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An introduction to the physical characteristics of the Roebuck Bay area and the Ramsar wetland, outlining the cultural significance of the study area for the Yawuru Traditional Owners, and the key values, ecological and cultural, which were identified by the Roebuck Bay Working Group (RBWG).

Information is given on the working group, who have initiated the community-driven and values based planning process for Roebuck Bay. It sets down the members involved in the RBWG and discusses the Traditional Owners and stakeholders.

The RBWG's planning work is graphically illustrated, the planning process, and the methodology are outlined. From this important work over the past five years has come four documents that are central to fully understand this preliminary draft of the Roebuck Bay Ramsar site Management Plan. They are the:

- Roebuck Bay Interim Management Guidelines
- Draft Management Plan for Crab Creek, and the associated
- Crab Creek Implementation and Action Plan — Sept 2009
- Ecological Character Description for Roebuck Bay.

(These documents can be accessed on the RBWG website http://www.roebuckbay.org.au )

With high biodiversity value, a wetland of international importance for migratory shorebirds, and surrounded by areas of cultural value to Aboriginal people, Roebuck Bay has captured the interest of the community who have drawn together in order to protect the natural and cultural assets of Roebuck Bay.
INTRODUCTION

The Roebuck Bay Ramsar site covers an area of 34,119 hectares immediately to the south and east of the remote township of Broome in north-western Australia. The area was declared a wetland of international importance in 1990 under an international agreement called the Ramsar Convention.

This officially recognised its importance as a wetland refuge for many thousands of migratory shorebirds.

The soft-bottom intertidal mudflats of the northern and eastern shores of Roebuck Bay and the high tide roosts of Bush Point and Sandy Point are the most biologically significant parts of the site. Roebuck Bay is one of less than twenty such sites worldwide supporting very large numbers of shorebirds that migrate from the Arctic each season. Rich in life with small bottom-dwelling animals known as benthic invertebrates, the Roebuck Bay has been assessed as supporting up to 300,000 shorebirds annually.

The Australian Government is a signatory to the Ramsar Convention, The Convention on Wetlands of International Importance Especially as Waterfowl Habitat, and as such is required to manage the Roebuck Bay Ramsar site to conserve its outstanding values and to ensure its wise and sustainable use. This requirement ties in with the Broome community’s strongly-held view that Roebuck Bay is a natural and cultural asset that deserves protection, in order to maintain its values.

But these outstanding ecological values are not the only values of Roebuck Bay. The area holds cultural, historical, social, economic, recreational, paleontological, educational and aesthetic values.

Roebuck Bay is part of the ancestral home of Yawuru people, the Aboriginal people of the area, for whom the land and sea have strong and enduring cultural, spiritual, social and economic significance.

An area of outstanding scenery and natural beauty, the remote town of Broome on the shores of Roebuck Bay has high aesthetic value, and is a major tourism destination generating significant income for the region. The stark contrasts of turquoise seas, red pindan cliffs, and green hues of surrounding mangroves, fringed by sandy beaches or grey muddy shores of the Bay, draws large numbers of tourists to the area each year.

Important to locals and visitors alike for its recreational values, Roebuck Bay supports considerable boating and fishing activity that includes commercial, recreational, and traditional subsistence fishing.

Since 1998 the Broome Bird Observatory near Fall Point at Mangalagun (Crab Creek) has provided an important base for national and international research and education, with a focus on the shorebirds and the factors that are driving the ecosystems that support them.
INTRODUCTION AND BACKGROUND

The Port of Broome, located at the north-western entrance to Roebuck Bay, is the principal deep-water port in the north-west region, and is ‘geared for growth’ as the Kimberley region develops.

Recognising the importance of the area and the growing pressures on it, the Roebuck Bay Working Group (RBWG) was formed in 2004 to achieve ‘the protection of Roebuck Bay’s values through community based management planning’. The RBWG brings together representatives of land and sea owners and managers, government agencies, local government, industry, special interest groups, and the community.

Sharon Griffiths and Associates have been engaged by the RBWG to develop a preliminary draft management plan for the Ramsar site in Roebuck Bay. This plan builds on a considerable body of work undertaken over the previous five years by the RBWG, in its process of community-driven, values based management planning.

1. Background

1.1 The study area

Roebuck Bay is a large, curved bay at the southern end of the Dampier Peninsula. The location of the Bay is considered to be between the coastal extremities of Minyirr (Gantheaume Point) in the north and Cape Villaret in the south. (See Figure 1.1). The Bay is located adjacent to the remote and regionally important town of Broome, and is surrounded by the vast pastoral stations of Thangoo and Roebuck Plains. The northern part encompasses the mouths of two major creeks – Jugajun (Dampier Creek) and Mangalagun (Crab Creek). A similar sized tidal system, Yardoogarra Creek is located at the southern part of the site. A long red cliff of pindan soil dominates the shore of the northern beaches. At the base of the cliff, and just outside the boundary of the Ramsar site, occasional dinosaur footprints are preserved in sandstone, (Thulborn et al. 1994).

Roebuck Bay experiences large tidal movements that expose vast areas of soft coastal mudflats which are home to a rich diversity of small, bottom-dwelling animals that are an essential food source to very large numbers of visiting shorebirds.

The mangrove forests, sand dunes, grasslands and Pindan cliff lines typical of this ancient dry tropical part of the Kimberley region come together to provide a mosaic of important habitats for shorebirds as well as breeding grounds for a diversity of fish species.

The area is semi-arid with a monsoonal climate of six distinctive local seasons. Most notable of these are the two referred to as the ‘wet’ and the ‘dry’. The wet season is a hot, humid time when the predominance of heavy rain comes along with monsoonal activity, usually between December and April, and the dry is a warm time occurring around May to October. Cyclonic activity is a common occurrence along the Kimberley coast, and affects both nature and people.
**The Ramsar site in Roebuck Bay**

This plan covers as its core area the Ramsar wetland. It does not however extend over the entire Roebuck Bay wetland ecosystem. The northern boundary is located east of the Broome town site and south-east of Jugajun (Dampier Creek) on the northern shore of Roebuck Bay near Gubanyaya, referred to by shorebird researchers as Campsite. The Ramsar site extends to a point south of Sandy Point. (See Map 1.2).

As Bennelongia (2009) points out on p16, most of the extensive grasslands east of the Bay referred to as Roebuck Plains are excluded from the Ramsar site. However ‘they are contiguous with the Bay and hydrologically connected’ and ‘the western boundary of the Ramsar site along the northern shore stops short of the Dampier Creek system’. See Figure 1.2.

While this plan covers the Ramsar site, it also refers to adjacent areas of influence that include the waters of Roebuck Bay and the town of Broome. The whole area is of immense significance to Aboriginal people, though the Ramsar site has been known more commonly for its importance for migrating shorebirds and the rich biodiversity on which the birds depend.

In technical terms, the study area can be described in summary as shown in Box 1.

**Box 1: Technical description of the Roebuck Bay Ramsar site study area**

Roebuck Bay lies within the Northwest (IMCRA) bioregion and the Timor Sea Australian Drainage Division. It is situated in an area geologically termed the Northern Canning Basin (Watkins 1993).

The Ramsar site is located within Roebuck Bay, a large 360km² irregularly curved embayment of the Indian Ocean. The Bay lies within the Shire of Broome, in the coastal dry tropics of the Kimberley region, Western Australia. It forms part of the Pindanland subregion of the Dampierland bioregion that covers approximately 52,000km². The Bay is bounded to the north-west and far south-east by low sand ridges and to the east and north by coastal flats of Holocene marine sediments. The coastal flats support mangal, samphire, hummock grasslands and paperbark swamps. Behind these, vast grasslands that are contiguous with the Bay occur on black soils of the Roebuck Plains (Graham 2002 in Bennelongia 2009, p28).

The extensive soft bottom intertidal mudflats of the northern and eastern shores of Roebuck Bay, which are high in biological diversity, and the high tide roosts at Bush and Sandy Points are considered to be the most biologically significant parts of the Ramsar site, which was Ramsar listed for several reasons including most notably, its outstanding value for shorebirds. The northern part of the site encompasses the mouths of two major creeks - Dampier Creek and Crab Creek. A similar sized tidal system, Yardogarra Creek, is located at the southern part of the site. A long red cliff, 2 to 6 metres in height, of Pindan soil, overlying yellowish-red Broome Sandstone of Cretaceous age dominates the northern shore of the Bay. In this area along the rocky foreshores, occasional dinosaur footprints are preserved in sandstone (Thulborn et al. 1994). Yawuru people speak of these land forms (prints) as emanating from Bugarregarre (The Dreamtime).

The extensive mudflat system of Roebuck Bay and the vast wetland plains to the east are the product of a palaeoriver that drained out of the Canning Basin during the early Miocene when Australian climates were much wetter (Van de Graf et al. 1977). The approximate location of the palaeochannel is identified in Vogwill (2003).

Roebuck Bay is subject to semi-diurnal tides with a tidal range of up to 10.5 metres. Spring tides occur every fortnight, flooding low-lying salt marshes behind the mangrove woodlands fringing the Bay. At low tide about 190km² of mudflat (45% of the Bay area) is exposed.

The 34,119 hectares of the Ramsar site is mostly occupied by intertidal mudflats (Bennelongia 2009) that are largely exposed when waters retreat during low tides that at times are up to 10.5 metres below the high tide level.
1.2 The Traditional Owners

The Roebuck Bay Ramsar site lies within the traditional estate of the Yawuru people of north-western Australia. The site has great cultural significance for Aboriginal people and provides a range of benefits and services for them. Both the land and sea are integral to the cultural, spiritual, social and economic life of Aboriginal people. In the Yawuru language, the Bay is named Nalen Nalena (Bennelonga 2009).

1.3 Stakeholders

The rich natural and cultural features of Roebuck Bay have seen a broad range of commercial and recreational interests develop over more than 100 years of non-indigenous settlement. Tourism, fishing, pearling, pastoralism, shipping and port activities combine with a diversity of water-based leisure and recreational activities. Exploration and mining for natural resources are important offshore activities. The area also plays an important part in scientific research and education. Together with the Traditional Owners, a diversity of government agencies (local, state and national), members of the scientific community, commercial interest groups, community groups and individuals are stakeholders in the Bay and its Ramsar site.

The Roebuck Bay Working Group

Since its formation the Roebuck Bay Working Group (RBWG) has consistently worked with the stakeholders to attract the resources required to undertake management planning for Roebuck Bay. As at July 2009 the RBWG had 49 members. These are listed below.

- Australia’s North West Tourism
- Australasian Wader Studies Group
- Broome Bird Observatory
- Broome Fishing Club
- Broome Community Seagrass Monitoring Project
- Broome Port Authority
- Broome Visitor Centre
- Broome Fishing Club
- Broome Shire Council
- Community volunteers
- Conservation Volunteers Australia
- Department of Agriculture and Food
- Department of Environment and Conservation
- Department of Fisheries
- Department of Planning
- Environ Kimberley
- Global Flyway Network
- Indigenous Land Corporation
- Kimberley Land Council
- Kimberley Professional Fishermens Association
- Pearl Producers Association
- Research scientists
- Thangoo Station
- Water Corporation
- West Kimberley Recreational Fishing Advisory Committee
- WWF Australia
- Yawuru Native Title Holders Aboriginal Corporation

The Working Group does not have decision-making powers over Roebuck Bay, but works collaboratively to improve communication and coordination, and to advance initiatives that will result in a sustainable management plan being produced for Roebuck Bay.

