

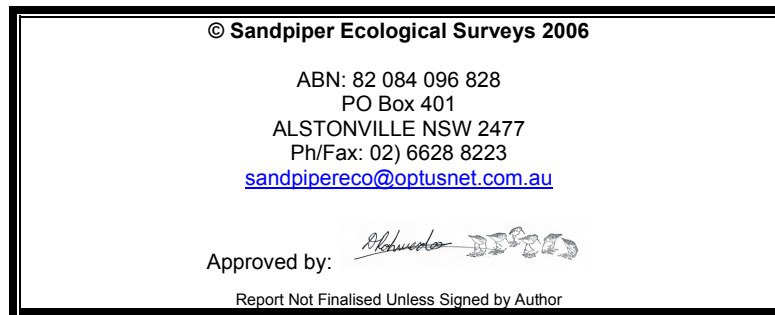
# SHOREBIRD CONSERVATION TOOLKIT

## DECISION-MAKING FRAMEWORK

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### Cover Photographs

Left side: Shorebird footprints – D. Rohweder.

Centre: Beach Stone-Curlews, Corindi River, NSW – D. Rohweder.

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# 1. INTRODUCTION

## 1.1 BACKGROUND

Sandpiper Ecological Surveys was contracted by WWF Australia to prepare a Decision Making Framework (DMF) for the Shorebird Conservation Toolkit (<http://www.shorebirds.org.au/shore/index.html>). The Toolkit is a web-based information resource that aims to:

- Increase awareness and understanding of shorebirds and their conservation needs.
- Improve the sharing of information between shorebird researchers and conservation groups and the broader community.
- Inform development, implementation and monitoring of shorebird conservation projects.

The objective of the DMF is to provide a simplified approach that enables shorebird site management groups to:

- Identify, assess and prioritise site management needs.
- Identify organisations with management responsibility.
- Monitor and evaluate the effectiveness of management strategies and actions.

The following report provides a general overview of the main components of a DMF that could be used to improve the management and conservation of shorebird habitats. The report has a broad focus and is aimed at organisations and personnel with a basic understanding of shorebird ecology, threatening processes, land use planning and management. The report aims to identify the basic information requirements for making decisions on shorebird management; however, it does not provide specific details on shorebird management Australia-wide.

Stakeholders concerned with identifying threats to shorebirds and managing threats should also review the Western Hemisphere Shorebird Reserve Network (WHSRN) Site Assessment Tool (SAT) and Sites Assessment Framework (Valencia & Duncan 2006). Both documents can be downloaded at [http://www.manomet.org/WHSRN/site\\_assessment.php](http://www.manomet.org/WHSRN/site_assessment.php). The SAT seeks to, amongst other things, identify critical threats and management actions, assess the effectiveness of site management and conservation efforts, and provide standardised information for priority setting, conservation action planning and advocacy for Network Sites. The SAT involves a qualitative computer-based assessment (excel spreadsheet) of issues within four key subject areas, Management Effectiveness, State, Threats and Conservation Actions. It includes a scoring system that enables threats and management actions to be ranked and provides the opportunity for monitoring and evaluation of management actions. The Threat and Conservation Action components of the SAT could be applied to almost any shorebird site. Some of the key components of the SAT are reflected in the DMF, although the DMF seeks to establish a process from the commencement of a project, whereas the SAT is focused on sites that are already recognised as being important shorebird habitats.

Throughout the report reference is made to the subject site, which in this context is the site where the DMF is being applied. The subject site can be a single roost or feeding area, an estuary or a stretch of coastline with numerous estuaries and embayments.

## 1.2 SCOPE OF WORK

The scope of work for this project, as specified by WWF Australia, was to design and develop a simple planning process that enables management stakeholder groups to identify:

- Threats, their source and impacts to shorebirds/shorebird habitat.
- Potential strategies, actions and information/skills/resources needed to manage threats, including a prioritisation of strategies and actions.
- Organisations with management responsibility.
- Potential measures to monitor and evaluate the success of management strategies and actions.

## 2. COMPONENTS OF THE DMF

There are several components to a DMF and these can be divided into five stages (Table 2.1). Stage One requires the identification of a project aim and objective. This stage is not discussed further; however, a well defined aim and objectives is essential for any management program and must be defined at the onset.

Stage Two involves the collation of background information on the shorebird population and important shorebird habitats within the subject site and common threatening processes. Stage Three involves the identification of threatening processes within the subject site (Threat Identification) and an assessment of their impact (Threat Assessment) on shorebirds. Stage Four involves the development of management strategies. Stage Five involves monitoring and evaluation of threatening processes (Table 2.1). Outputs are identified for each stage of the DMF (Table 2.1).

The DMF proposed in this report is similar to a typical risk management framework (after Carey *et al.* 2006) which includes:

- formulating the problem;
- identifying the ecological values/assets perceived to be at risk;
- identifying the hazards (threats) likely to adversely impact upon these values;
- analyzing the likelihood and consequences;
- characterising and ranking the risks;
- developing a risk management plan to minimize these risks;
- implementing this plan; and
- monitoring the system to ensure the management plan is indeed reducing the impact of the priority risks.

Table 2.1: Summary of the major components of a simplified Decision Making Framework for shorebirds

Stage	Component	Sub-Component	Specific Issues
One	Project Definition	Aim & Objectives	Identify the specific aim and objectives of a project at the commencement to ensure that project outcomes can be evaluated.
Two	Background Information	Knowledge of important shorebird habitats within the subject site.	Spring and neap tide, diurnal and nocturnal roosts, staging areas; Diurnal and nocturnal foraging sites; Nest sites/areas.
		Shorebird population and habitat use within the subject site.	Species, population size and status; Preferred habitats and movement; Preferred prey; Behaviour.
		What types of processes threaten shorebirds?	Habitat Loss; Habitat Modification; Habitat Disturbance. Habitat Pollution (changes in prey abundance); Mortality (predation, hunting, poisoning); Competition for food (Commercial harvesting); Climate Change; Natural disasters (flood, drought, fire etc); intrinsic factors (limited dispersal, recruitment, juvenile mortality etc).
Output: 1. Understanding of habitat use at subject site; 2. Prioritisation of sites; 3. Identify & fill data gaps; 4. Understanding of threats.			
Three	Threat Identification	Which potential threatening processes occur at the site	Local variations of the following: Habitat Loss. Habitat Modification. Habitat Disturbance. Habitat Pollution (changes in prey abundance). Mortality (predation, hunting, poisoning). Competition for food (Commercial harvesting) Climate Change.
		Where do threatening processes occur?	On-site (direct); Off-site (indirect) Determine if the land is used for commercial or recreational activity
	Threat Assessment	Threat regime	Determine the type, frequency, duration, intensity, proximity and probability of threats.
		How is the shorebird population effected?	Describe how shorebirds will/are being affected by the impact/s. Determine the long-term implications of impacts to shorebirds.
		Which threats pose the highest risk?	Undertake a threat prioritisation to identify the most prominent threats.
Output: 1. Prioritisation of threats; 2. Threat/site comparison identify high risk sites; 3. Research to fill data gaps.			
Four	Management Options	Threat specific management strategies	Develop specific strategies to ameliorate each of the identified threats. Review - local planning instruments; - recovery plans; - state fauna protection legislation;
	Management Responsibility	Is it public or private land?	Determine the tenure and zoning of the land. Identify the land owner. Determine whether the land is managed by local, state or federal government.
		Identify highest priority management options.	Prioritise the proposed management options to determine which should be given priority.
Output: 1. Development of targeted and costed management strategies; 2. Prioritisation of management strategies.			
Five	Monitoring and Evaluation		Monitor the shorebird population to see how it responds to management. Monitor focus groups/activities to determine if management is effective. Evaluate each adopted management option to determine which have been effective in ameliorating threats.
Output: 1. Design a monitoring program; 2. Process to evaluate management options; 3. Process to provide feedback on actions.			

