal restoration on shorebird populations and behaviour.	Action 3.1.1-3
	Continue to investigate plots of lands around existing parks at Tomago and Hexham Swamp that could be purchased by NPWS to add to Hunter Wetlands National Park to anticipate future sea level rise.	Action 3.2.1-1
Objective 4: Develop fast tracked management responses	Create an online hub to act as a centralised location for storing and disseminating information from the working group.	Action 4.1.1-2
	Establish separate working groups for the Hunter Estuary and Worimi Conservation Lands to oversee actions for migratory shorebirds from this plan modelled on Manning BNB Working Group.	Action 4.1.1-3
Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation	Develop a regional shorebirds communications strategy.	Action 5.1.1-1
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Undertake research into spatial and temporal distribution of interspecific shorebird foraging and roosting behaviour through the use of camera traps and MOTUS radio telemetry. Compare these data with sites in Port Stephens and Manning River Estuary.	Action 1.1.1-4
	Undertake a substrate analysis and explore opportunity to expand data on movement, feeding and roosting behaviour to using stable isotopes to track predator-prey dynamics to ensure the Hunter Estuary meets and supports the needs of a diverse range of species. Compare these data with sites in Port Stephens and Manning River Estuary.	Action 1.1.1-5



Medium Priority

Objective	Action	Reference Link
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Continue to support HBOC's ongoing monthly migratory shorebird monitoring through Birdlife Australia's National Migratory Shorebird Monitoring Program.	Action 1.2.1-2
	Secure funding for procuring shorebird survey equipment (i.e. telescopes, binoculars) and develop a procedure to lend this equipment to volunteers during surveys and retrieve it from them afterwards.	Action 1.2.1-6
	Continue data sharing agreement between the HBOC and BirdLife Australia to manage survey data.	Action 1.2.1-7
Objective 2: Reduce, or eliminate human and introduced threats	Continue current management strategies and compliance measures in the Hunter Estuary outlined in the Hunter Wetlands National Park Plan of Management.	Action 2.1.1-4
	Consult with the Worimi LALC and Worimi Conservation Lands Board of Management for access to Worimi LALC lands from the beachfront to expand current survey area to include the lagoon in the Tongue.	Action 2.1.1-7
Objective 4: Develop fast tracked management responses	Ensure communications regarding shorebird monitoring, Little Tern breeding, and estuary management actions are distributed to all stakeholders, relevant private land holders and community groups through the working group once established.	Action 4.1.1-4
	Ensure the protection of indigenous values in the area when undertaking any management actions for migratory shorebirds.	Action 4.1.1-5
	Continue to monitor the development of plans to move forward with building of the Richmond Vale Rail Trail through Hexham Swamp.	Action 4.2.1-2
Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation	Continue the Discovery Ranger program for environmental education (linked to the school curriculum) in collaboration with the Hunter Wetlands Centre Australia and Wetlands and Awabakal Environmental Education Centre. Target caravan parks, tourist visitor centres and tourism bodies/destinations to reach visitors to the Hunter Estuary and Worimi Conservation Lands. Schools visit topics to include migratory as well as beach-nesting shorebirds.	Action 5.1.1-3
	Utilise existing social media channels through the working group to develop and implement a targeted social media strategy to promote awareness of migratory shorebirds to visitors and residents of Hunter estuary and Worimi Conservation Lands.	Action 5.1.1-4
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Collaborate with researchers to update existing forecast maps of potential changes to mudflat, saltmarsh and mangrove habitat distributions due to climate change induced sea level rise.	Action 1.1.1-8
	Engage a regional (and NSW state-wide if possible) 'Shorebird Monitoring and Community Engagement Coordinator' to ensure consistent data collection is undertaken for migratory and beach-nesting shorebirds at key estuaries across NSW including the training of volunteers and set up of standardised monitoring regimes.	Action 1.2.1-3
	Hold two training workshops yearly to recruit new volunteers/counters into the monitoring program (run one beginner, general introduction workshop for recruiting new bird counters and one advanced bird identification workshop for current bird counters). As part of these workshops, encourage data sharing and increase the capacity of current	Action 1.2.1-4