1.4 The planning process (methodology)

To date management planning for Roebuck Bay has had a strong community focus, because it is largely the local community that will undertake and guide the day-to-day management and monitor (formally and informally) the condition of the Bay and its Ramsar site. These are the people likely to remain vigilant and to provide early warning signals if changes in ecological character of the area are emerging.

Initially, in 2004, the RBWG set down its vision and objectives. These are given in detail in Section 2.1. Community-based management planning for Roebuck Bay was then undertaken over a five year period and included values mapping, the identification of management issues resulting in an Issues Paper, and development of Interim Management Guidelines (IMGs) by consultants Community Solutions. Having followed a sound process of community and stakeholder engagement, the RBWG used the IMGs as an interim measure to get people generally committed to the overall vision and objectives, while waiting for more detailed information from the Crab Creek management planning and an Ecological Character Description.

The flowchart illustrates the Roebuck Bay Working Group’s planning progress to date. See figure 1.4.

In 2008 Sharon Griffiths and Associates, in collaboration with Acacia Springs Environmental (Dr David Deeley) undertook the first trial of collaborative management planning for an area of Roebuck Bay. The site selected was Crab Creek, an area under increasing human pressure, and including part of the Ramsar wetland. The Crab Creek area is renowned worldwide as a vital feeding and roosting site for migratory shorebirds, but less well known is the fact that the coastal country has enormous cultural significance to Yawuru, the Aboriginal people of the area. The draft Crab Creek Management Plan was submitted to the RBWG in June 2009, and is awaiting finalisation.

An Ecological Character Description (ECD) for Roebuck Bay was developed by Bennelonga Pty Ltd in December 2008, for the Department of Environment and Conservation and adopted in April 2009. This is a key report and provides the technical background needed for planning to manage the Bay.
The Roebuck Bay Working Group’s (RBWG) history, aims, and vision are explained.

Principles to guide the conservation and wise use of Roebuck Bay taken from the Interim Management Guidelines are set down. From these principles are derived the management objectives for the Bay, and some actions recommended by the RBWG. The eight principles are listed below.

1. Maintain the cultural, spiritual, sustenance and economic values of Roebuck Bay for Yawuru Traditional Owners.
2. Minimise activities likely to cause disturbance to shorebirds and other species important to the ecological and cultural values of Roebuck Bay.
3. Minimise loss of habitat significant to shorebirds and other species in Roebuck Bay; maintain and restore the biodiversity in the area.
4. Maintain and restore water quality across Roebuck Bay.
5. Ensure that natural surface and groundwater flows are maintained as far as possible.
6. Prevent the introduction of invasive plants and animals into Roebuck Bay; contain and/or eradicate invasive species where infestations have occurred.
7. Promote environmentally sustainable economic uses of Roebuck Bay.
8. Increased human use and visitation should not be permitted to damage the natural and cultural values of Roebuck Bay.
The Roebuck Bay Working Group's stated aims are:

- advancing and advocating integrated management planning to protect, restore and maintain the natural and cultural values of Roebuck Bay;
- advancing initiatives to produce a community based management plan;
- providing the opportunity for the community to express its values about the Bay.

To ensure Roebuck Bay is managed in an ecologically sustainable manner for present and future generations.

To ensure Roebuck Bay is managed in an ecologically sustainable manner for present and future generations.

People have always valued Roebuck Bay but often for differing reasons. Vernes et al (2005) identified many reasons Roebuck Bay means many things to many people — to some it’s an ancestral home to which they have continuing responsibility; a place to hunt, fish and collect shellfish; to others its importance lies in its status as one of the most important migratory shorebird sites in Australia. For many people it is simply a place to relax and unwind; for others it’s a place from which to earn a living: from fishing, mud crabbing, hovercraft rides, pearl farming and shipping.

2.1 Roebuck Bay Working Group and the Vision for Roebuck Bay

Since time immemorial Roebuck Bay has been a vital part of the cultural landscape that supports Aboriginal people. They have a strong need and desire to protect and maintain the cultural and natural assets in order to maintain their culture, their lifestyle and indeed their health and wellbeing. The Aboriginal people do not distinguish between cultural and natural assets, but see them as one.

In more recent times, the 1990 declaration of the Ramsar site as a wetland of international importance officially recognised the importance of Roebuck Bay as a refuge for many thousands of migratory shorebirds.

In 2004 a group of people each with a vision to protect the Bay and a desire to establish a collaborative effort to ensure that protection, came together. Yawuru Traditional Owners, (represented by Rubibi, an umbrella organisation for the Aboriginal people of Broome), WWF Australia, and the Broome Bird Observatory (BBO) instigated the development of the Roebuck Bay Working Group (RBWG). Initially the project was to work towards the protection of cultural areas and the conservation of shorebirds and their habitat. The prime objective for the RBWG was to secure the resources required to undertake much-needed planning.

The Roebuck Bay Working Group's stated aims are:

- advancing and advocating integrated management planning to protect, restore and maintain the natural and cultural values of Roebuck Bay;
- advancing initiatives to produce a community based management plan;
- providing the opportunity for the community to express its values about the Bay.
The Vision held for Roebuck Bay by the RBWG is:

- To ensure Roebuck Bay is managed in an ecologically sustainable manner for present and future generations.

In order for this to occur, the RBWG believes it is essential that the planning for Roebuck Bay remains a community-based effort as that is what has sustained the local interest until now.

### 2.2 Management objectives

Building on the Values Mapping process by Community Solutions in 2004, the June 2006 stakeholder workshop identified eight key management principles (Lambert & Elx 2006) from which high level management objectives for Roebuck Bay are readily derived.

1. Maintain the cultural, spiritual, sustenance and economic values of Roebuck Bay for Yawuru Traditional Owners.
2. Minimise activities likely to cause disturbance to shorebirds and other species important to the ecological and cultural values of Roebuck Bay.
3. Minimise loss of habitat significant to shorebirds and other species in Roebuck Bay; maintain and restore the biodiversity in the area.
4. Maintain and restore water quality across Roebuck Bay.
5. Ensure that natural surface and groundwater flows are maintained as far as possible.
6. Prevent the introduction of invasive plants and animals into Roebuck Bay; contain and/or eradicate invasive species where infestations have occurred.
7. Promote environmentally sustainable economic uses of Roebuck Bay.
8. Increased human use and visitation should not be permitted to damage the natural and cultural values of Roebuck Bay.

The RBWG, with input from the community and government agencies, agreed on the eight principles and some recommended actions (RBWG 2009), to guide the conservation and wise use of Roebuck Bay during the interim until a management plan is completed and implemented. Built on the eight principles the Interim Management Guidelines (IMGs) were developed and publicly released in August 2009. They are reproduced below.

### 2.3 Interim Management Guidelines – August 2009

#### 1. Maintain the cultural, spiritual, sustenance and economic values of Roebuck Bay for Yawuru Traditional Owners.

- **Some recommended actions:**
  - Yawuru Traditional Owners continue to have an active role in the RBWG and Ranger program in Minyirr Park.
  - Vehicle points for coastal access (e.g. boat launching) are planned in consultation with Yawuru Traditional Owners.
  - To better manage human impacts, signage and barriers are erected to protect the natural and cultural values of Roebuck Bay.

#### 2. Minimise activities likely to cause disturbance to shorebirds and other species important to the ecological and cultural values of Roebuck Bay.

- **Some recommended actions:**
  - Ensure no developments occur along Crab Creek Road or between Broome Port and Dampier Creek that interfere with shorebird roosts.
  - Protect shorebird roosts from disturbance by vehicles and helicopters.
  - Protect dolphins, dugongs and turtles from boat injuries, with boat speed less than five knots around creeks, mangroves, seagrass and shallow turbid water.
  - Minimise loss of habitat significant to shorebirds and other species in Roebuck Bay; maintain and restore the biodiversity in the area.

Some recommended actions:
- Establish community-based monitoring programs for a range of key plant and animal species (i.e. benthos, dolphins, dugongs, mangroves, seagrass, shorebirds and turtles).
- Undertake studies of habitats for key species to gain a greater understanding of the ecosystem requirements.
- Monitor fish and dugong stocks and impacts from fishing/hunting to record baseline data.

#### 3. Maintain and restore water quality across Roebuck Bay.

- **Some recommended actions:**
  - Water discharged into Roebuck Bay to meet National Water Quality Standards.
  - Develop and implement stormwater and drainage management guidelines.
  - Undertake a review of the Broome groundwater management plan.
  - Monitor bores installed around areas where waste water is used, stored or likely to infiltrate.

#### 4. Prevent the introduction of invasive plants and animals into Roebuck Bay;

- **Some recommended actions:**
  - Assess possible impacts on groundwater from any new development.
  - All development in accord with setback guidelines outlined in the State Coastal Planning Policy (SPP No. 2.6), to protect people and property against severe storms, shoreline movement, sea level rise and fluctuations in coastal processes.
  - Emergency response plans are regularly revised for pollutant and oil spills in the bay and catchment areas and ongoing collaboration to identify high risk areas.

#### 5. Increased human use and visitation should not be permitted to damage the natural and cultural values of Roebuck Bay.

- **Some recommended actions:**
  - Undertake a baseline study of water quality, species present and environmental conditions at Broome Port and Gantheaume Point.
  - Implement increased quarantine vigilance on all vessels to prevent introduction of diseases and invasive species.
  - Regular water monitoring at Broome Port/Gantheaume Point for early detection and eradication of pests e.g. black-striped mussels and harmful aquatic weeds.

#### 6. Promote environmentally sustainable economic uses of Roebuck Bay.

- **Some recommended actions:**
  - Undertake studies of habitats for key species to gain a greater understanding of the ecosystem requirements.
  - Establish community-based monitoring programs for a range of key plant and animal species i.e. benthos, dolphins, dugongs, mangroves, seagrass, shorebirds and turtles.
  - Undertake studies of habitats for key species to gain a greater understanding of the ecosystem requirements.
  - Monitor fish and dugong stocks and impacts from fishing/hunting to record baseline data.

Some recommended actions:
- Assess possible impacts on groundwater from any new development.
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- Emergency response plans are regularly revised for pollutant and oil spills in the bay and catchment areas and ongoing collaboration to identify high risk areas.
What is Ramsar?
An explanation of the Ramsar Convention, its international context, key aims, planning methodology, and the criteria as it applies to the Roebuck Bay Ramsar wetland is given.

This section provides definitions and helps understand the key terms used in Ramsar management planning, and those used in this plan. For example, the Limits of Acceptable Change (LAC) is a concept that recognises that while change is inevitable, in order to protect the values of the Ramsar wetland those changes must be within acceptable limits.

What makes Roebuck Bay special?
The Roebuck Bay site is recognised worldwide as an important wetland and was listed under the Ramsar Convention because it meets internationally identified criteria, for:
- Wetland values
- Threatened species/communities
- Regional biodiversity
- Key habitat in life cycle of migratory shorebirds
- Supports >20,000 waterbirds
- Supports >1% of waterbird species
- Significant for indigenous fish
- Key habitat in fish life cycle.
3.1 What is Ramsar?