## 2.1 BACKGROUND INFORMATION

Background information on the characteristics of the shorebird community is fundamental to identifying and managing threatening processes. Without at least a basic understanding of the species present, the location of resources (roosts, feeding areas, nest sites) and how birds utilise these resources it is very difficult to know when impacts are occurring and predict the effects of impacts (Van de Cam *et al.* 2004). Furthermore, information on the local, state, national and international importance of the site is essential to set management priorities and link with funding programs. Critical background information includes:

- Knowledge of the type and status of species and the number of individuals present at a site.
- Knowledge of important (diurnal & nocturnal) habitats and how these habitats are used (i.e. roosting, foraging, nesting).
- Knowledge of the local, state and national importance of the site.

The above information is essential to determine how a species or community of shorebirds may be affected by a perceived threat and to put threats into a broader perspective. There is a reasonable amount of published information on the distribution of shorebirds, important shorebird sites and population estimates at both National and State levels (e.g. Lane 1987; Smith 1990; Watkins 1993; Driscoll 1997; AWSG database), although there is a clear need for improved data collection methods. Furthermore, State and Federal legislation provide lists of threatened species, endangered ecological communities and threatening processes. This information should form the basis of initial investigations into the shorebird community at a site.

Site-specific detail on the location of roosts, feeding areas and nest sites is generally more difficult to access and so to are data on species and population estimates for smaller sites. Nevertheless, this information is available for many sites, although background research will be required. Potential sources of 'local' information include local councils, local and state bird groups, Australasian Wader Studies Group, local consultants, universities, state and federal agencies responsible for biodiversity conservation, local, state and federal non-government organisations. In some cases targeted on-ground surveys may be required to obtain the necessary background information (Crome 2002; QWSG 2005). Some of the required background information may be available from local ornithological groups and these groups represent a valuable resource in the decision making process.

Prior to identifying site-specific threats it is important to gain some understanding of what activities constitute a threat to shorebirds. There are numerous research papers on individual threats and more general information can be found in Lane (1987), Smith (1990), Straw (1997), Priest *et al.* (2002), Straw (2003) and EPA (2005).

## 2.2 THREAT IDENTIFICATION

The second phase of the framework is to identify the type of threatening processes that affect shorebirds at a site. Some form of research that includes site observation and literature review will be required to identify and substantiate threats. Ideally threats should be quantified, although the gathering of quantitative data is often a luxury that is not afforded by timeframes. The level of evidence required to substantiate a threat will depend on the threatening process and the stakeholders involved. Substantive quantitative data is likely to be required to alter management of approved (& proposed) commercial activities and entrenched human recreation patterns.

Whilst some threats are widespread and fairly universal (e.g. disturbance of roosting birds by human recreation) others, such as Acid Sulphate Soils or specific development projects are more localized.

The background information gathered on threats in Stage One can be used as a baseline to identify threats within the subject site. Carey *et al.* (2004) discuss eight aids that can be used to assist with threat identification, including the use of a hazard matrix (threat type \* threat attribute analysis) and brainstorming. They also recommend group assessments to avoid personal biases.

The response of shorebirds to a threat should also be considered as there can be complex interrelationships between different threats, the distribution of threats and the response of birds. These will often depend on the distribution of threats within a site and the availability and distribution of habitat. Site-specific information on the implications of a threat to the shorebird community is essential to determine if a perceived threat actually exists and quantify what effect it could have on the shorebird community.

## **2.2.1 INFORMATION REQUIRED TO IDENTIFY AND SUBSTANTIATE A THREAT**

To make sure that funds and effort are appropriately allocated it is necessary to ensure that threats are understood and can be substantiated. Background (substantive) data on threats would most likely be required for any funding application or request to change site protection. It is important to make sure that this information is available in the early stages of the project.

### ***Potential or actual threats***

The first step in threat identification is to determine if a threat is actually occurring. In some instances threat identification will be difficult, whilst in others it will be straightforward. It is fairly easy to create a list of all potential threats within a site but more difficult to determine which are actual threats (Sandpiper Environmental 2004). Ideally research on potential threats should be conducted to quantify their impact/s; however, this option is rarely feasible and threats often need to be identified by using qualitative means and reference to published information. In many instances it will be feasible to utilise our understanding of shorebird ecology and published information on threats to conclude that a threat is actual.

For example, repeated observation of disturbance of roosting migratory shorebirds by unleashed dogs at a spring tide roost is sufficient to conclude that a potential threat exists. Review of migratory shorebird ecology tells us that these birds must be able to rest undisturbed at high tide and that spring-tide roosts are important, which suggests that the threat is actual. The ease with which a threat can be identified may also depend on whether it is direct (i.e. disturbance) or indirect (i.e. pollution), frequent or rare.

### ***Type and source of threats***

Numerous factors are known to threaten shorebirds and their habitat and there are several papers that provide an overview of threatening processes (Buick & Paton 1989; Lane & Davies 1990; Lawler 1996; Melville 1997; Priest *et al.* 2002; Saintilan 2003; Weston 2003). These articles provide an initial point of reference for site managers seeking to define threats at their site and in many instances the absence of site-specific data means that the general literature must be used. Threats can be divided into seven broad categories:

- Habitat loss – removal of habitat through reclamation, sand extraction and erosion.
- Habitat modification – changes in the characteristics of habitat that reduce its utility for shorebirds. This may occur through erosion, subsidence, vegetation growth, drainage etc.
- Habitat disturbance – Generally human-related activities that result in disturbance to roosting, foraging and nesting shorebirds i.e. pleasure craft, humans walking and jogging, recreational and commercial fishers, domestic dogs and off-road vehicles.
- Habitat pollution – accumulation of pollutants in body fat that reduces life span and potentially reproductive ability and/or the abundance of prey.
- Mortality – death of individuals through hunting by humans for food, recreation or site protection, predation by introduced species or mortality due to development.

- Competition for food – harvesting of shellfish by commercial and recreational fishers represents direct competition with some species of shorebird.
- Climate change - considered to be a potentially significant threat to shorebird habitat. The impact of climate change is likely to vary considerably between sites, although it is expected to lead to a combination of habitat loss and modification. In some instances it may also result in habitat creation or expansion.
- Natural Disasters – floods and drought can have a profound impact on shorebird habitat, particularly inland wetlands.
- Intrinsic factors – limited dispersal, juvenile recruitment and juvenile mortality are examples of intrinsic factors that can affect shorebird populations.

Threats can be either direct or indirect and occur on-site or off-site. The ability to identify the source of threats varies between types. The source of disturbance from 4WD vehicles and unleashed dogs is likely to be obvious; however, the source of pollution of aquatic habitat may not. Identifying the threat source is essential as management will need to target the source to ensure impacts are ameliorated.

### ***Threat attributes***

There are various attributes of threatening processes that should be considered, including: Type, Frequency, Intensity, Duration, Proximity, Timing and Probability (likelihood). Collectively these attributes could be termed the threat regime. An understanding of the threat regime will be valuable to prioritise between different threatening processes within a site and identify the urgency of management action.

The threat regime can be defined as:

- Type – what type of threat is it?
- Frequency – how often does a threatening process occur?
- Intensity – how many individuals are involved or how much pollution occurs?
- Duration – how long does the impact last?
- Proximity – does the impact occur on-site or off-site and is it direct or indirect?
- Timing – when does it occur?