	volunteers to enter data into BirdLife’s online data portal, Birdata, and to collect additional data on threats to migratory shorebirds.	
	Increase support for current volunteers to mentor new ones through increased communication with BirdLife’s Migratory Shorebird Team, and the creation and sharing of specialised outreach materials.	Action 1.2.1-5
Objective 2: Reduce, or eliminate human and introduced threats	Consult with NPWS to explore potential to increase shorebird signage at Stockton Sandspit and Kooragang Dykes to notify waterway users to maintain their distance, and at Stony Point to facilitate compliance for dogs off leash.	Action 2.1.1-5
	Continue public education program to manage people traffic at Stockton Sandspit led by NPWS. Organise a community walk and talk session to educate locals and visitors about maintaining their distance from roosting and feeding shorebirds.	Action 2.1.1-6
	Source funding to support a regular Dog’s Breakfast event during peak times of the year at the northern end of WCL and Stockton Sandspit to educate beach goers about the importance of keeping their dog on a leash to minimise disturbance to shorebirds.	Action 2.1.1-8
	Continue exclusion control measures for deer and cattle at Tomago wetlands to protect saltmarsh habitat.	Action 2.2.1-2
	Continue wild dog baiting program on Worimi Conservation Lands and explore potential to include fox baiting at the southern end of the site.	Action 2.2.1-3
Objective 3: Maintain and protect key habitat values	Encourage private land holders and community groups to monitor shorebirds on their property through inclusion in shorebird training and monitoring workshops.	Action 3.1.1-5
	Continue marine debris clean-up activities in Hunter Estuary and Worimi Conservation Lands. Explore opportunity to collaborate with community organisations and not-for-profits and continue to engage Local Aboriginal Land Councils or indigenous groups to achieve this work.	Action 3.1.1-6
	Create a repository of all climate change mapping and modelling of the Hunter Estuary and Worimi Conservation Lands to prevent duplication of effort. Use mapping and modelling data to identify potential limits on habitat migration for coastal saltmarsh and intertidal mud flats due to residential, commercial and industrial infrastructure.	Action 3.2.1-2
	Continue with current plans to modify Kooragang Dykes to reduce the impact of climate change induced sea level rise.	Action 3.2.1-3
Objective 4: Develop fast tracked management responses	Apply to extend the current boundaries of the Hunter Estuary Wetlands Ramsar site to include previously excluded lands set aside for industry that have not been developed with a focus on prioritising those that are shorebird habitat or can be restored as such.	Action 4.2.1-3
Objective 2: Reduce, or eliminate human and introduced threats	Investigate impacts of foxes, cats and wild dogs at shorebird feeding and roosting sites through the use of camera traps and MOTUS radio telemetry tracking. Collaborate with HLLS Australasian Bittern Project and NPWS to achieve these aims and share data. Use these data to support long-term baiting programs if found necessary.	Action 2.2.1-1
Objective 3: Maintain and protect key habitat values	Restore drainage at Market Swamp by opening a culvert under the railway line. Explore options to improve drainage at Deep Pond and Pambalong Nature Reserve.	Action 3.1.1-4