Ramsar is a term arising from an intergovernmental treaty that focuses on the conservation and wise use of wetlands that was signed in the Iranian city of Ramsar in 1971. Australia was amongst the first nations to support the treaty, commonly referred to as the ‘Ramsar Convention’. The official title is The Convention on Wetlands of International Importance, especially as Waterfowl Habitat. It has as its mission:

The Convention’s mission is the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world.

(Ramsar 2008)

Australia as one of the contracting parties, has agreed to the principles of the Ramsar Convention. For example under Article 3.1 to:

... formulate and implement their planning so as to promote the conservation of Ramsar listed wetlands and as far as possible the wise use of wetlands in their territory.

The Convention defines ‘wise use’ of wetlands as:

... their sustainable utilization for the benefit of human kind in a way compatible with the maintenance of the natural properties of the ecosystem.

In turn, ‘sustainable utilization’ is defined as:

... human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations.

The Commonwealth Government of Australia must ensure all levels of government and those stakeholders responsible for managing Ramsar wetlands take on this responsibility and commit to work towards:

...the wise use of all their wetlands through national land-use planning, appropriate policies and legislation, management actions, and public education.

Wetlands located in Western Australia (WA) that are listed as Wetlands of International Importance, under the Ramsar Convention are protected under Commonwealth and Western Australian legislation.

Any action that is likely to have a significant impact on a Ramsar wetland (and reduce or threaten its ecological character), must be referred to the Australian Government Department of Environment, Water, Heritage and the Arts, and the Environmental Protection Authority of WA, and undergo an environmental assessment and approval process. (DEC Brochure 2009, 2009384 0909-2M)

It is important that the management plan meet the needs of those responsible to the international community through the Ramsar Convention and its requirements.
The principles arising from the Ramsar Convention (Ramsar 2002), adopted at the Conference of the Contracting Parties in Spain in 2002, provide the basis for preparing management plans for Ramsar wetlands. This preliminary draft management plan for the Roebuck Bay Ramsar site is designed to respond to the Ramsar requirements. The principles adopted alert those responsible for the wetlands management to the requirement that once a wetland is listed as a Ramsar site, then they are to provide a description of the ecological character of the wetland, (see Key Terms in Table 3.4.1). Furthermore they are obligated to monitor the Ramsar site to ensure that early warnings can be gained of any factors that have the potential to alter that ecological character.

Conforming to the Ramsar principles will be achieved by drawing on the information in the Ecological Character Description (ECD) for Roebuck Bay, and by the implementation of this Roebuck Bay Ramsar Site Management Plan (preliminary draft).

3.2 What makes Roebuck Bay an internationally important Wetland?

For a wetland to be listed, that is included on a List of Wetlands of International Importance, it must meet at least one of nine Ramsar criteria, summarised below. Roebuck Bay is considered to currently meet seven of the nine criteria.

Roebuck Bay was first listed as a Ramsar wetland of international importance in 1990, primarily due to its intertidal mudflats and parts of the hinterland, being among the most important migratory shorebird feeding grounds and roosts on the East Asian-Australasian Flyway. (Watkins 1993). The Ramsar Information Sheet (RIS) for the Roebuck Bay wetland was updated by DEC in 2003, with the site considered to meet all of the then eight criteria. This RIS can be found in the attachments. In 2009, in the recently prepared ECD for Roebuck Bay, consultants Bennelongia Environmental Services updated the RIS information and present good evidence for the site meeting seven of the current nine Ramsar criteria as follows:

<table>
<thead>
<tr>
<th>Criterion 1: Wetland values</th>
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<tbody>
<tr>
<td>The site is a superb example of a tropical marine embayment within the Northwest (IMCRA) bioregion. It is one of only a dozen intertidal flats worldwide where benthic food sources are found in sufficient densities that they regularly support internationally significant numbers of waders.</td>
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<tr>
<th>Criterion 2: Threatened species/communities</th>
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<tbody>
<tr>
<td>Loggerhead Turtles Caretta caretta (nationally endangered) and Green Turtles Chelonia mydas (nationally vulnerable) regularly use the site as seasonal feeding areas and as a transit area on migration. Flatback Turtles Natator depressus (nationally vulnerable) regularly nest in small numbers around Cape Villaret during the summer months. Sawfish Pristis ciavata (nationally endangered) regularly use the tidal creeks and mangrove areas for breeding and refuge.</td>
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<th>Criterion 3: Regional biodiversity</th>
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<tr>
<td>The site supports a significant component of the regional (Northwest IMCRA bioregion) intertidal and shallow marine biodiversity in terms of the marine mammals (Dugong, turtles and dolphin), marine invertebrate infauna, and avian fauna across the site. The total density of macrobenthic animals (1,287 individuals/m2) is high by global standards for a tropical mudflat and species richness is very high (estimated to be between 300 - 500 species).</td>
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<th>Criterion 4: Key habitat in life cycle</th>
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<tr>
<td>The site is one of the most important migration stopover areas for shorebirds both in Australia and globally. It is the arrival and departure point for large proportions of the Australian populations of several shorebird species, notable Bar-tailed Godwit Limosa lapponica and Great Knot Calidris tenuirostris. The site provides essential energy replenishment for many migrating species, some of which fly non-stop between continental East Asia and Australia.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criterion 5: Supports &gt;20,000 waterbirds</th>
</tr>
</thead>
<tbody>
<tr>
<td>The site regularly supports over 100,000 waterbirds. The highest number of shorebirds counted at the site was 170,915 in October 1983 and allowing for turnover, the total number of shorebirds using the site may exceed 300,000 annually. It is the fourth most important site for waders in Australia in terms of absolute numbers and the most important in terms of the number of species it supports in internationally significant numbers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criterion 6: Supports &gt;1% of waterbird species</th>
</tr>
</thead>
<tbody>
<tr>
<td>The site regularly supports &gt; 1% of the population of at least 22 wader species (20 migratory and 2 resident in Australia.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criterion 7: Significant for indigenous fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>The currently documented values of the Bay for indigenous fish species do not appear to make it outstanding or different from other parts of the Kimberley region.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criterion 8: Key habitat in fish life cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>The site is important as a nursery and/or breeding and/or feeding ground for at least five species of fish and for mud crabs and prawns. The site’s mangal system is particularly important as a nursery area for marine fishes and prawns.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criterion 9: Supports &gt;1% of non avian species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient information for assessment.</td>
</tr>
</tbody>
</table>

Note: > is greater than or equal to

3.3 Limits of Acceptable Change affecting the Ramsar wetland

Australia is obliged to ensure that the condition of the Ramsar site at Roebuck Bay stays as it was when it was first listed under the Ramsar Convention, or that the site’s ecological condition is improved. If there are changes (and changes should be expected) we as a nation, are obliged to ensure that these changes occur only within acceptable limits.

As outlined in Ramsar requirements for listed wetlands (Ramsar 2002), where changes are detrimental to the site, Limits of Acceptable Change measures are used to describe the extent to which a change is permissible within natural variability and at what point reduction or loss of a value becomes unacceptable because it is likely to be irreversible.

Insufficient information for assessment.
### 3.4 Terminology used in Ramsar wetland management planning

The word Ramsar is now in common usage as an adjective describing not only wetlands of international importance but other Ramsar related elements for example, Ramsar criteria, Ramsar requirements, the Ramsar Treaty, Ramsar sites and indeed Ramsar management plans.

‘Ecological character’ is defined under the Ramsar Convention (2005) as ‘the combination of the ecosystem components, processes and benefits/services that characterise the wetland at a given point in time’. Bennelongia on page v, (Bennelongia 2009) goes on to say that describing the ecological character of a Ramsar wetland is a fundamental step towards documenting its baseline condition so that any changes in ecological character may be identified. Management plans for Ramsar sites are thus designed to assist in ensuring that the ecological character of the wetland is maintained.

Table 3.4.1 explains a number of the key terms used in relation to Ramsar sites and their management.

Table 3.4.2 shows the relationship between the key terms and elements (from above table); the ecosystem drivers, levers, components and processes that together determine the ecological character of the Roebuck Bay Ramsar site, and the services and benefits that are received as a result.

The Roebuck Bay Ramsar site, like other wetlands of high conservation value, is strongly connected to the surrounding landscape through the different physical, chemical and biological components of the area, and the interactions between those components. In preparing a management plan that will meet the need to protect the character of the area, account must be taken both of these components and the processes linking them, as well as of the benefits and services that describe the values of the area.

Perhaps most important of all in the development a successful management plan is an understanding of the critical drivers of the whole wetland system and the levers that interact with those drivers. Consideration of these factors will assist in building shared understanding of what needs to be done to manage the threats and pressures and to conserve the key natural and cultural values of the Roebuck bay Ramsar site.

### Table 3.4.1: Key terms commonly used

<table>
<thead>
<tr>
<th>TERM</th>
<th>INTERPRETATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Components</td>
<td>Physical, chemical and biological components of the system. Biological components being defined as habitats, species and genes, physical components as geology, hydrology etc and chemical components as nutrients, salinity etc</td>
</tr>
<tr>
<td>Processes</td>
<td>Interactions between the physical, chemical and biological components, that in turn supply benefits or services to humans</td>
</tr>
<tr>
<td>Benefits/Services</td>
<td>‘Ecosystem services’ are defined as ‘the benefits that people receive from ecosystems’, in accordance with the Millennium Ecosystem Assessments process. Benefits and services include products (provisions) such as food, fuel and fresh water; regulation of climate change, water and natural hazards; cultural benefits such as spiritual enrichment, recreation, education and aesthetics; and supporting services such as water and nutrient cycling and habitat.</td>
</tr>
<tr>
<td>Values</td>
<td>In Ramsar terms ‘values’ are generally thought of as ‘ecosystem services’ or the benefits that people obtain from the ecosystem (the wetlands and their surrounding management area). While the focus of these benefits is ecological, it is also recognised that benefits may be cultural, social, economic, or scientific and educational.</td>
</tr>
<tr>
<td>Drivers</td>
<td>The factors (both past and present) that drive change in the wetland, or determine the location and underpinning functions of the wetland in its landscape. At a broad level drivers include climate, geomorphology and hydrology, but they may also be used to refer to direct human influences (such as land use, invasive species, or water extraction) or indirect (such as economics, science, culture or religion). Understanding the fundamental natural processes is important to defining management. The Ramsar planning process focuses on factors influenced by humans which lead to change in the wetland system.</td>
</tr>
<tr>
<td>Levers</td>
<td>Levers refer to the human-induced factors that alter the components or processes in an ecosystem, e.g. drainage works, tourism pressure on fishing. Levers are key to management; being things that can be changed to influence the ecology of the Bay. Lever, while not a Ramsar term, is widely used in wetland management planning in Australia.</td>
</tr>
<tr>
<td>Ecological Character Description (ECD)</td>
<td>*An ECD tells the story of a wetland by describing the ecological baseline information and establishing quantitative benchmarks. These descriptions assist in identifying changes to the ecological character of a site.</td>
</tr>
</tbody>
</table>

(Adapted from Bennelongia 2009, p.81, p.40 and *DEC Brochure 2009, 2009384 0909-2M*)
The values held by the community for Roebuck Bay are described.