### ***Implications of each threatening process***

Most of the threats listed above can have serious detrimental impacts on shorebird populations and thus their implications are serious. Threats, such as predation or hunting, that result in direct mortality will have a direct and obvious impact (i.e. mortality), whilst others, such as frequent human-related disturbance of roosting birds, may be subtle and initially appear minor. In the case of human recreational disturbance the effects may not become obvious for several years but could manifest as a slight annual decline in population size. Other examples of subtle, but detrimental, impacts include pollution of aquatic habitats and the encroachment of woody vegetation over roosts. Regardless of the subtlety of a threat the end result, in many cases, will be a decrease in population size, although this may take some years to become evident. The inherent variability in shorebird populations and the non-systematic nature of population surveys greatly reduce the ability to identify subtle changes in population size and thus determine that a threat is occurring. Nevertheless, in instances of human disturbance there is sufficient published data to accept that frequent disturbance is detrimental.

Some threatening processes will have the same effect (implications) regardless of location; however, the implications of others are likely to vary depending on the availability, distribution and nature of habitat. Determining the implications of a threatening process to the shorebird population should be assessed at temporal and spatial scales. Temporal scales of threat include, immediate, medium term and long term. Spatial scales of threat include, part of a site, entire site, all habitat used by a population etc. Various combinations of the above scales could be used to determine the implications of a threat. An immediate threat that affects all habitat used by a population is of obvious concern and the implication of such a threat is likely to be a noticeable population decline.

The final part of the threat identification stage of the DMF is the prioritization of threats to determine which pose the greatest risk to shorebirds at the Subject Site. Prioritisation is discussed in Section 3.

## **2.3 MANAGEMENT**

### **2.3.2 MANAGEMENT STRATEGIES**

A basic understanding of management requirements will be derived from the threat identification process described above. Due to the variability of habitats used by shorebirds in Australia it is a major task to discuss management actions for all possible threat scenarios and specific management options will need to be addressed for each site. The following section provides a broad overview of some standard approaches to management. These approaches may need to be altered to suite site specific situations but should provide stakeholders with a starting point. At most sites there are likely to be a number of appropriate actions to manage threats and where possible more than one approach should be adopted to increase the chances of success. Broadly speaking, management actions can be divided into seven strategic areas (Table 2.2):

- 1) Environmental Planning and Regulation.
- 2) Communication and Education.
- 3) Conservation.
- 4) Research.
- 5) Habitat and Site based Actions.
- 6) Species Based Actions.
- 7) Monitoring and Evaluation.

Many shorebird sites in Australia will most likely require a combination of actions within several strategic areas. Several of the strategic areas are interrelated and actions in one area should be complemented by actions in another. For example, increased community awareness is essential for managing human-related disturbance; however appropriate environmental planning, regulation of breaches and conservation of sites is required to support community awareness.

Three key issues to consider in developing management actions are:

- The land tenure (or tenures) upon which the subject site occurs.
- Management actions must be specific and targeted towards the threat.
- Management aim and objectives.
- Broad-scale or sweeping management actions will be difficult to implement and will detract from funding applications.

A Plan of Management (PoM) that identifies and prioritises threats, lists and evaluates management actions, sets a timeframe for the implementation of actions, identifies resource requirements, sources of financial support and a process for monitoring and evaluation of actions should be part of any management project. A PoM need not be overly complicated and it can be focused at a variety of scales, from single roost sites to estuaries to coastlines. The value of a PoM is that it formalises the management process providing clear steps that can be followed through time.

Sources of information on threats and the management of threats can be obtained from:

- Priest *et al.* (2002) – Shorebird Conservation in Australia.
- Straw (2003) - Status and Management of Migratory Shorebirds in Sydney.
- Watkins (1993) - A National Plan for Shorebird Conservation in Australia.
- Lane (1987) - Shorebirds in Australia.
- Straw (1997) - Shorebird Conservation in the Asia Pacific Region.
- EPA (2005) - Shorebird Management Strategy for Moreton Bay.
- DEH (2006) - Wildlife Conservation Plan for Migratory Shorebirds.
- Wetlands International (2001) - Action Plan for the conservation of migratory shorebirds in the East Asian-Australasian flyway 2001-2005.
- Smith (1990) - The Biology and Management of waders in NSW.

### 2.3.2 MANAGEMENT RESPONSIBILITY

Management responsibility will vary depending on the land tenure. Broad types of land tenure include:

- Commonwealth – national and marine parks, military training reserves, aboriginal land.
- State – crown reserves, national & marine parks, nature reserves, state conservation areas, aboriginal land, aquatic reserves.
- Local Council.
- Private.
- Leasehold.

If the ownership of the subject site is unclear then advice should be sought from the local council and the appropriate land manager approached. A list of state and commonwealth government agencies that play a role in environment protection and their respective web address is provided in Table 2.3. Further contact details for each department is provided in Appendix A.

State agencies responsible for land use planning, conservation and environmental impact assessment are most relevant to shorebird conservation as they play a primary role in regulating and managing land use. Local government also has a critical role as it guides land use planning on private land and often has involvement and influence on the management of estuaries and coastlines.

### 2.3.3 LEGISLATION AND PLANNING CONSIDERATIONS

It is unlikely that shorebird management can be undertaken without considering state and federal legislation and policies and local and regional environmental planning instruments. Obtaining statutory approvals can sometimes require a considerable amount of time and effort and it is therefore essential that the statutory requirements are identified at the commencement of a project.

The statutory requirements of a project and the authorities to be consulted will depend on the land tenure within and adjoining the subject site and the activity proposed. It is important to recognise that conservation programs can, in some cases, pose a risk to other threatened and protected species and they can also have social consequences. Any project that involves construction work will often require approval from local and/or state government. Initial advice on statutory approvals can often be obtained from local councils.

Specific statutory issues that may arise during a project include:

- Protection of threatened and migratory species, endangered ecological communities and endangered populations.
- Consistency with Recovery Plans and Threat Abatement Plans.
- Consistency with management plans such as Estuary Management Plans, Coastline Management Plans, Shorebird Management Plans and Strategies, Wildlife Conservation Plans.
- Local Government approval (permissibility within zone).
- State Government approval (permissibility under state legislation) – will vary from state to state but likely to be required for works and to justify impacts. Construction of a high-tide roost may require approval from the land manager and the agencies responsible for the protection of aquatic habitats, commercial fisheries and watercraft.
- Cultural Heritage.
- The need for appropriate community consultation.
- Companion animal legislation.
- Existing use rights.
- Access for emergency services.
- State Government Policies and Action Plans

Table 2.2: Seven strategic areas for improved shorebird site management.