Low Priority

Objective	Action	Reference Link
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Reach out to members of stakeholder groups to participate in surveys and university students. Promote volunteering and Work Integrated Learning (WIL) opportunities through existing stakeholder community engagement programs.	Action 1.2.1-8
Objective 2: Reduce, or eliminate human and introduced threats	Expand Discovery Rangers program in Port Stephens to include the Hunter Estuary and incorporate migratory shorebirds. Explore potential to include migratory shorebirds as part of the online educational package 'Animals in Your Backyard' created by HLLS.	Action 2.1.1-9
	Continue to consult with the owner of Smithy's property to discuss aircraft disturbance and removal of tyres on property.	Action 2.1.1-10
	Continue to monitor impacts of sand dredging facility on Little Tern breeding attempts. Manage as necessary.	Action 2.1.1-12
Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation	Explore opportunities for community shorebird events as part of ongoing Flyway efforts (e.g. Threatened Species Day, World Migratory Bird Day, sister schools / sister wetlands programs, Welcome/Farewell Shorebirds events, etc.).	Action 5.1.1-5
	Add information on migratory shorebirds to the existing communication products handed out to visitors to Worimi Conservation Lands.	Action 5.1.1-6
	Build on existing sister wetlands connection with Japan for the EAAF in the Hunter Estuary to encompass all migratory shorebirds.	Action 5.1.1-9
Objective 2: Reduce, or eliminate human and introduced threats	Engage with 4WD clubs to educate 4WD users about the importance of protecting migratory shorebird habitats as part of driver training activities. Provide information on shorebirds at point of sale for beach permits to 4WD users.	Action 2.1.1-11
Objective 3: Maintain and protect key habitat values	Explore potential to collaborate with researchers to measure nutrient run-off in Fullerton Cove and potential impacts on invertebrate fauna.	Action 3.1.1-7
Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation	Implement a training program for Landcare coastal groups and volunteers to become shorebird ambassadors through the National Shorebird Monitoring Program. Use existing outreach materials to engage beach goers.	Action 5.1.1-7
	Provide information on shorebirds at point of sale for beach permits to 4WD users and dog/cat registrations. Distribute information on the importance of keeping your dog on a leash for migratory shorebirds through vet clinics to pet owners (e.g. information postcards).	Action 5.1.1-8



Conclusion and Next Steps

This Site Action Plan for shorebirds provides a framework for a coordinated approach to migratory shorebird conservation in the Hunter Estuary and Worimi Conservation Lands. Regular population monitoring at these sites as part of the National Shorebird Monitoring Program will play a critical role in evaluating the effectiveness of conservation actions undertaken as part of this process.

Managing shorebird habitat can be difficult, but the five main objectives of this Site Action Plan capture the essence of the challenges migratory shorebirds are facing in the Hunter Estuary and Worimi Conservation Lands. If this plan is successful in (1) ongoing monitoring and increasing knowledge of migratory shorebird populations; (2) reducing, or eliminating human and introduced threats; (3) protecting key habitat values; (4) developing fast tracked management responses; (5) and increasing Communication, Education, Participation and Awareness Programmes for shorebird conservation, then the situation for shorebirds in the Hunter Estuary and Worimi Conservation Lands will be substantially and sustainably improved in the mid- to long-term.

The issues identified for the Hunter Estuary and Worimi Conservation Lands make it necessary to achieve broad collaboration amongst all stakeholders. They include problems such as lack of ongoing monitoring, human disturbance, pest animals, vegetation encroachment, altered hydrological regimes, and lack of communication strategy. All have been identified as playing a role in for the area. This list is likely incomplete and will be refined and extended in the future as new issues emerge and unforeseen aspects surface.



References and useful links

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Shorebird Sister Schools Program, Available at: <https://www.fws.gov/sssp/index.html>

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World Migratory Bird day, Available at: <https://www.worldmigratorybirdday.org/>



Appendices

A. Site Accounts

Hunter Estuary

Note: Site account has been directly transferred from the Australian National Directory of Important Migratory Shorebird Habitat.

Site Name: Hunter Estuary

Ramsar Site: Hunter Estuary Wetlands (Site Number: 24)

Directory of Important Wetlands:

REFCODE	Wetland Name
NSW138	Hexham Swamp
NSW089	Shortland Wetlands Centre
NSW080	Kooragang Nature Reserve

Wetland Types: A4, A5, A6, A7, A8, C8, A10, A11, A9, A12

Flyway Network Site: Hunter Estuary Ramsar Site (EAAF010)

Key Biodiversity Area: Hunter Estuary KBA

Land Tenure: Currently freehold agricultural land and a Nature Reserve and national park.