- Ecological values
- Aboriginal cultural values
- Socio/cultural values
- Economic values
- Aesthetic and intrinsic values
- Education and research values.

Local values are the primary focus while broader regional, national and international values are also given consideration.

Roebuck Bay is used for a wide range of activities by people, and supports many living organisms. The Bay's value and that of the Ramsar site within it, comes from the importance people place on those uses, the cultural and natural systems that exist, and the benefits and services that people receive from the Bay. However some of these values and some of the activities conflict.

While values held for Roebuck Bay extend beyond the community values to those that arise in the global, national and regional context, not all values have equal status. The natural and cultural values have been identified as the key priorities for protection by the Roebuck Bay Working Group.

This plan will show that some uses that are valued are also putting considerable pressure on Roebuck Bay and threatening the health of the Ramsar wetland.

Table 3.4.2 Ecosystem drivers, levers, components and processes that determine the ecological character of Roebuck Bay and the Ramsar site

From (Bennelongia 2009, p.82, Figure 24).
Roebuck Bay and the Ramsar site have always been valued by people. The values are many and diverse, and on occasions these varying values have conflicted, or have the potential to conflict. Furthermore many of the highly valued human uses are also the pressures or threats that increasingly impact on the Bay.

In 2004 a values mapping exercise for Roebuck Bay was undertaken that involved substantial stakeholder consultation. This resulted in a report that included a map showing the various values around Roebuck Bay and the Ramsar wetland, (Community Solutions 2004, p9). The map is shown at Figure 4.1.

In Ramsar terms ‘values’ are generally thought of as the services or benefits that people obtain from the ecosystem; the wetlands and their surrounding management area. While the focus of these benefits is ecological, it is also recognised that benefits may be cultural, social, economic, or scientific and educational. These key terms are explained in Table 3.4.1.

‘Value’ used here is taken to mean the worth, the importance and significance of Roebuck Bay.

In this Roebuck Bay Ramsar Site Management Plan (preliminary draft) it was important to consider the values from the broader area that influences Roebuck Bay. For example, the global market for oil and energy influences the commercial value from offshore exploration and mining in the Kimberley region, and through this comes increased pressure on the Bay. Population growth in the area and in the wider region brings with it a range of increasing pressures on the Bay and the regional cattle industry brings pressures both on land use and the port facilities.

Broome’s climate and large tidal variation mean a constantly changing outlook across Roebuck Bay. These factors have also influenced the natural movement of people to and from the cooling coast. The ecosystem is naturally highly variable with distinct seasonality in rainfall, wind patterns, tidal ranges, and in the life cycles of animal and plant communities. The plants and animals around Roebuck Bay have evolved to cope with the prevailing seasonal patterns including the monsoonal conditions. Many of the people living here have adapted their lifestyle and use of the Bay environment synchronised with the seasons, although this is changing as people now lead faster, busier more sedentary and technologically-enhanced lives.

The high ecological diversity of Roebuck Bay has always influenced the human use of the area. Over thousands of years it has been favoured by the local community because they could always catch a fish or find food from the mudflats or nearby mangroves.
Of paramount importance to both Aboriginal people, whose ancient association with the Roebuck Bay area endures to this day, and residents and visitors of more recent times, is a desire to retain a valuable place for their culture, recreation, enjoyment of the natural features, refreshment of the human spirit and peaceful ambience (Griffiths 2009).

Furthermore the economic value of Roebuck Bay is significant to not only the local community but throughout the region, and increasingly important on a national and international level. See Figure 4.1

4.1 Ecological values
Predominately known for its wetland values and importance for the migratory shorebirds, Roebuck Bay is a superb example of a tropical marine embayment within the Northwest (IMCRA) bioregion. The intertidal mudflats contain millions of small mud-dwelling animals. Both the total density of these animals and the diversity of species present are high, when compared with tropical mudflats across the world (see the ECD in Bennelongia 2009). Roebuck Bay's Ramsar site is one of only a dozen intertidal flats worldwide where benthic food sources are found in sufficient densities that they regularly support internationally significant numbers of wader birds (Watkins 1993).

The Ecological Character Description for Roebuck Bay (ECD) states that the site supports more than 1% of the international population of at least 22 species of shorebird, 20 of them migratory (Bennelongia 2009, p.36). The area is regularly home to over 100,000 shorebirds, with the total number of birds using the site as a summer stop-over in any one calendar year estimated to exceed 300,000. While most of the shorebird activity is centred on the mudflats, the small tidal creeks behind the mangroves are important to some species such as Whimbrel. Further inland, the grass plains provide important feeding areas for birds such as the Little Curlew and Oriental Pratincole (Minton 1987 in Watkins 1993, p.13). A number of reptiles and amphibians are recorded around the Roebuck Bay areas, including turtles, geckoes, lizards, dragons, skinks, monitors, snakes, sea snakes and crocodiles (Bamford unpublished data in Watkins 1993, p.13). Estuarine crocodiles are recorded to occur infrequently but increasingly, around Broome’s foreshores and more commonly in the tidal creeks near town.

Roebuck Bay is highly valued for its fish stocks and while data is insufficient, the inshore areas of the north-western Australian coast are considered to have approximately 1400 species of fish.

Extensive mangrove communities (mangals) fringe the Bay and are an important nursery area for marine life. Examples include larval and juvenile fish, the nationally endangered sawfish who use the tidal creeks and mangrove areas for breeding and refuge, a rearing area for a range of invertebrates and an important feeding area for prawns and mud crabs. The scientific importance of the mangrove habitats and mudflats for crabs has been noted in previous studies (Charmers and Woods 1987 in Watkins 1993, p.14). Johnson (1990 in Watkins 1993, p.3) divided Roebuck Bay mangal into a northern and southern section. The Broome section was estimated to cover 640 ha, while in the south there were 200 ha in the Thangoo section. Several of the mangrove species provide important food sources for honeyeaters and bats during flowering and fruiting.
Seagrass beds at Roebuck Bay are a vital plant community that directly support an estimated 70% of marine life and are invaluable to coastal fisheries found offshore (F. Bishop pers. comm.). Seagrasses provide key food for the nationally endangered and vulnerable turtles (Loggerhead and Green Turtles as well as Flatback Turtles that nest around Cape Villaret during summer), Australian snubfin and Bottlenose dolphins and dugong also feed on the seagrass. Seagrasses also help to maintain the water quality and clarity (Beazley 2009).

The Bay’s high biodiversity of inshore cetacean species (large sea mammals) adds to the high biodiversity value of the area.

Dr Deborah Thiele, pers. comm., noted there are three dolphin species resident in Roebuck Bay and that her research has already shown that the Mangalagun area (Crab Creek) is a primary foraging area for the Australian snubfin dolphin Orcaella heinsohn. (Recently discovered in 2005, the discovery of a new mammal is extremely rare). While all dolphins are protected under the EPBC Act, the Australian Snubfin dolphin is Australia’s only endemic dolphin (it is unique to northern Australia), and it is considered that ‘coastal and river dolphins are among the most threatened species of mammal in the world’ (WWF 2009). Samphire flats extend from the landward side of the mangroves and their flats. These flats may be inundated by some high tides. The saline grass plains are slightly higher in elevation than the samphire flats and the soil has a lower salinity. The dominant species there is Saltwater Couch, which forms dense grassland. Toward the edge of the grass plains are thickets of paperbarks (melaleuca) which may grow to 10 m in height. These are important for cultural purposes and for medicinal use, and provide important habitat for wildlife such as wallabies and butterflies.

The dominant vegetation type on inland areas around the study area is called pindan woodland. This vegetation type is very common in the south-western Kimberley. In current usage pindan refers to both the dominant soil type, the red earthy sands, and/or the vegetation type it supports, (Willing 2008). Pindan occurs adjacent to Roebuck Bay inland from the low cliffs between Kunin (Fishermans Bend) and Mangalagun (Crab Creek).

A zoogeographical study in 1981 found the area to be an inter-zone between terrestrial mammal fauna of the North Kimberley and the Great Sandy Desert. It shared 60% similarity with the North Kimberley and 32% similarity with the Great Sandy Desert (McKenzie 1981 in Watkins 1993, p.7). Broome Bird Observatory has also collected some data on mammals. This list is valuable in that it refers to the area directly adjacent to the northern end of Roebuck Bay and its Ramsar site.

The biological diversity of the Roebuck Bay system is highly valued and is comprised of unique salt flat, salt marsh, mangrove, mudflat, seagrass, rocky reefs, and other estuarine-marine systems. The high value is primarily due to the multiple habitats all in close proximity to one another. Many studies have shown that the more of these key habitats you have in proximity, the higher the biodiversity. Conversely if you lose one, the implications for the system’s health and maintenance of biodiversity are greatly reduced. According to Dr Deborah Thiele (pers. comm.), this is what makes Roebuck Bay special – and critical to other listed values; fish numbers, health of marine life, water quality etc. This interconnectedness and diversity of biological communities in and around the Bay underpins and supports vital and life sustaining flow-on effects for example throughout the food chain and up to the cultural practices and the people who rely on them.

4.2 Aboriginal cultural values

Roebuck Bay and the Ramsar site within it, is a place to which the Yawuru Traditionally Owned have deep spiritual connections. Places of significance occur all along its beaches and cliff lines and throughout the song cycle system that includes the deep waters of the Bay and the tidal creeks as well as the surrounding areas of land including pastoral properties. As of July 2008, the Register of Aboriginal Sites listed at least 65 heritage locations in the vicinity of the Ramsar site, 17 of which lie within or immediately adjacent to it, principally in the Fall Point, Thangoo and Cape Villaret areas (see the ECD in Bennelongia 2009).

Not only do Yawuru people have a spiritual attachment to the area, but they also have a keenly felt sense of responsibility for its care. Their use of this coastal country (both land and sea) forms the basis of their cultural, spiritual, social and economic life. With its rich mudflats fringed by mangroves, its beds of seagrasses and its reefs, sand and clean water the Bay is a veritable ‘coastal supermarket’ and has sustained people for centuries. However, it is in the coastal havens around the foreshores of Roebuck Bay, which Aboriginal people have occupied and enjoyed for centuries, that a feeling of encroachment from the outside world is strongest and where values often conflict (LGDP 1996). Often the areas that are popular for recreation today are the same places that are highly valued for customary practices such as fishing, gathering cockles and practicing law and culture.

Today the Roebuck Bay area continues to sustain people and their culture, and provide for cultural, social, educational and economic needs.

4.3 Socio-cultural values

Roebuck Bay provides for social and cultural benefits such as physical and mental well-being, food gathering and cultural transmission. It provides easy access to recreation areas, a cool getaway place during the ‘wet’, an escape from the hot homes and closed air-conditioned spaces and relief from claustrophobic indoors and is therefore highly valued.

Ready access to the Bay and foreshores allows residents to escape from the domestic pressures, to find a contemplative and calm atmosphere, or take in the fresh air, sunshine and wide open spaces for exercise and activity. The diversity of people and lifestyle uses around the Bay, provides exposure to cross-cultural values, notably around the foreshores of Crab Creek and Town Beach, that are regarded as an important part of cultural understanding and tolerance within the community (Griffiths 2009).
Historical and heritage values
Roebuck Bay forms part of the Kimberley coast where Aboriginal people have lived since time immemorial.