Strategic Area	Justification	Components
Environmental Planning & Regulation	<p>Environmental planning and regulation of planning law is fundamental to ensure that important sites gain the appropriate level of protection, whether this is under Federal, State or Local environmental planning law.</p> <p>Regulation of activities is the next step following protection or zoning. Regulation by local and state authorities is essential to control both commercial and recreational activities.</p> <p>Biodiversity conservation legislation provides the opportunity for improved protection of shorebird habitat.</p>	<p>Environmental planning occurs at all levels of government and includes biodiversity conservation legislation, various plans: Conservation Management Plans, Recovery Plans, Threat Abatement Plans, Protected Area Management Plans, Catchment Management Plans, Regional Environmental Plans, Local Environmental Plans, Estuary and Coastline Management Plans and Development Control Plans. All tiers of environmental planning provide some protection for shorebirds and their habitat, although the effectiveness often depends on the focus of the plan.</p> <p>It is at the local planning level where most issues arise and where there is good opportunity to protect habitat before conflicting land uses develop. Local Environmental Plans provide the opportunity to zone high conservation value land for protection and prohibit potential threatening processes. Unfortunately many important shorebird habitats are not appropriately zoned under LEP's. It is essential that these areas are identified and the zoning changed. The procedure required to change zoning varies between states, although the first step is to identify conflicting values and then lobby local and state government for changes in zoning.</p> <p>Regulation of land use is the next step in the planning process. Regulation is required to ensure that areas zoned for conservation are used in accordance with the zone provisions. State government agencies and local council are the primary regulatory authorities, although community groups, individuals and NGO's play an important role in identifying breaches.</p> <p>State and federal lists of threatened species, endangered ecological communities, endangered populations and threatening processes should be reviewed to ensure that appropriate species, populations, communities and threats are included and therefore considered during environmental impact assessment.</p> <p>The impact amelioration process within Environmental Impact Assessments for development is another aspect of planning law that can provide benefits for shorebird conservation.</p>
Communication & Education	<p>The aim of communication and education is to increase the awareness of local communities and government about shorebird ecology and threats. Education is fundamental to managing many human-related issues, such as disturbance.</p> <p>Involvement of the local community in site management, surveys and monitoring is also important to encourage a sense of ownership. Ownership of sites can prove beneficial when it comes to developing strategies to change human behaviour.</p> <p>Community support can be valuable in lobbying government to provide funding for conservation programs.</p> <p>Communication between managers is also important to ensure the transfer of ideas and identify conflicts between regulation and site management.</p>	<p>There are various means of increasing community awareness, including:</p> <ul style="list-style-type: none"> <li>- Shorebird identification &amp; information field-days.</li> <li>- Volunteer ranger programs.</li> <li>- Brochures targeting specific user groups such as 4WD owners, recreational &amp; commercial fishers.</li> <li>- School visits &amp; development of school-based marine &amp; coastal education programs.</li> <li>- Articles in the local media.</li> <li>- Community-based population surveys.</li> </ul> <p>The responsibility for increasing community awareness and involvement is likely to vary between regions and states; however, NGO's and Catchment Management Authorities may provide the basis for developing such programs.</p> <p>Community groups typically do not have the expertise required to design and coordinate fieldwork and assistance will often be required. The need for external input should be recognised at the outset of any project that seeks to increase community awareness and involvement.</p> <p>All levels of government and NGO's have a role to play in distributing information on threats, successful management actions and conflicts between regulation and site management.</p>

Table 2.2: cont.

Strategic Area	Justification	Components
Conservation	<p>The gazettal of conservation reserves is one of the most widely used means of protecting high conservation value land, including shorebird habitat.</p>	<p>Inclusion of public (&amp; private) land within conservation reserves is an effective means of protecting important shorebird habitat. The inclusion of sites within conservation reserves provides a formalised management regime and the opportunity to regulate activity in accordance with accepted procedures. Inclusion of sites within the protected area network can also increase the ability to attract funding for on-ground works.</p> <p>The gazettal of sites as conservation reserves can also lead to problems, particularly if remediation works are contrary to state policy. In some cases the approval process required for habitat remediation within a conservation reserve may be quite onerous and more time consuming than if the site were managed by a different authority.</p> <p>Inclusion of a site within a conservation reserve does not mean that all threatening processes will cease. In some cases long-term regulation and planning will be required to ensure that threatening process are ameliorated.</p> <p>Nomination of sites to the Ramsar Convention is another option for improving site protection.</p>
Research	<p>Research on all aspects of shorebird ecology and management is essential. In the context of this report research on threatening process is required to ensure that impacts can be substantiated. Substantive data is often required to change government policy or to ameliorate the impact of development.</p>	<p>Potential field of research include:</p> <ul style="list-style-type: none"> <li>- feeding ecology and habitat use (roost, feeding areas, nest sites etc).</li> <li>- population monitoring.</li> <li>- shorebird movements.</li> <li>- targeted research on species of special concern (Garnett &amp; Crowley 2000).</li> <li>- potential and known threatening processes.</li> <li>- habitat restoration &amp; creation.</li> <li>- effectiveness of environmental planning law in protecting shorebirds.</li> </ul>
Habitat & Site Based Actions	<p>Habitat restoration and creation are important components of site management as many shorebird sites have been degraded or habitat creation is required to compensate for habitat loss elsewhere.</p> <p>Site-based actions can include a range of on-ground works from community-based initiatives to protected area management that are aimed at improving the quality or protection of habitat.</p>	<p>Careful consideration is required before research is undertaken and research projects should be conducted over appropriate spatial and temporal scales and with appropriate replication.</p> <p>Specialist input may be required to design an appropriate research project.</p> <p>The specific components of habitat restoration and creation will vary depending on the site, planning framework and funding. Some general components of a restoration plan include:</p> <ul style="list-style-type: none"> <li>• Appropriate funding for initial and ongoing work.</li> <li>• An appropriate site.</li> <li>• Approval from relevant statutory authorities.</li> <li>• Restoration plan, including input from engineers and possibly hydrologists for habitat creation projects.</li> <li>• A management plan that specifies, amongst other things, monitoring and maintenance requirements.</li> <li>• Appropriate mechanism for site protection and the regulation of land use.</li> </ul> <p>Some types of on-ground works include:</p> <ul style="list-style-type: none"> <li>• Information or regulatory signs.</li> <li>• Weed control.</li> <li>• Feral animal control.</li> </ul>

Table 2.2: cont

Strategic Area	Justification	Components
Species Based Actions	In some cases the impact of threatening processes can be ameliorated through species based actions	<p>Components of species based actions include:</p> <ul style="list-style-type: none"> <li>• Re-introductions</li> <li>• Sustainable use</li> <li>• Recovery management</li> <li>• Disease, pathogen and parasite management.</li> </ul>
Monitoring & Evaluation	Monitoring and evaluation should form an integral part of many of the threat management actions discussed above. Monitoring and evaluation provides the opportunity to gather information on the effectiveness of conservation programs and this information can be used to modify existing programs or to inform future programs.	<p>The components for monitoring and evaluation programs are similar to research projects in that they should be carefully designed and undertaken in a rigorous and standardised manner. The organisations responsible for monitoring and evaluation should be encouraged to publish their findings to ensure that information is available to a wider audience and ensure that successful actions ideas can be implemented at other sites. The journal of the AWSG, the <i>Stiff</i> and the AWSG website are two media where material could be published.</p>

## 2.4 SUPPORTING RESOURCES

The need for supporting resources will often depend on the scale of the project. Identifying sources of support is often one of the most difficult components of a management project regardless of whether the project is being conducted by a local interest group or a government agency. Management projects often develop through a cooperative approach between NGO's, state and local government and local interest groups and it is rarely the case that individuals or small groups would be in a position to implement management, although such groups may regularly identify the need for management. In a cooperative situation the various stakeholder groups provide support to one another, whether that is transfer of knowledge, resources or labour. During the process of developing a management strategy various supporting resources will become evident, particularly when stakeholders are working in a cooperative environment. In-kind support is often suggested as an appropriate means of including all stakeholders in a cooperative program. Projects that are linked with existing Natural Resource Management Programs will often have a better chance of obtaining funding.

The types of resources required for most projects include:

- Information (knowledge) and experience – on the site, shorebird ecology, threats and their impact, management actions, human recreation management.
- Materials – specific requirements that are dependent on the project.
- Labour – reporting, on-ground work.
- Statutory Approvals – may be required depending on land tenure and impact of proposed work.
- Funding – financial support for labour, materials etc.