Biogeographic Region: Sydney Basin

Geographical Coordinates: -32.855533, 151.725357

Total Area: 14,108 hectares

Number of Count Areas: 37

International Significance Criteria:

Species Criteria:

Species	Threshold (1%)	Max count	Date of max count	Number of surveys meeting threshold	Number of surveys meeting national threshold	Data source
Eastern Curlew	350	406	17/02/2007	4	269	Shorebirds 2020, Birddata (2004 - 2016), Eremaea Birds, eBird, AWSG/Shorebirds 2020
Red Knot	1,100	2,172	19/10/2006	3	39	Shorebirds 2020, Birddata (2004 -



						2016), Eremaea Birds, eBird, AWSG/Shorebirds 2020
Sharp-tailed Sandpiper	850	5,000	18/11/2014	76	132	Shorebirds 2020, Birdata (2004 - 2016), Eremaea Birds, eBird, AWSG/Shorebirds 2020

This directory compared with previous assessment (Bamford et. al. 2008): Site now includes formerly separate Cedar Hill and Hexham Swamp sites. Numbers of Eastern Curlew markedly lower. Bar-tailed Godwit, Black-tailed Godwit, Curlew Sandpiper, Terek Sandpiper, Ruddy Turnstone and Latham's Snipe now omitted and Sharp-tailed Sandpiper now added due to numbers markedly lower/higher, change in the 1% threshold, data deficiency or improved coverage in the source data period, changes to site boundary for surveys and/or unknown reason.

Species Abundance: Not met

National Significance Criteria:

Species Criteria:

Species	Threshold (0.1%)	Max count	Date of max count	Number of surveys meeting threshold	Data source
Bar-tailed Godwit	325	3,000	02/10/2010	176	Shorebirds 2020, Birdata (2004 - 2016), Eremaea Birds, eBird, AWSG/Shorebirds 2020
Curlew Sandpiper	90	600	28/02/2015	98	Shorebirds 2020, Birdata (2004 - 2016), Eremaea Birds, eBird, AWSG/Shorebirds 2020
Pacific Golden Plover	120	500	30/01/2018	84	Shorebirds 2020, Birdata (2004 - 2016), Atlas Record Forms,



					eBird, AWSG/Shorebirds 2020
Black-tailed Godwit	160	371	15/11/2008	11	Shorebirds 2020, Birdata (2004 - 2016), Atlas Record Forms, AWSG/Shorebirds 2020
Marsh Sandpiper	130	270	09/02/2007	3	Shorebirds 2020, Atlas Record Forms, AWSG/Shorebirds 2020
Common Greenshank	110	196	15/12/2016	12	Shorebirds 2020, Atlas Record Forms, Birdata (2004-2016), AWSG/Shorebirds 2020, Birdata
Whimbrel	65	102	11/02/2006	10	Shorebirds 2020, Atlas Record Forms, AWSG/Shorebirds 2020
Latham's Snipe	18	97	17/12/2006	12	Shorebirds 2020, Atlas Record Forms, AWSG/Shorebirds 2020, Birdata
Double-banded Plover	19	60	11/08/2018	1	Shorebirds 2020



Species Abundance:

Threshold	Max Count	Date of max count	Number of surveys meeting threshold	Data source
2,000	6,015	10/10/2015	47	Shorebirds 2020, Birdata (2004 – 2016), AWSG/Shorebirds 2020, Birdata

Species Diversity:

Threshold	Max Count	Date of max count	Number of surveys meeting threshold	Data source
15	16	10/12/2016	6	Shorebirds 2020, Birdata (2004 – 2016),

References:

Hunter Wetlands National Park Draft Plan of Management (2015) NSW National Parks and Wildlife Service. Available online at <http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf>.



Worimi Conservation Lands

Note: Site account has been directly transferred from the Australian National Directory of Important Migratory Shorebird Habitat.

Site Name: Worimi Conservation Lands

Ramsar Site: NA

Directory of Important Wetlands: NA

Wetland Types: A5

Flyway Network Site: NA

Key Biodiversity Area: NA

Land Tenure: National Park, Regional Park, and Indigenous Lands.