Before Europeans arrived Aboriginal people were not alone in their use of coastal marine resources. Seafaring explorers and traders who sailed the Kimberley coast lead to the discovery of commercial opportunities around Roebuck Bay. Fishers from Makassar in South Sulawesi visited the Kimberley region from the early 1700s. There is evidence that a significant trade in marine resources between the Makassans and local Aboriginal communities occurred. The Makassans collected trepang (sea cucumber), shark fin and turtle for trade with the Chinese. (Sickert 2003, and Environs Kimberley web in Griffiths 2009).

Later during the 1860s, pearling fleets began extensively working the seas around Broome looking for wild Pearl shell (Pinctada maxima). By the 1880s the industry had become established around the foreshore of Roebuck Bay. Initially, the pearlers only inhabited the foreshore area until they became more established by building permanent residences, which formed the basis of the township now known as Broome. (Gunn 1989 in Griffiths 2009).

Broome’s pearling industry and its exciting history are tied to Roebuck Bay and its foreshores — this is what has helped establish the town’s multicultural character. The adventure and romance, the riches and the tragedy of the ‘Town by the Bay’ has haunted and fascinated many and still captures the interest of visitors to Broome, (Drewe Robert 2009 in Griffiths 2009).

There are significant heritage sites located around and within the Bay, including the wrecks of the flying boats strafed down during World War 2 — Buccaneer Rock, burial sites of both Aboriginal and European people who have descendants still living here today, and numerous fossilised dinosaur footprints around the foreshores. The paleontological values associated with the dinosaur track ways in the Roebuck sandstone at Fall Point which date from the Cretaceous period are of considerable scientific interest (see the ECD in Bennelongia 2009, p.16).

The unique history and Roebuck Bay’s heritage values continue to be highly regarded by both Broome residents and visitors.

Recreation
Many people in Broome spend the majority of their time in air-conditioned homes, cars and workplaces, and this has resulted in less contact with the natural environment. In this situation, opportunities for renewed contact with the natural worlds assume an increased significance. Access to places like Roebuck Bay for recreation and health has become even more important to residents as the town of Broome develops and expands and the pressures of living in close proximity increase.

Town Beach, Entrance Point and Mangalagun (Crab Creek) all provide entry points for those wanting to access Roebuck Bay’s excellent fishing and crabbing or to go hunting in the waters, particularly the tidal creeks around the Bay. The land has an array of interesting flora and fauna that provides bush tucker and medicine as well as vital habitat and welcome shade. Close to the foreshores can be found a diversity of wildlife that includes bats and snakes in the mangroves, hermit crabs that scurry to the cliffs, ospreys that nest above busy car parks, honeyeaters feeding from the flowering trees, and reptiles that warm up on the red pindan soil.

In 2004 a community based values mapping project (Community Solutions 2004) identified the out-of-town land sites most used for recreational activities as:

- Crab Creek (Mangalagun) — fishing, crabbing and other activities
- Dampier Creek — fishing, water-skiing and other boating activities
- Fishermans Bend (Kunin) and other places on the Bay’s northern beaches — bird watching, walking, fishing and general enjoyment of the area and its scenery
- Bush Point — bird watching, eco-tourism.

Within the Broome town site, the Roebuck Bay foreshore areas are highly prized for recreation — namely Town Beach, Entrance Point, Simpsons Beach, Streeters Jetty, Mangrove Point, Reddell Point and Reddell Beach.

The south side of Roebuck Bay is becoming increasingly popular for recreation particularly fishing (for people with boats or vehicles) being close to a myriad of unspoiled creek systems like Jacks Creek and the much larger Yardooogarra system both of which reputedly have ‘healthy’ stocks of the prized barramundi and threadfin salmon. As visitation increases at tourist spots like Barn Hill on Thangoo Station, and the eco-beach resort at Yardooogarra during the ‘dry’ season, more people are taking advantage of these recreational opportunities and the area’s natural attributes and resources.

4.4 Economic values
While Roebuck Bay and its surrounding catchment area are recognised as containing a broad range of economic values significant to the future of the area, both scientists and the community have consistently identified that many of these values also pose potentially significant threats to the ecological values that contribute to the significance of the area as an internationally recognised Ramsar wetland. In developing the preliminary draft management plan for the Roebuck Bay Ramsar site it is important to consider the significant economic values of pastoralism, extractive industries such as mining and petroleum and commercial fishing, tourism, and town and industrial development. However at the same time the potential threats that each of these poses and their impacts need to be considered in management, and be weighed against those commercial benefits.

Roebuck Bay offers economic benefits that range from non-cash components e.g. seafood to feed the family and opportunities for healthy recreation, to the more commonly understood commercial benefits such as that offered by the regional Port which is a supply base for international resource companies and mineral exploration, and critical to the live cattle export trade, commercial fisheries, cruise shipping and charter boat tourism and pearling.

Tourism, both domestic and international, generates a significant income for the Kimberley and Broome. Popular activities associated with or near the Ramsar site include birdwatching, sightseeing, bushwalking, camping, fishing, boating, crabbing, kayaking and swimming as well as local tourism operations such as hovercraft and charter boats.
There are sizable non-cash economy-wide benefits to be achieved from conserving the Bay’s natural and cultural values, and through this protecting and improving the quality of life of Aboriginal people (HR 2009). Examples of this are the provision of readily available access to food and cultural resources and to areas of cultural significance (spiritual values). The Roebuck Bay area also provides opportunities for free access to natural areas for recreation and cultural transmission, and thereby promotes physical and mental health benefits. The Bay offers welcome relief from the town’s social pressures such as overcrowded houses, and the coastal areas can be used to develop opportunities for training and employment and cultural and eco-tourism initiatives. All these are important non-cash values in the Broome community.

The Port of Broome plays a key role in supporting local, regional and global economies. It supports the live cattle export trade, and is the base for offshore oil and gas exploration supply vessels, Navy ships, pearling, fishing and charter boats and cruise liners and is the main fuel and container receivable point for the region according to the port’s website.

For example, Broowe Basin oil and gas activities brought 30 vessel visits per month to the port in 2007-08; the oil and gas sector provided 49% of the Port Authority’s total revenue from shipping (Figure 29, BPA 2009a), and cruise ship visitor spending brought an estimated $2million in 2007-08. (Broome Port Authority Annual Report 2008). The economic value of the growing cruise ship trade is anecdotally reported to flow on to small business in Broome.

The Port area comprises an extensive land holding that supports a wide range of economic and other values. The Port reserve area includes a jetty & berthing facilities, administration complex, a restaurant and takeaway facility, Dept of Fisheries office, workshop & maintenance yard, public amenities, Broome Fishing Club, offshore supply base, bulk fuel terminal, bitumen plant, aquaculture park, seawater pumping facilities, slipways, truck and container freight yards and cargo laydown and storage yards.

The Port has a diverse range of values, e.g. as a ‘locals’ fishing jetty and a favoured cool recreation locale in the ‘wet’ for local residents and tourists. High value is placed on the Entrance Point boat ramps for residents and visitors, including the annual saltfish competition.

Commercial value also accrues from the small amounts of irrigated agriculture that occurs in and around Broome on horticulture lots at 12 Mile, Skuthorpe and Shamrock Gardens near Broome currently producing mangoes, melons, bananas and irrigated pasture seeds. Irrigated pasture grasses and fodder crops are also grown on Kilto (adjacent to Roebuck Plains).

While these industries are valued commercially they are reported to place pressure on Roebuck Bay (see Bennelongia 2009, pp. 97-102).

Fishing

Fishing in the Kimberley is a major contributor to the regional economy. The economic value of recreational angling to the region is apparently substantial, one example being the Broome Billfish Classic said to have brought in over $250,000 to the local economy in 1992 alone. (pers. comm. Jeff Cooper). No dollar values are available for either recreational or commercial fishing in Broome, however the prawn stocks were valued at $0.5 million in 2007 according to the North Coast Bio-region report (www.fish.wa web on 27/09/09). Finfish trawling and finfish wetlining also hold commercial value in waters of the Kimberley. Information is limited on the impacts of regional fishing on Roebuck Bay stocks.

Pearling

Pearling is a well-established industry and although subject to market pressures, it brought $92.5 million to the region in 2006-2007 (KDC 2009). Pearling is historically important to Broome and the industry has iconic status that value-adds to tourism. Pearls are farmed in many sheltered Kimberley coastal embayments including Roebuck Bay. The pearling industry needs clean water in which to operate, and this factor is valued by a range of users of the Bay.

Research and development activities based around fishing, pearling and other aquaculture industries bring value to the area as well as to the industries, for example at the Manbana establishment near the Port.

Pastoral

The pastoral industry is an important contributor to the Kimberley region, being highly valued for its contribution to remote area employment, Aboriginal enterprise and for its commercial value.

Thirty percent of the estimated 100 pastoral stations in the Kimberley are operated by Indigenous people, with the Roebuck Plains Station located adjacent to Mangalagun (Crab Creek), being considered the ‘jewel in the crown’ of Aboriginal holdings.

The Kimberley herd of beef cattle numbers around 600,000 representing approximately 30 per cent of WA’s herd. Cattle are transported many hundreds of kilometres by road train into Broome. Here they are kept in holding yards at Roebuck Plains Station and at yards adjacent to the Port, before being transported live, via ships to overseas markets. In 2007 more than 90,000 cattle were exported to South-East Asia. The Department of Agriculture reports that the value of cattle disposals from the region has increased to between $60 and $70 million in 2004-05. Current trends indicate an increase in live cattle exports.

The pastoral industry is an old established business in the Kimberley and its heritage is valued as a significant part of the region’s history and development.

Tourism

Tourism is a highly valued industry bringing an estimated 346,600 overnight visitors annually to the region, who spend $257 million on average each year. (KDC 2009)

Broome and the Kimberley are heavily promoted as ‘must see’ tourist destinations. Fine weather, a naturally beautiful and largely unspoiled scenic environment that offers wide open spaces, great fishing, freedom for independent travel, clean beaches and waterways, an extraordinary array of native plants and animals, an ancient living Aboriginal culture and the prospect of adventure and excitement ‘in the wild’ draws people to travel throughout the region.
Slightly more removed from Roebuck Bay and its Ramsar site, but still with potential to impact adversely on them are a range of other economic development activities.

The Broome International Airport is the largest regional airport in Australia. It services Broome and the Kimberley, and is often referred to as the gateway to the region. The availability of air transport is highly valued by the Broome community. The airport serves the requirements for both scheduled and unscheduled passenger services, medical evacuations for the Royal Flying Doctor Service, for a growing fly in-fly out workforce, and supports an extensive general aviation and charter services, helicopter operations and Coastwatch for the region. The airport is the service base for a number of significant Kimberley industries, including tourism, mining, offshore oil and gas and pearlimg.

Existing statistics show for the financial year 2007-08, Broome International Airport handled a total of 380,000 passengers with a total of 32,610 aircraft movements, all of which have potential to impact adversely on the shorebirds for which Roebuck Bay is an internationally important location.