### 2.4.1 KEY RESOURCES

Two key aspects of the above list are *Information* and *Funding*. Information requirements will depend on the project and the stakeholders involved. Some of the essential information, such as the importance of various sites and the species present may be known by stakeholders; however some background information will be required to ensure that best-practice procedures are adopted.

#### ***Information Sources***

##### *Internet*

The Internet provides a readily accessible source of information on shorebirds both in Australia and overseas. A search of key words, such as *Shorebirds* and *Australia*, will identify a large number of sites. In some respects the number of sites can be overwhelming and the search can be refined by including additional key words. It is also important to remember that not all information on the internet is accurate. As a starting point stakeholders may wish to firstly interrogate the web sites of: the Department of the Environment and Heritage (DEH); state government agencies (Appendix A); local councils, peak national NGO's (e.g. Birds Australia, WWF Australia, Wetlands International, Australasian Wader Studies Group, state ornithological groups (e.g. Victorian Wader Studies Group etc).

### *Federal Government Agencies*

The Federal Government administers the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The act includes schedules of migratory and threatened species which include numerous shorebirds. The Department of the Environment and Heritage which administers the Act has recently prepared a draft Wildlife Conservation Plan for Migratory Shorebirds (DEH 2006) and supports a number of other shorebird conservation projects within the East Asian-Australasian Flyway.

### *State Government Agencies*

State government agencies that are responsible for management of biodiversity, natural resources and crown land will undoubtedly have information on shorebirds and shorebird management. Whilst the internet enables access to some state agency resources it is recommended that direct contact be made with local agency staff to discuss shorebird populations threats and threat mitigation.

### *Local Government*

Many projects are likely to require input from local council and if Council is not directly involved staff can provide valuable support by providing information on zoning, permissible use, approvals, associated Council programs and mapping resources.

### *Non-Government Organisations (NGO's)*

Peak NGO's include WWF Australia, Birds Australia, Australasian Wader Studies Group, Australian Conservation Foundation, the Bird Observers Club of Australia and Coastcare. There are also a number of state-based bird groups that have a specific focus on shorebirds such as the Victorian Wader Studies Group and the Queensland Wader Studies Group. Direct contact with state-based groups can provide valuable 'local' information, not only on shorebirds and threatening processes but also other relevant contacts, sources of funding and data.

### *Local Researchers*

Discussion with shorebird researchers that have done work at the subject site and review of any published material can provide useful background information. Word-of-mouth and the internet are probably the most effective means of identifying researchers, although local universities could also be contacted.

### **Funding**

Funding is likely to be required for most projects, although whether external funding is necessary or work can be undertaken within the existing budgets of land management agencies will depend on the location, type and scale of work involved. In many instances external (or additional) funding will be required even for state agencies. There are a variety of funding sources, although it is not always clear which is the most appropriate. Information on potential sources of funds can often be obtained through discussions with other stakeholders involved in the project. Information on Federal funding programs can be obtained from the Department of the Environment and Heritage grants and funding webpage - <http://www.deh.gov.au/programs/index.html>. Catchment Management Authorities also provide funding for a range of projects. Other funding sources include local government, state government programs and the private sector.

Many local councils and state agencies have natural resource extension officers that often have a good understanding of funding sources. Whilst obtaining information on threat management potential funding sources may also become apparent.

During the planning phase of a management project it is essential to consider potential funding options and identify the funding cycles to ensure that applications are submitted at the appropriate time. Furthermore, the competitive nature of funding applications must be recognised and applications should be well written, researched and all actions are costed. Funding is more likely to be provided for projects that have a clear aim and utilise accepted best-practice techniques.

## **2.7 MONITORING, EVALUATION AND REPORTING**

Monitoring and evaluation of management actions is an important component of any management project. Monitoring provides the opportunity to assess the response of shorebirds and shorebird habitat to management actions and to evaluate which actions have provided the greatest benefit. The end result of monitoring should be the evaluation of management actions and actions that have minimal benefit should be discontinued or given a lower priority in future programs. Monitoring and evaluation should be followed by reporting of results. Reporting is important to ensure that the knowledge gained can be used elsewhere and to provide the opportunity to justify decisions on the viability of management actions. There are various options for reporting and disseminating information; however, it is preferable to utilise an option that can reach as large an audience as possible. To this end publication of monitoring results in the *Stilt* or inclusion on a web site is preferable.

Monitoring does not need to be overly complicated, although it is important to consider appropriate methods and survey design to make sure that the monitoring program provides the necessary information to evaluate management actions. Advice may be required from specialists or agency staff to develop a suitable monitoring program. The design of the monitoring program will depend on the subject to be monitored. The Shorebird Assessment Tool developed for the WHSRN can be used to monitor the success of management when applied over time. The feasibility of using the SAT or a similar approach at a subject site should be investigated prior to developing monitoring program.

Some basic types of monitoring include:

- Standardised and systematic shorebird population surveys.
- Standardised targeted surveys to determine the presence/absence and abundance of threatened or focal species.
- Surveys of breeding success.
- Foraging behaviour (time spent foraging, food intake)
- Standard photo points to assess changes in roost characteristics (i.e. structure, vegetation).
- Monitoring predator abundance as part of control programs.
- Geographic Information Systems (GIS) to assess changes in size, shape and distribution of shorebird foraging and roosting habitat.
- Observation of human activity.
- Visitor surveys to obtain information on site use and adherence to regulations.

Some of the important components of monitoring include:

- Use standardised methods.
- Ensure that the survey design is appropriate to address the question.
- The temporal and spatial scale of monitoring.

- Who will undertake monitoring (this will influence the design and reporting requirements).
- Prior to commencement consider how data will be analysed and presented to make comparisons before and after management.
- Collect data before and after management commences to enable comparisons to be made.

Table 2.3: List of State and Commonwealth Government Departments that play a role in environmental protection.

Government	Agency	Web Address
Commonwealth	Department of the Environment and Heritage	<a href="http://www.deh.gov.au/">http://www.deh.gov.au/</a>
	Department of Defence (Environment & Heritage Management)	<a href="http://www.defence.gov.au/environment/">http://www.defence.gov.au/environment/</a>
South Australia	Department for Environment and Heritage	<a href="http://www.environment.sa.gov.au/">http://www.environment.sa.gov.au/</a>
	Department of Water Land and Biodiversity Conservation	<a href="http://www.dwlbc.sa.gov.au/">http://www.dwlbc.sa.gov.au/</a>
	Environment Protection Authority (EPA)	<a href="http://www.epa.sa.gov.au">http://www.epa.sa.gov.au</a>
New South Wales	Department of Environment and Conservation	<a href="http://www.environment.nsw.gov.au/index.htm">http://www.environment.nsw.gov.au/index.htm</a>
	Department of Natural Resources	<a href="http://www.dlwc.nsw.gov.au">www.dlwc.nsw.gov.au</a>
Queensland	Environmental Protection Agency	<a href="http://www.epa.qld.gov.au/">http://www.epa.qld.gov.au/</a>
	Department of Energy	<a href="http://www.energy.qld.gov.au">http://www.energy.qld.gov.au</a>
	Department of Natural Resources, Mines and Water	<a href="http://www.nrm.qld.gov.au">http://www.nrm.qld.gov.au</a>
Victoria	Department of Sustainability and Environment	<a href="http://www.dse.vic.gov.au/dse/">http://www.dse.vic.gov.au/dse/</a>
	Environment Protection Authority	<a href="http://www.epa.vic.gov.au/">http://www.epa.vic.gov.au/</a>
Australian Capital Territory	Environment ACT	<a href="http://www.environment.act.gov.au">http://www.environment.act.gov.au</a>
Northern Territory	Department of Natural Resources, Environment and the Arts	<a href="http://www.nreta.nt.gov.au/">http://www.nreta.nt.gov.au/</a>
	Parks and Wildlife Commission of the Northern Territory Address:	<a href="http://www.nt.gov.au/ipe/pwcnt/">http://www.nt.gov.au/ipe/pwcnt/</a>
Tasmania	Department of Infrastructure, Energy and Resources	<a href="http://www.dier.tas.gov.au/">http://www.dier.tas.gov.au/</a>
	Department of Primary Industries and Water	<a href="http://www.dpiwe.tas.gov.au/">http://www.dpiwe.tas.gov.au/</a>
	Department of Tourism, Arts and the Environment	<a href="http://www.dtae.tas.gov.au">http://www.dtae.tas.gov.au</a>
	Tasmania Parks and Wildlife Service	<a href="http://www.parks.tas.gov.au/">http://www.parks.tas.gov.au/</a>
Western Australia	Department of Conservation and Land Management	<a href="http://www.calm.wa.gov.au/">http://www.calm.wa.gov.au/</a>
	Department of Environment	<a href="http://www.environment.wa.gov.au">http://www.environment.wa.gov.au</a>
	Department of Industry and Resources	<a href="http://www.doir.wa.gov.au">http://www.doir.wa.gov.au</a>