Biogeographic Region: Karuah Manning

Geographical Coordinates: -32.813672, 151.947948

Total Area: 4042.5 hectares

Number of Count Areas: 3

International Significance Criteria:

Species Criteria: Not met

Species Abundance: Not met

National Significance Criteria:

Species Criteria:

Species	Threshold (0.1%)	Max count	Date of max count	Number of surveys meeting threshold	Data source
Double-banded Plover	19	173	13/06/2014	38	Shorebirds 2020, Birdata (2004 - 2016), AWSG/Shorebirds 2020, Birdata
Pacific Golden Plover	120	154	20/10/2017	1	Shorebirds 2020

Species Abundance: Not met

Species Diversity: Not met

References:

Worimi Conservation Lands Plan of Management (2015). State of NSW and the Office of Environment and Heritage <http://worimiconservationlands.com/>.



B. List of Relevant Local Management Plans

Hunter Estuary

Hunter Wetlands National Park Plan of Management, NSW National Parks and Wildlife Service (2020). Available at: <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Parks-reserves-and-protected-areas/Parks-plans-of-management/hunter-wetlands-national-park-plan-of-management-200152.pdf>

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Worimi Conservation Lands

Worimi Conservation Lands Plan of Management, NSW Office of Environment and Heritage (2015). Available at: <https://worimiconservationlands.com/plan-of-management/>



C. Stakeholders

Below is a list of stakeholders relevant to the implementation of this Site Action Plan in the Hunter Estuary and Worimi Conservation Lands. This list is not exhaustive and a key aim of this Site Action Plan is to increase the diversity and number of stakeholders involved.

Australasian Wader Studies Group

Awabakal LALC

Birdlife Australia

Crown Lands

EcoNetwork

Hunter 4WD Club

Hunter Bird Observers Club

Hunter Local Land Services

Hunter Regional Landcare Network

Hunter Water

Lower Hunter Landcare

Newcastle City Council

Newcastle Coal Infrastructure Group

Newcastle Port Corporation

NSW Department of Primary Industries – Fisheries

NSW Department of Primary Industries and Environment

NSW National Parks and Wildlife Service

Port Waratah Coal Services

University of Newcastle

Water Research Lab

Worimi LALC



D. Workshop Attendees

Name	Organisation
Alan Stuart	Hunter Bird Observers Club
Alissa Rogers	Hunter Local Land Services
Andrea Griffin	University of Newcastle
Ann Lindsey	Hunter Bird Observers Club
Boyd Carney	NSW National Parks and Wildlife Service
Brian Hughes	Hunter Local Land Services
Brock Smith	Hunter 4WD Club
Chris Purnell	BirdLife Australia
Christophe Tourenq	NSW Department of Planning, Industry and Environment
Emily Mowat	BirdLife Australia
Eva Twarkowski	Hunter Local Land Services
Hayley Ardargh	Newcastle Coal Infrastructure Group
Helen Kemp	MidCoast to Tops Landcare Connection
Henrietta Mooney	Hunter Regional Landcare Network
Jackie Spiteri	Newcastle Port Corporation
Jennifer Lewis	Hunter Local Land Services
Jessica Lek	MidCoast to Tops Landcare Connection
Jo Erskine	NSW National Parks and Wildlife Service
Judy Little	Hunter Bird Observers Club
Katherine Howard	NSW National Parks and Wildlife Service
Laura Rhodes	BirdLife Australia
Marta Ferenczi	BirdLife Australia
Mick Roderick	BirdLife Australia
Peggy Svoboda	Hunter Local Land Services
Phil Straw	Australasian Wader Studies Group
Reegan Walker	Hunter Local Land Services
Stacey Mail	Lower Hunter Landcare
Steve Klose	BirdLife Australia
Tom Clarke	Hunter Bird Observers Club
Warren Mayers	Worimi Conservation Lands Ranger



Local Land Services



Australian Government

National Landcare Program



This project is supported by Hunter Local Land Services through funding from the Australian Government's National Landcare Program.



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