Town site development
The development of the town site brings enormous financial gains and the continued development of Broome and the Kimberley is highly valued in many quarters. In terms of economic output, the construction industry is the fourth largest industry in the region, after tourism and pearling (KDC 2009, p.8). The development of Broome North, near to Roebuck Bay, will see the release of an estimated 4,000 lots over the next 10-30 years. This is expected to house up to 13,000 people. This not only provides for much needed housing but provides economic spin-off and creates employment and business opportunities that may benefit Broome residents, investors and business interests from around the State and elsewhere. See Section 5 for pressures and threats associated with this value.

However increased development in the Broome North area will bring with it potential impacts on water quality through runoff and pollution, changes to freshwater regimes entering the Bay, encroachment on habitats in the Bay and increased disturbance to habitat and wildlife.

Mining and energy
The mining industry is the Kimberley’s largest contributor to the WA economy, valued at $991million in 2006-07 (KDC 2009). Broome is the main regional service centre for the mining and petroleum industries. The Browse Basin is a globally significant offshore oil and gas reserve, located approximately 400 kms north of Broome. It appears to be driving the growth in commercial activity at the Port. With the increase in mining and petroleum activity in the Kimberley has come a significant increase in commercial sea and air traffic to Broome, bringing huge economic benefits to the town.

As this sector grows and use of the Port expands, the potential for pollution and for habitat disturbance to the Bay and its Ramsar site also increase.

Agriculture

There are small agricultural land holdings at 12 Mile and Skuthorpe, located relatively close to Roebuck Bay, and pasture grasses and fodder crops are grown on Kiltlo Station, close to Roebuck Plains. The majority of crops in the Kimberley however, are grown in the Ord River Irrigation Area near Kununurra. The Dept of Agriculture and Food estimated the value of Ord production to be $87.3 million (KDC 2009, p.11). While there are some food and melon crops grown for the domestic market, the majority of land is planted with sandalwood. It is understood this may change in the next few years, as Ord Stage 2 is developed. The demand for associated goods and services e.g. agri-business and freight coming through Broome has commercial value.

'The conservation of Roebuck Bay seems to be at odds with an economically expanding Broome. However, keeping the Bay in its present near pristine state will help to keep the fishing and pearling industries healthy. It has other benefits too, as there is a clear shift in tourist behaviour. Instead of just lying on the beach or staying at a good hotel, tourists are now likely to seek a more active holiday that includes excursions to nearby natural attractions, thus the growth in the very existence of Broome depends on maintaining a healthy Roebuck Bay.'

From The Best of the Northwest Landscape special edition, (CALM, p. 39).

4.5 Aesthetic and intrinsic values

Roebuck Bay is a place of outstanding natural beauty and diversity. Visual amenity values, the wide open spaces with broad views across the Bay are highly valued by residents and visitors alike. (Griffiths 2009). The intense and contrasting colours of brilliant blue skies, milky turquoise waters and the undeveloped backdrops of intense orange-red pindan cliffs, fringed by multi-hued mangrove species, buffered here and there by sandy beaches and fascinating rock formations are all valued.

With the town’s rapid growth, urban development and diminishing access to natural areas of public open space, people are going further afield in search of a place to get away from the stresses in their life, to catch a fish and recreate. Historically people have headed to the cool and shady places close to the coast to find peace and quiet and to ‘refresh the spirit’. People continue to be drawn to these areas close to water as they have a strong association with physical and mental wellbeing. (Griffiths 2009).

In the book Beyond the Lattice, Broome’s early years (Sickert 2003, in Griffiths 2009), grasps the essence of Roebuck Bay and talks of ‘the tangible qualities, or the elusive ones’ such as the ‘strong inescapable cultural attachment the Aboriginal people have with the land and sea here and the inspiration the Bay provides for creative people like writers, artists and musicians, or the spiritual awareness it evokes in many’. These aesthetic and intrinsic qualities are part of what is termed the ‘sense of place’.

Cleared of land, wild fires, foreshore development, introduced weeds, increased vessel movements on the Bay, events such as these all have the potential to change the landscape and visually detract from the attractiveness of the natural scenery around the Bay.

Broome’s sense of place is intrinsically linked to Roebuck Bay and its aesthetic and intrinsic values continue to be significant to both residents and visitors.
4.6 Education and research values

The significance of the Roebuck Bay Ramsar site for scientific research and cultural education is highly valued, not just by the local residents but by the international community.

Natural areas provide a valuable community resource for education and research, particularly a site as accessible as Roebuck Bay. The area (both land and sea) has provided a local opportunity for adults and children to experience nature and develop awareness and interest in the environment. Broome schools and tertiary institutions often use the Roebuck Bay area as an outdoor teaching resource with opportunities to develop cultural and bush skills and to raise awareness and gain knowledge about the environment.

Broome Bird Observatory (BBO) uses the Mangalagun (Crab Creek) area for educating and raising awareness in their many visitors and researchers, who come from around the world.

BBO along with Birds Australia and a few passionate ‘birders’ have championed this by researching migratory shorebirds and the habitats they depend on. The Australasian Wader Studies group has been involved in research of the Bay for 28 years.

Importantly the Bay foreshore areas are a cultural asset for Yawuru people to foster and educate their children in Aboriginal culture e.g. to understand seasonal availability and sustainable use of bush tucker and traditional medicines, to pass on stories and songs, to undertake customary practices such as hunting and gathering and other cultural responsibilities.

There have been a number of research projects over recent years, or currently underway that will better inform management planning for Roebuck Bay. These include continuing work on the mapping of invertebrate organisms and sediments of the mudflats, studies of the behaviour and physiology of migratory shorebirds, monitoring of seagrass beds, Lyngbia monitoring, and a genetics research project on sawfish (the Sawfish Rostrum Project). Seagrass monitoring, turtle monitoring, study of dolphins notably the Australian Snubfin dolphin, and mud sampling have also been undertaken. The majority of these studies involve the community working side-by-side with national and international scientists.

Through research, uncertainties have been studied and critical information gaps have been identified. Highly valued knowledge gathering and research have been key strategies in gaining a better understanding of the complexity of the natural systems that form Roebuck Bay and sustain the Ramsar listed wetland.
Pressures on and threats to the key values held for Roebuck Bay is considered from the perspective of management themes.

- Human pressures arising from a broad range of uses
- Foreshore erosion resulting from changed land uses and the impacts of climate change
- Changed quality and quantity of water flowing into the Bay
- Disturbance to shorebirds and to habitat, as well as species loss
- The cumulative impacts of increased development
- Lyngbya and other invasive species
- Availability of coastal food stocks and resources
- Coastal vulnerability to natural processes
- The influences of climate change

While some of the pressures on the natural and cultural values of Roebuck Bay and its Ramsar wetland occur naturally, most come from human use.

This section outlines stakeholder perceptions of the threats and pressures and focuses on

- Shorebird disturbance
- Townsite development water quality and flows
- Industry and development e.g.
  - Mining and energy
  - Transport and freight
  - Pastoral activity
  - Irrigated agriculture
  - Aquaculture and pearling
  - Tourism
  - Fishing

Assessing the risk posed by different threats and the extent to which they can be addressed locally, (the scale of manageability) and understanding where the major gaps in knowledge exist provides a basis upon which to develop management priorities.
This section seeks to provide the background to the threats and pressures impacting on Roebuck Bay’s key natural and cultural values.

It is often those very uses of Roebuck Bay that people most value and enjoy, that are the levers exerting pressure on the Bay, and which increasingly threaten the health of the Ramsar wetland.

While impacts arising from a natural process, (a driver), such as a cyclone, the rise in sea temperature, or a storm surge, will exert pressures on Roebuck Bay, our focus is on the human-induced levers that must be adjusted so that the components and processes making up this internationally important wetland system are maintained. An important step towards protecting Broome’s Ramsar site is to identify and understand the threatening processes, both natural and human-induced, and to seek, avoid or mitigate the many pressures and threats that affect it.

Key findings on the marine areas of WA, in the State of the Environment Report Western Australia 2007 (SOE 2007), indicated that ‘Degradation of the marine environment due to human activities is likely to be increasing due to increased shipping, ports, marinas, coastal housing and coastal development’. These factors are highly pertinent to Roebuck Bay and its Ramsar site.

Ramsar listing and International partnerships established for the protection of migratory shorebirds and their habitats recognise the importance of the Roebuck Bay Ramsar site. Such recognition does not however confer protection from the many pressures that, if not kept in check, will cause a serious decline in its extraordinary values.

The Auditor General (2006, p.5) in his opening comments on the management of Ramsar listed wetlands in Western Australia observed that: ‘Wetlands across the world including WA are under threat’. He went on to say that although the value of rare and unique wetlands is recognised ‘… conservation of these sites needs to improve, particularly the management planning and implementation of strategies if degradation is to be prevented and prohibitive rehabilitation costs avoided’.
5.1. Stakeholder perceptions of threats and pressures

A considerable body of work has been undertaken by the Roebuck Bay Working Group (RBWG) to identify how stakeholders perceive the pressures that impact on Roebuck Bay and threaten its values. Overwhelmingly these were identified as human-induced pressures. Key global, national and regional pressures that have implications through the Kimberley region, and flow-on effects to Broome and Roebuck Bay were identified in 2008, during the Crab Creek management planning. During this process participants drew attention to the pressures and threats they considered most likely to affect Roebuck Bay and placed the focus on those where local management effort could be most effective. Because of the significant role played by local residents in managing this relatively remote and internationally significant wetland, local stakeholder priorities are the focus of this preliminary draft management plan for the Roebuck Bay Ramsar site.

The Draft Management Plan for Crab Creek, (Sharon Griffiths & Assoc. and Acacia Springs Environmental (2009), in Section 4, p.32, categorised various dimensions of pressures, threats and management issues into themes for management. Table 5.1 has been adapted from this, using Ramsar site examples. Each theme is categorised as arising from a natural process, a driver, or due to human influence, a lever, (Bennelongia, 2009). The scale of application, the location where the management effort should be focused, is identified in the table and further developed in the Scales of Manageability in Section 5.3.2.

Threats and pressures consistently identified by stakeholders as having a negative impact on Roebuck Bay included loss of habitat, disturbance to fauna, introduction of diseases and invasive organisms, pressures evolving from the changing socio-economic profile of the Kimberley region (and Broome in particular), fishing (commercial, Indigenous and recreational), increasing population and tourism numbers, and coastal, town and industrial development. Pressures related to pastoral activities, agriculture, aquaculture and pearl farming are commonly mentioned. The operations at the Port of Broome featured prominently in stakeholder concerns about the Bay's health, as did changes in water quality and flows.

In recent times, stakeholders have expressed increasing unease and are indeed fearful of the likelihood of threats and growing pressures on Roebuck Bay, resulting from global factors such as climate change and the ramifications from depletion in the world’s oil supplies. Recent incidents around Broome waters (oil spill) and on offshore rigs in the nearby Timor Sea (oil and gas leaks) have stimulated this fear about the potential for catastrophic impacts on local waters and the living organisms that depend on them.