### 3. PRIORITISATION

Prioritising or ranking shorebird sites, threatening processes and management actions is an important component of the DMF and the resultant priority list can be used to guide future actions and the allocation of funds. Prioritisation is necessary to ensure that systematic and strategic methods are used to identify the most important sites and threats (Department of Natural Resources and Environment 2002). A prioritisation facilitates priority setting, resource allocation and decision making.

There are various ways to undertake a threat prioritisation, although a set of assessment criteria are typically required. These criteria should include biological, social and financial attributes and can be applied using either qualitative or quantitative approaches (Carey *et al.* 2006). Both van Dam *et al.* (2006) and Wayte *et al.* (2004) suggest a hierarchical approach that moves from qualitative to quantitative assessment. Quantitative methods can range from simple desktop studies to full predictive modeling (Carey *et al.* 2006). The approach adopted is likely to reflect the resources available and the implications of the threats being assessed. In some cases complex scoring systems can be developed with scores allocated to each threat based on its attributes (see Werren 2001 for various weed prioritisation methods).

Different methods can be adopted to establish priorities between shorebird sites, threatening processes and management options, although the prioritisation will generally involve a threat by value (or attribute) matrix. It is also possible to combine site and threat prioritisations to determine which sites have the highest level of threat and which threats are the most widespread.

#### ***Prioritising Shorebird Sites***

A simplistic shorebird prioritisation process involves assigning a numerical value to specific biological and physical attributes of each site. The site attributes included in the prioritisation should reflect the range of criteria that influence the importance of a site for the local shorebird population. The weighting system adopted can introduce bias into the prioritisation process and it is therefore important that the criteria be developed or reviewed by various stakeholders with knowledge of the site and shorebird ecology and that a consensus position is developed. Basic site prioritisation criteria developed to prioritise shorebird habitat in the Clarence River Estuary are included in Table 3.1 (after Sandpiper Environmental 2004).

#### ***Prioritising Threats***

The threat prioritisation process discussed in this report is similar to the Ecological or Environmental Risk Assessment process discussed by Carey *et al.* (2006), van Dam *et al.* (2006) and Carey *et al.* (2004). Risk assessment has become a standard component in assessing the likelihood and consequences of human actions on biological systems (Carey *et al.* 2006; van Dam *et al.* 2006).

The Australian Standard (AS4360) represents a simplified semi-quantitative risk assessment procedure that is widely used to assess environmental risk (Fletcher *et al.* 2001). This process involves the subjective use of a matrix that defines the risk of a hazard as a product of its consequence and likelihood (Carey *et al.* 2006). In this process both the consequences and likelihood of each threat are rated from 1 to 5 (Table 3.2). Threats can then be divided into high, moderate and low depending on their score. Carey *et al.* (2006) discuss several limitations with the semi-quantitative AS4360 method and note that in many instances a quantitative approach would be required. However, they concede that the requirement for a quantitative approach is likely to depend on the available data, significance of the issue and resources.

Table 3.1: Draft attributes to prioritise estuarine bird habitat.

Attribute	Method of Assessment
Number of Species	Score of 0.1 for each species recorded at a site over the period of the survey.
Number of migratory species	Score of 0.1 for each migratory species recorded at a site over the period of the survey. Migratory species are those listed on the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
Threatened Species listed on the	Score of 2 points for each Threatened Species recorded at a site over the period of the survey. Threatened species are those listed on the <i>Environment Protection and Biodiversity Conservation Act 1999</i> and/or relevant state legislation such as the <i>NSW Threatened Species Conservation Act 1995</i> .
Breeding Records	Score of 1 point for each species recorded breeding at a site over the period of the survey.
Function	Utility of roosts – Score of 1 for neap tide roost; 3 for low spring tide roost; 5 for spring tide roost. Utility of feeding grounds – Score of 1 for a predominantly spring tide feeding ground and 2 for a spring and neap tide feeding ground.
Frequency of Occurrence of threatened species.	Score of 0.1 for each time (survey) that a threatened species was recorded at a site over the period of the survey. Threatened species are those listed on the <i>Environment Protection and Biodiversity Conservation Act 1999</i> and/or relevant state legislation such as the <i>NSW Threatened Species Conservation Act 1995</i> .
Importance to the local shorebird population.	Score of 1 for every 10% of the total local shorebird population present at a site.
Importance to the local population of each species.	Score of 1 for every 10% of the total local population of each species present at a site.

To ensure that a robust and systematic approach is adopted a set of criteria should be developed to assist in determining consequences and likelihood of a threat and enable the assessment process to be repeated and evaluated. Each criterion should be assigned a rating based on its importance (Stoklosa undated). The attributes of a threat and the implications of a threat discussed in section 2.2.1 should be considered during the risk assessment process.

Table 3.2: Categories of risk for a semi-quantitative assessment using the Australian Standard after Carey *et al.* 2006. Risk ratings: 15-25 High; 5-15 Moderate; 1-4 Low.

Likelihood	Consequence				
	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost Certain (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Moderately likely (3)	3	6	9	12	15
Unlikely (2)	2	4	6	8	10
Rare (1)	1	2	3	4	5

Carey *et al.* (2004) expand on the application of the two-way table (above) by applying spearman correlation analysis, summaries of risk ratings and Fault Trees on risk ratings obtained from a group of participants in a threat analysis workshop. They provided six recommendations for applying ecological risk assessment including:

- Undertake group assessments to incorporate a diversity of thoughts.
- Include all possible valued attributes and potential threats.

- Define hazards clearly and in relation to specific consequences.
- Degree of uncertainty about a particular threat should be incorporated into the priority list.
- Use tools such as influence diagrams and fault trees.
- Repeat the risk assessment on a regular basis.

Depending on the scale of the threats and the resources available it may be possible to adopt a tiered approach whereby all threats are assessed using the semi-quantitative method described above and key (high priority) threats are assessed further using a quantitative process (van Dam *et al.* 2006).

An alternative to the risk assessment process described above is to develop a threat type by threat attribute matrix (Simpson *et al.* 2002). In such a matrix threat attributes could include components of the threat regime discussed in section 2.2.1. Each threat attribute would be divided into several categories with each category given a numerical weighting (i.e. 1-5) based on the level of threat. A single score would be provided for each threat attribute for each threat type. The individual attribute scores could then be summed to identify high priority threats.

The threat assessment component of the WHSRN SAT provides a good example of a threat type by threat attribute matrix (Valencia 2006). The SAT lists 216 individual threats within 12 threat categories and site managers are asked to assign a value (scaled from 0-3) to each of five threat attributes (Timing, Scope, Severity, Location and Trend) for each threat present at a site (Table 3.3). These values are then added together and the cumulative score can be used to rank threat types. In the SAT scores of 8-9 are high, 6-7 medium, 2-5 low and 0-1 negligible.

Although the risk assessment process enables threats to be ranked for an entire subject site it may be worthwhile completing a threat by site value matrix to further determine which sites experience the highest levels of threat. In cases where there are numerous sites and threat types, the matrix can become quite large although it is useful for cases where targeted management is proposed. Such a matrix compares each of the habitats or sites within a subject site to each threat type and enables combinations of high values and high threats and overall threats to each value to be identified (Carey *et al.* 2004). This process enables sites with high threats to be identified.

Table 3.3: Extract from the WHSRN SAT threat assessment worksheet (Valencia 2006). First row added for interpretation.

THREATS	THREAT TYPES					THREAT ATTRIBUTES			CUMULATIVE SCORE
	TIMING	SCOPE	SEVERITY	LOCATION	COMMENTS & DETAILS <i>(Mention indicators and dates if available)</i>	TREND	IMPACT		
0. No threats									
1. <u>Habitat conversion/loss/degradation (human induced)</u>									
1.1. <u>Agriculture</u>									
1.2. <u>Land management of non-agricultural areas</u>									
1.3. <u>Extraction</u>									
1.4. <u>Infrastructure development</u>									
1.5. <u>Fires</u>									
1.6. <u>Other causes</u>									
1.8.1. Military activities									
1.8.2. Changing salinity									
1.7. <u>Unknown causes</u>									
2. <u>Invasive alien species</u>									
2.1. <u>Competitors</u>									
2.2. <u>Predators</u>									
2.3. <u>Hybridizers</u>									
2.4. <u>Pathogens/parasites</u>									
2.5. <u>Other</u>									
2.5.1. Pets, domestic animals									
2.5.1. Genetically modified organisms									
2.6. <u>Unknown</u>									

### **Prioritising Management Actions**

Management actions should be prioritised according to their ability to address the identified threats (Department of Natural Resources and Environment 2002). The need to prioritise management actions will depend on the number of actions proposed and the difficulty associated with distinguishing between these actions. Priority should be given to management actions that are cost effective, that is, provide the highest benefit in a timely and financially efficient manner, are likely to be successful at ameliorating the identified threat/s and which are feasible. To enable management actions to be prioritised it is necessary to make sure that each action has a specific aim.

Several factors will constrain the viability of management actions and it is therefore important to undertake a prioritisation process that includes consideration of constraints and benefits (Table 3.4). The prioritisation process could involve a value-weighted process where points are assigned depending on the potential value of an action and deducted for each limitation.

In addition to considering the above constraints the overall viability of the proposed management actions must be considered. Actions that are untested or which have uncertain benefits should be assigned a lower ranking. Such a pragmatic approach to management is justified given the resources available and competition for these resources. For example, various actions could be proposed to manage 4WD use of a shorebird roost (e.g. advisory signs, wardening, regulation, environmental protection zoning, inclusion in a conservation reserve & prohibition). Individually some of these actions will provide better outcomes than others and the outcomes can be greatly improved by combining actions. In the above scenario the combination of: inclusion in a conservation reserve, advisory signs and regulation represents a comprehensive approach to managing 4WD vehicles

Table 3.4: Potential constraints that should be considered during the prioritisation of management actions.

<b>Constraints</b>	<b>Rationale</b>
Feasibility	Some management actions will be constrained by engineering and environmental issues. The construction of roosts in tidal areas may be severely constrained by engineering requirements, whilst the construction of roosts near airports or wind-farms may not be appropriate.
Permissibility (Planning & legislative)	Issues such as land tenure and zoning and environmental protection law can constrain some projects.
Cost (social, environmental & financial)	There are several different costs that should be considered, including: financial, social and environmental. In most cases it is hoped that the environmental benefits outweigh the costs; however, this may not always be the case. Actions with an environmental cost will most likely be constrained by permissibility issues. Social costs may be considerable where management actions involve changes in land use. The financial cost of a project is often a primary constraint and actions that cannot be funded will not be implemented regardless of their benefit.
Resources and support	The ability of the proposed action/s to link with existing Natural Resource Management (NRM) programs, utilise available resources and knowledge can have a strong bearing on their on-ground success and ability to attract funding.
Threat Implications	The implications of the particular threat will influence the prioritisation of actions. In most cases actions that ameliorate an imminent threat that is predicted to affect the local shorebird population would be given priority over actions that focus on less important threats.
Overall value	The value of different management actions to the conservation of shorebirds vary considerably and higher priority should be given to actions that provide the most effective means of ameliorating threatening processes.

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## APPENDIX A

### LIST OF STATE AND COMMONWEALTH ENVIRONMENT PROTECTION AGENCIES AT 30 JUNE 2006

For an updated list visit: <http://www.deh.gov.au/about/library/govtdepts.html>

#### *Australian Government*

**Department of the Environment and Heritage (previously Environment Australia)**

**Minister:**

[Senator the Hon Ian Campbell](#)

**Department Address:**

John Gorton Building  
King Edward Terrace  
CANBERRA ACT 2600  
GPO Box 787  
CANBERRA ACT 2601  
Phone: +61 2 6274 1111  
Fax: +61 2 6274 1123

**Secretary:**

David Borthwick

**Web Site:**

<http://www.deh.gov.au>

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#### *Australian Capital Territory*

**Environment ACT**

**Minister:**

Mr John Hargreaves MLA  
Department of Urban Services  
Level 2, Macarthur House  
12 Wattle St  
LYNEHAM ACT 2602  
PO Box 144  
LYNEHAM ACT 2602  
Phone: +61 2 6207 9777  
Fax: +61 2 6207 2227

**Web Site:**

<http://www.environment.act.gov.au>

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## ***New South Wales***

### **Department of Environment and Conservation**

**Minister:**

The Hon Robert John Debus MP

Department of Environment and Conservation (NSW) was formed in September 2003 and incorporates the Environment Protection Authority, National Parks and Wildlife Service, Botanic Gardens Trust and Resource NSW.