In developing a management plan for the Ramsar site, it is important to focus on those pressures that are likely to represent specific threats to the ecological character of Roebuck Bay, and to understand the activities that contribute to those threats. In the Ecological Character Description for Roebuck Bay (EDC), Bennelongia (2009, p.97) identified the threats

<table>
<thead>
<tr>
<th>No</th>
<th>Management theme</th>
<th>Examples of threats</th>
<th>Category*</th>
<th>Scale of Applicationb</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Human use pressures on cultural &amp; natural resources</td>
<td>Over fishing, destruction of middens, increased fire, competition for diminishing coastal resources, growing recreational needs</td>
<td>Lever</td>
<td>Kimberley Roebuck Bay Crab Creek</td>
</tr>
<tr>
<td>2</td>
<td>Coastal vulnerability</td>
<td>Cyclones, storm surge, sea level rise, climatic changes e.g. temperature rise, increased rainfall</td>
<td>Driver</td>
<td>Broome Roebuck Bay foreshores Crab Creek</td>
</tr>
<tr>
<td>3</td>
<td>Foreshore erosion</td>
<td>Eroded sediment smothering mangroves, erosion gullies, uncontrolled vehicle access</td>
<td>Lever</td>
<td>Broome Crab Creek</td>
</tr>
<tr>
<td>4</td>
<td>Water quality and quantity of inflows to Roebuck Bay</td>
<td>Sewerage and oil spills, reduced groundwater flows, increased international shipping ballast and waste, pollutants from developed areas</td>
<td>Lever</td>
<td>Kimberley Broome Roebuck Bay Crab Creek</td>
</tr>
<tr>
<td>5</td>
<td>Habitat disturbance and species loss</td>
<td>Migratory shorebird disturbance, loss of seagrass, loss of habitat for dolphins, dugongs &amp; turtles, injuries to marine mammals, wildfires, invasive pests &amp; diseases</td>
<td>Lever</td>
<td>Kimberley Roebuck Bay Broome Crab Creek</td>
</tr>
<tr>
<td>6</td>
<td>Impacts from development</td>
<td>Destruction of habitat, changed drainage regimes, reduced coastal buffer, increased waste and erosion, industrial activity and horticulture</td>
<td>Lever</td>
<td>Kimberley Broome Roebuck Bay</td>
</tr>
<tr>
<td>7</td>
<td>Lyngbya</td>
<td>Implications for human health from algal toxins</td>
<td>Lever</td>
<td>Broome Roebuck Bay</td>
</tr>
<tr>
<td>8</td>
<td>Important coastal food stocks and resources</td>
<td>Fish, crabs, cockles, bush buckers, medicines, wood and other natural materials</td>
<td>Lever</td>
<td>Crab Creek Broome Roebuck Bay Kimberley</td>
</tr>
<tr>
<td>9</td>
<td>Invasive species</td>
<td>Weeds, ballast organisms,avian influenza, cane toads, intentionally introduced species such as buffel grass and neem trees</td>
<td>Lever</td>
<td>Roebuck Bay Broome Western Australia</td>
</tr>
<tr>
<td>10</td>
<td>Climate change</td>
<td>Altered ocean currents, increase in sea level, increased temperatures</td>
<td>Driver</td>
<td>Broome Australia</td>
</tr>
</tbody>
</table>

Category* = Categorising according to Roebuck Bay ECD (Bennelongia, 2009) Application* = The scale of application is where the local management effort should be applied.

Table 5.1 Management Themes for Roebuck Bay Ramsar site
to the ecological character as those deriving from agriculture, water use and groundwater extraction, urban development, Lyngbya, commercial and recreational fishing, recreation, tourism and climate change.

Based on previous reports to RBWG, it would seem by far the most serious threats to the natural and cultural values of the Roebuck Bay area and its Ramsar wetland are those caused by human activity. Locally this includes increased boating and shipping in and around the Port, use of off-road vehicles and higher visitation numbers around the coast, unsustainable take of fish, shellfish and other sea foods, stormwater runoff, erosion, pollution and siltation as a result of townsite development and industrial activity, drainage or filling of wetland areas, reduction in native vegetation and the introduction of invasive species into both land and waters. For example weeds like neem trees into the urban landscape, buffel grass in pastoral areas, and the Black-lipped Mussel in the Bay.

These pressures may to some extent be offset by plans for a marine park or reserve in Roebuck Bay, and by an increased awareness and understanding of the Roebuck Bay area by tourists, the resident community, and most importantly by key decision makers.

5.2 Threats and pressures in focus

Current trends indicate that the human pressures on the Bay’s wetland habitat are expected to increase in the future along with the growth in population. The result may be further disturbance to shorebirds and marine mammals, and to the ecological processes that support living organisms, as well as negative impacts and destruction of significant Aboriginal cultural sites and coastal food resources.

5.2.1 Shorebird disturbance and habitat loss

Habitat loss and degradation pose the main threat to migratory shorebirds. Each year, thousands of birds make the long and arduous journey to and from their breeding grounds — essential to their lives. To make the passage, they rely on an uninterrupted string of healthy wetlands on which to feed and rest. Substantial changes to any wetland site will put pressure on others, threatening the viability of the whole. (pers. comm., Chris Hassell)

If migratory shorebirds cannot access their habitual feeding and roosting places along the East Asian-Australasian Flyway, they may not reach the southern feeding and roosting grounds of Australia and New Zealand. This will have huge implications for the Roebuck Bay Ramsar site itself as it has evolved around the annual migration of shorebirds.

Locally, at the popular and accessible northern beach areas such as Mangalagun (Crab Creek), increased human visitation has resulted in high levels of disturbance to migratory shorebirds. (Rogers, Hassell & Lewis (n.d.)

Many pressures both here and abroad are contributing to the degradation of important shorebird habitat, stemming from a tangle of factors that include: global climate change, growth in the human population, the reclamation of wetlands along the East Asian-Australasian Flyway, clearing of land and modification of tidal or shallow water environments, development of polluting and unsustainable industries, and the introduction of non-native plants and animals.

Habitat loss or degradation is likely to follow from the future development of Broome.

5.2.2 Town site development

Strong growth in the development of Broome reflects the demands from a rapidly growing population, the increasing number of visitors, and the vast economic opportunities in the Kimberley region.

Plans are afoot for a new International Airport site, and for major expansion of the townsite and residential development at Broome North. This bushland site of approximately 700 hectares lies immediately north of the town and drains into Roebuck Bay. An estimated 2,500 residential blocks will be released over the next five to seven years, and the District Development Plan (Landcorp 2009) indicates more than 4,800 residential dwellings within the project area.

The requirement to meet the needs of an increasing population includes the provision of essential services such as shelter, power, water, sewerage and waste disposal. This demand creates increased stressors from groundwater drawdown and altered surface drainage patterns. This is in part due to the construction of roads and the sealing of surfaces, which reduces the penetrability of surface areas. Examples are expansive built environments like shopping centres, car parks, airport runways, housing estates, resorts and the proliferation of paved residential and public areas. This also leads to the concentration and redirection of stormwater runoff away from habitats toward vulnerable ecosystems (e.g. coastal foreshores), and causes increased peak runoff velocities potentially leading to significant increases in erosion, and changes to water quality.

Developments in Broome include a new wastewater treatment facility, expansion of the borefields to cope with the town water supply needs, as well as upgrading the water supply mains and increasing storage via new tanks around Broome.

The new wastewater treatment plant to be established on a 200 ha site at Lot 67 Crab Creek Road is scheduled to start development in late 2009. This will involve major earthworks and excavation (WaterCorp, 2009). Concerns have been expressed by members of RBWG about the proximity to Roebuck Bay of the treatment site and the planned irrigation field, and issues of water drainage, infiltration and use of recycled water.

Not only development itself, but changes to the purpose and use of land may have a strong influence on and exert pressure upon the coastal fringes around Roebuck Bay. Areas that have historically provided bushland site expansion of the townsite and residential development at Broome North. This vast economic opportunities in the Kimberley region.

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Not only development itself, but changes to the purpose and use of land may have a strong influence on and exert pressure upon the coastal fringes around Roebuck Bay. Areas that have historically provided somewhat of a buffer between the township and the Bay continue to be developed and this has had flow-on effects to the Ramsar site. For example in recent years, Traditional Owners, represented by Rubibi (Shire of Broome/Rubibi 1997), expressed concerns about pollution entering the Bay from a nearby caravan park septic system, about the changed drainage regimes after the extension and development of the Broome airport runway, and from the development of a shopping centre over wetlands in Chinatown.

The prospect of Broome International Airport’s relocation, development of new industrial areas and a new wastewater treatment plant, and
the clearing of large areas of bushland for townsite development in areas adjacent to the Bay pose considerable management challenges to maintaining water quality and flows into Roebuck Bay.

5.2.3 Changed water quality and flows
Broome is almost entirely dependent on groundwater. Therefore recharge is crucial for urban management and in order to protect dependent ecosystems including the maintenance of coastal vegetation. The flow-on impacts of flooding from the wet season rains and the extensive drainage networks established for the built up town areas, will need to be alleviated or taken into account in design and planning to prevent water quality and flow problems into Roebuck Bay.

The Ecological Character Description for Roebuck Bay states:

> Bay water quality appears to be poor. . . . high nutrient and phytoplankton concentrations in coastal waters are frequently associated with adverse impacts on amenity and ecosystem functions. . . . the lack of long-term water quality data for the Bay is a concern. (Bennelongia 2009, p.56)

5.2.4 Industry and development
The Kimberley region’s economy is dependent on a number of industries. These include mining and petroleum, pastoralism, irrigated agriculture, tourism, pearling and fishing, retail trades and services, and construction, transport and related industries. Each of these pose potential threats to the key ecological and cultural values of Roebuck Bay and has the potential to impact adversely on the Bay and its Ramsar site if not managed appropriately.

Mining and petroleum
The Kimberley mining industry is a significant contributor to the economies of both the State and Commonwealth. Broome is the main service centre for the region’s mining and petroleum industries.

The Kimberley region is renowned for its natural resources, and has huge reserves of oil and natural gas. It also has enormous mineral wealth that includes uranium, diamonds, silver, lead, zinc, iron ore, bauxite and gold.

The Kimberley is highly dependent on fuel supplies for access to remote markets and to transport goods, materials and people in and out of the region. The growth in the global population has raised expectations of a 40% surge in energy requirements by 2030, and the growing concern about greenhouse gas emissions is said to be underpinning demand for cleaner sources of energy according to Woodside’s Voelte (2009).

Diminishing oil supplies, limits to world oil production (peak oil) and an increase in the demand for energy from growing populations and developing countries have resulted in the rising cost of energy, increasing the price of fuel, electricity, manufactured goods and transport worldwide. This is an important economic factor for people in remote areas. This global trend is expected to continue and affect the cost of providing food and fresh water.