**Environment Protection Authority Address:**

59-61 Goulburn Street  
SYDNEY NSW 2000  
PO Box A290  
SYDNEY SOUTH NSW 1232  
Phone: +61 2 9995 5000  
Fax: +61 2 9995 5999  
Pollution Line: 131 555 (within Australia)

**Web Site:**

<http://www.epa.nsw.gov.au/>

**NSW National Parks and Wildlife Service Address:**

Level 1, 43 Bridge St  
HURSTVILLE NSW 2220  
PO BOX 1967  
HURSTVILLE NSW 2220  
Phone: +61 2 9585 6444 (Switchboard)  
Information: 1300 36 1967 (within Australia)  
Fax: +61 2 9585 6555

**Web Site:**

<http://www.npws.nsw.gov.au>

### **Department of Natural Resources**

[DNR contact details](#)

Web Site: [www.dlwc.nsw.gov.au](http://www.dlwc.nsw.gov.au)

### **Department of Planning**

[DP contact details](#)

Web Site: [www.planning.nsw.gov.au](http://www.planning.nsw.gov.au)

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## ***Northern Territory***

### **Department of Natural Resources, Environment and the Arts**

**Minister:**

Ms Marion Rose Scrymgeour

**Department Address:**

Level 2, Darwin Plaza Building  
41 Smith St  
DARWIN NT 0800  
GPO Box 30  
Palmerston NT 0831  
Phone: +61 8 8924 4139  
Fax: +61 8 8924 4053

**Web Site:**

<http://www.nreta.nt.gov.au/>

**Parks and Wildlife Commission of the Northern Territory Address:**

Goyder Centre  
25 Chung Wah Terrace  
PALMERSTON NT 0830  
PO Box 496  
PALMERSTON NT 0831  
Phone: +61 8 8999 5511  
Fax: +61 8 8932 3849

**Web Site:**

<http://www.nt.gov.au/ipe/pwcnt/>

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**Queensland**

**Environmental Protection Agency**

**Minister:**

The Hon Desley Boyle MP (Minister for Environment, Local Government, Planning and Women)

**Address:**

160 Ann Street  
BRISBANE QLD 4000  
PO Box 15155  
CITY EAST QLD 4002

**Contacts**

Phone: +61 7 3227 7111

**Web Site:**

[www.epa.qld.gov.au](http://www.epa.qld.gov.au)

**Department of Energy**

**Minister:**

The Hon R. John Mickel

**Address:**

Level 17  
61 Mary Street  
BRISBANE QLD 4000  
PO Box 15216  
CITY EAST QLD 4002  
Phone: +61 7 3224 6320  
Fax: +61 7 3238 3088

**Web Site:**

<http://www.energy.qld.gov.au>

**Department of Natural Resources, Mines and Water**

**Minister:**

The Hon Henry Palaszczuk

**Address:**

Mineral House  
41 George Street  
BRISBANE QLD 4000  
GPO Box 2454  
BRISBANE QLD 4001  
Phone: +61 7 3896 3111

**Web Site:**

<http://www.nrm.qld.gov.au>

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## **South Australia**

### **Department for Environment and Heritage**

**Minister:**

The Hon John David Hill MP

**Address:**

Chesser House  
91-97 Grenfell Street  
ADELAIDE SA 5000  
GPO Box 1047  
ADELAIDE SA 5001  
Phone: +61 8 8204 9000 (Switchboard)  
Fax: +61 8 8124 4939

**Web Site:**

<http://www.environment.sa.gov.au/>

### **Department of Water Land and Biodiversity Conservation**

**Address:**

Grenfell Centre  
25 Grenfell Street  
ADELAIDE SA 5000  
GPO Box 2834  
ADELAIDE SA 5001  
Phone: +61 8 8463 6800

**Web Site:**

<http://www.dwlbc.sa.gov.au/>

### **Environment Protection Authority (EPA)**

**Address:**

77 Grenfell Street  
Adelaide SA 5000  
GPO Box 2607  
ADELAIDE SA 5001  
Phone: +61 8 8204 2000  
Fax: +61 8 8204 9393

**Web Site:**

<http://www.epa.sa.gov.au>

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## **Tasmania**

### **Department of Infrastructure, Energy and Resources**

**Minister:**

The Hon Bryan Green MHA

**Address:**

10 Murray Street  
HOBART TAS 7000  
GPO Box 936  
HOBART TAS 7001  
Phone: 1300 135 513

**Web Site:**

<http://www.dier.tas.gov.au/>

### **Department of Primary Industries and Water**

**Minister:**

The Hon David Llewelyn MHA

**Address:**

Marine Board Building 1 Franklin Wharf

HOBART TAS 7000  
GPO Box 44  
HOBART TAS 7001  
Phone: +61 3 6233 8011  
Fax: +61 3 6234 1335

**Web Site:**

<http://www.dpiwe.tas.gov.au/>

**Department of Tourism, Arts and the Environment**

**Minister:**

The Hon Paula Wriedt MHA

**Address:**

22 Elizabeth Street  
HOBART TAS 7000  
GPO Box 771  
HOBART TAS 7001  
Phone: +61 3 6233 5732  
Fax: +61 3 6233 5555

**Web Site:**

<http://www.dtae.tas.gov.au>

**Tasmania Parks and Wildlife Service**

**Address:**

Lands Building 134 Macquarie Street  
HOBART TAS 7000  
GPO Box 1751  
HOBART TAS 7001  
Phone: 1300 135 513  
Fax: (03) 6224 0884

**Web Site:**

<http://www.parks.tas.gov.au/>

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**Victoria**

**Department of Sustainability and Environment**

**Ministers:**

The Hon Johnstone William Thwaites (Minister for Environment and Minister for Water)  
The Hon Rob Hulls MLA (Minister for Planning)  
Elaine Carbines (Parliamentary Secretary for the Environment)

**Address:**

8 Nicholson Street  
EAST MELBOURNE VIC 3002  
PO Box 500  
EAST MELBOURNE VIC 3002  
Phone: +61 3 9637 8000  
Fax: +61 3 9637 8100

**Web Site:**

<http://www.dse.vic.gov.au/>

**Environment Protection Authority**

**Address:**

Herald and Weekly Times Tower  
40 City Road  
SOUTHBANK VIC 3006  
PO Box 4395QQ  
MELBOURNE VIC 3001  
Phone: +61 3 9695 2700  
Fax: +61 3 9695 2780  
Pollution Watchline: +61 3 9695 2777

**Web Site:**

<http://www.epa.vic.gov.au/>

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**Western Australia**

**Department of Conservation and Land Management**

**Minister:**

the Hon Mark McGowan MLA (Minister for the Environment)

**Department Addresses:**

Hackett Drive  
CRAWLEY WA 6009  
Phone: +61 8 9442 0300  
Fax: +61 8 9386 1578

**and**

17 Dick Perry Avenue  
Western Precinct Technology Park  
KENSINGTON WA 6151  
Locked Bag 104  
BENTLEY DELIVERY CENTRE 6983  
Phone: +61 8 9334 0333  
Fax: +61 8 9344 0466

**Web Site:**

<http://www.calm.wa.gov.au/>

**Department of Environment**

**Minister:**

the Hon Mark McGowan MLA  
20th Floor, 197 St George's Terrace  
PERTH WA 6000  
PO Box K822  
PERTH WA 6842  
Phone: +61 8 9222 9111  
Fax: +61 8 9222 9410

**Web Site:**

<http://www.environment.wa.gov.au>

**Department of Industry and Resources**

**Minister:**

the Hon Alan Carpenter BA LLB MLA

**Address: 1**

Adelaide Terrace  
1 Adelaide Terrace  
EAST PERTH WA 6004  
Phone: +61 8 9222 3333  
Fax: +61 8 9222 3862

**Web Site:**

<http://www.doir.wa.gov.au>

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**Address 2:**

Dumas House  
2 Havelock St  
WEST PERTH WA 6005  
Phone: +61 8 9222 5555  
Fax: +61 8 9222 3862

**Address 3:**

Mineral House  
100 Plain St  
EAST PERTH WA 6004  
Phone: +61 8 9222 3333  
Fax: +61 8 9222 3862

**Office of Energy**

**Minister:**

the Hon Alan Carpenter MLA

**Address:**

9th Floor, Governor Stirling Tower  
197 St Georges Tce  
PERTH WA 6000  
Phone: +61 8 9420 5600  
Fax: +61 8 9420 5700

**Web Site:**

<http://www.energy.wa.gov.au/>