An increase in the cost of energy and fuel will have substantial implications for Roebuck Bay:

- Financial pressures on low income communities may rise, causing a greater reliance on the harvesting of sea food stocks such as fish, turtle, cockles, crabs and dugong from Roebuck Bay. This may be unsustainable in the long term, particularly as it is likely to occur alongside an increase in the resident population.
- The cost of infrastructure and public works is predicted to rise. This could in turn compromise the development of works required to control erosion and pollution of the Bay, for example engineering work for roads, drainage and for water supplies.
- The diminishing supply of global oil has stimulated an increase in the research and development of alternative energy supplies, sparking massive activity in natural gas exploration and production off the Kimberley coast, and bringing with it increasing pressure on Roebuck Bay and adjacent land and sea.
- Unfortunately, this activity has resulted in one of the worst oil spills in Australia’s history. In August 2009, the West Atlas rig leaked oil and gas into the Timor Sea. Despite the best in technology and global expertise it took over 11 weeks to contain. In October 2009, a second leak from a neighbouring rig was reported. Following huge amounts of oil spilt into the sea, and dispersants used to clean up the oil, have come reports of harmful effects on birds and sea animals and significant impacts on seaweed crops for farmers on the Indonesian island of Rote, about 500km from the Australian mainland, who reported more than 1000ha of harvest destroyed, and fishers from nearby West Timor reported finding ‘masses of dead fish’ (Verstageen 2009). These spills are a reminder of the danger associated with the oil and gas industry and the potential impacts on Roebuck Bay as the Browse Basin reserves begin to be exploited offshore.

A significant pressure on Broome and Roebuck Bay is likely if the proposed development on the nearby coast of an industrial estate, or precinct, for the processing of natural gas from the Browse Basin goes ahead. This will bring on expansion of activity at both the Port of Broome and the Broome International Airport as supply headquarters for the LNG industry. In turn, this will attract thousands more people to the area and increase human pressures such as traffic on the land, sea and air, increase pollution from industry and everyday living, and result in more land clearing and changed drainage flows. Disturbance to Aboriginal cultural sites will increase as will demands for recreation and leisure opportunities creating additional stress on the coastal areas, fish stocks, and a reported widening of the income gap between Aboriginal and non-Indigenous people. (Griffiths 2009)

An increase in research and development activity by the mining and petroleum sectors has seen a rapid increase in air and sea traffic in Broome and this looks set to rise further. In the past year there has been a significant increase in the number of large helicopter movements and these have been impacting on the shorebirds in the Ramsar site on
Roebuck Bay. Substantial increase in vessel movements at the Port of Broome to support the development at the Browse Basin has occurred. Development pressure such as the expansion of Broome, groundwater extraction and construction of causeways were considered major threats to the health of wetlands in local catchment areas potentially impacting on Roebuck Bay, according to (Yu & Yu 1999; Graham 2002, p19 in WWF-Australia). Heavy mineral sands, sandstone, kaolin, clay and brick deposits are also mined in the area (Cooper & Flint 2005; Environks Kimberley 2003) and could pose a risk to localised wetlands, depending on the degree of protection enforced.

These and other mining activities have put pressure on, or threatened the Bay’s cultural and ecological values. The extraction of gravel from pits between Crab Creek Road and Roebuck Bay has resulted in destruction of Aboriginal cultural sites, siltation of the beach and foreshore areas and a loss of amenity, notably at Fatima, commonly known as Quarry Beach. (Griffths 2000, p.5)

Kaolin or ‘china clay’ deposits occur on Thangoo Station adjacent to Roebuck Bay. In 2002 a mining application was rejected, putting an end to a proposal to establish a series of open pit mines to a depth of 100m over 650ha less than 2km from the Ramsar listed wetland.

Pastoral activities

Beef cattle production is arguably the Kimberley region’s oldest industry and over 50% of the area is still held under pastoral lease. The Department of Agriculture and Food reports that there are an estimated 100 pastoral stations in the region (KDC 2006). In recent years however many pastoral properties have diversified into tourism or other industries to make ends meet.

Cattle are grazed on the open range then transported by road train to Broome. They are held in paddocks or in holding yards on Roebuck Plains Station or close to the Port, before being transported live via ships to overseas markets. In 2007 more than 90,000 cattle were exported to South-East Asia. Current trends indicate an increase in live cattle exports.

On properties adjoining the Bay, namely Roebuck Plains Station and Thangoo Station, cattle graze on the grass plains and pindan vegetation. This can cause degradation of the land and saltwater environments through soil compaction, soil erosion, introduction of weeds, freshwater drawdown, increased nutrient loads, altered fire regimes and increased runoff into the Bay during heavy rainfall events. This can result in algal blooms and reduced health of the mangrove habitats, so important to the benthic invertebrates on which migratory shorebirds feed.

A large number of weed species are well established locally around Broome and in the Kimberley e.g. buffel grass. Many of these were introduced by the pastoral industry during the last century as cattle fodder. Other weed species have been introduced more recently. If left untreated, these will continue to damage the natural vegetation communities adjacent to Roebuck Bay, either through direct competition or altered fuel loads that increase the risk of hot fires. Increased fires on Roebuck Plains and Thangoo Stations, along with cattle grazing, will decrease vegetation cover. This would result in erosion of the plains, stormwater runoff and sitiation of Roebuck Bay during heavy rainfall events, thus threatening the ecosystem balance.

Irrigated agriculture

Irrigated agriculture in the West Kimberley takes place on smallholdings at 12 Mile and Skuthorpe, and Shamrock Gardens near Broome, and crops of pasture grasses and fodder are grown on Kilto Station, close to Roebuck Plains.

The impact on Roebuck Bay from local agriculture is mainly considered to be impacts to both groundwater and the Bays quality of water. These properties drain into Roebuck Bay or Eighty Mile Beach which is another Ramsar wetland, via a series of small inland lakes or wetlands. There is a danger that runoff may be polluted, increasing the risk of nutrient and chemical pollution of the Bay.

As agriculture in the Kimberley region is expected to grow, so too is the potential for the introduction of new invasive species, and the demand for agri-business goods and services being transported through Broome.

Transport and freight

• Port of Broome

The Port of Broome is the main deepwater port servicing Western Australia’s Kimberley region. The Port plays a key role in supporting local, regional and global economies. It supports the live cattle export trade, and is the base for offshore oil and gas exploration supply vessels, tenders for rigs, Navy ships, pearlimg, fishing and charter boats and cruiene liners. It is the main fuel and container receivable point for the region. (Broome Port website 2009)

There has been a substantial increase in the business and operation of the Port since the jetty extension was completed in 2006. For example, Browse Basin oil and gas activities increased from an average of five vessel visits per month in 2006-07 to 30 vessel visits per month in 2007-08. (Broome Port Authority Annual Report 2008). Services and berthing opportunities for fishing, pearlimg and charter boats have also increased.

The growth of Broome as a base for Canning Basin and Browse Basin oil and gas exploration as well as other mining activities is likely to lead to an expansion of Broome port facilities (Capt. Vic Justice pers. comm., Community Solutions, 2004). Oil from Blina in the central-west Kimberley is currently trucked in and shipped out of the Broome port. Exploration permits for petroleum are held over the inland lakes of the Bay. Pressure to develop petroleum reserves within the Bay and increased shipping activities all increase the risk of a globally catastrophic oil spill (ANCA 1996).

In May 2009, Broome suffered an oil spill close to the Port of Broome, caused by thelive cattle export ship Devon (Perth Now 22 Aug 2009). Globs of oil were found washed up along Broome beaches and 40km of polluted sand had to be removed.

Stakeholders at planning workshops and in community consultations raised concerns about the future growth and activities in the Port area. An increase in port activity increases the potential for serious threats to the...
The existing airport is the transport or service base for the commercial viability of the pearling and fishing industry, and for seafood and resources vital for cultural and sustenance purposes and for the commercial viability of the pearling and fishing industry, and for recreational fishing purposes.

Vessel movements also have the potential to stir-up bottom sediments, which may affect water quality. Roebuck Bay is known to be highly turbid and relies on tidal flushing to maintain water quality.

Other activities exerting pressure either directly or indirectly noted by workshop participants included the hovercraft vessels that transport tour groups each day from the Port across Roebuck Bay to the foreshore at Mangalagun (Crab Creek). Port land is increasingly being cleared of vegetation to make way for storage areas associated with offshore research, development and industry. It is believed that this will create changes to drainage patterns and cause erosion as well as destroying native habitat. Maintenance of boats is undertaken on the foreshore at the Port and concerns were noted in 2008 by R8WG members regarding the practice then of sand blasting. These and other practices such as anti-fouling wash-downs, drainage and waste disposal have raised concerns about pollution of the Bay. It was further noted that with increased activity at the Port comes ancillary vehicle movements and cargo, greater need for safe harbor facilities e.g. moorings, as well as requirements for sewerage disposal, bilge water, and an array of marine services including the storage, care and maintenance of boats.

- **Broome International Airport**

  The existing airport is the transport or service base for a number of significant Kimberley industries, including tourism, pearling, and mining which includes offshore oil and gas. As a result, helicopter flights to and from Broome have increased significantly in recent times. Disturbance to migratory shorebirds at the Ramsar site was occurring until recent agreement was reached on alternate helicopter flight paths. In September 2009 there were an estimated 18 helicopter movements in and out of the Broome Airport every week, from the three oil and gas companies operating offshore rigs. (pers. comm., Nick Belyea 9 September 09). This represents a 100% increase over the previous year and further growth is anticipated.

  The proposed relocation of the Broome International Airport to the identified site near Waterbank raises additional issues for conserving the key values of Roebuck Bay. The Environmental Protection Authority Report stated:

  The construction and operation of a proposed new airport has the potential to lead to pollution from fuel spillage, sewage disposal, and surface drainage. . . . these pollutants have the potential to impact on the Broome Groundwater Reserve, part of which lies beneath the northerly portion of the airport site. In addition, the airport has the potential to lead to pollutants of surface water quality and subsequent impacts on groundwater and Roebuck Bay. (EPA 2001, p.13)

  The impact on the migratory shorebirds and consequent Ramsar values is also described. The construction and operation of the airport has the potential to impact on migratory birds by causing mortality through bird strikes, disturbance of feeding and roosting birds, contaminants entering Roebuck Bay through surface or groundwater and confusion of migrating birds from bright lights at the airport. (EPA 2001, p.14)

  They note also that the clearing of approximately 200 hectares of native vegetation will impact on the terrestrial fauna. (EPA 2001, p.8)

**Tourism**

Broome and the Kimberley are increasingly popular tourist destinations and draw significant numbers from Australia and around the world. Visitation to the Kimberley region is largely seasonal, occurring mainly between May and October and is estimated to be 346,600 annually (KDC 2009). This places huge pressures on those scenic places that are the most heavily promoted. In the Shire of Broome for example, during the peak tourist season when the population triples, large numbers of people are placing considerable strain on the natural environment, including Roebuck Bay, and on the town’s services and infrastructure.

Visitors often travel independently, in 4WDs, camper vans and caravans, or they come as part of guided tours in coaches, or by air. A number of people cruise in by boat. Visitors who drive to Broome, often come for a few months or for extended breaks frequently as part of an annual pilgrimage to warmer weather. Many seek to camp for free, to enjoy the ‘great outdoors’ and to exploit the natural resources, such as fish and crabs that seem so abundant.

Activities such as guided tours to Crab Creek and other parts close to the Ramsar site bring additional pressures on the physical environment. In the main however, guided tour groups are better managed and put less stress on the area than uncontrolled visitation and they offer the opportunity to raise visitor awareness of the area’s key values.

Much of the nature-based tourism across the Kimberley is self-managed. There is insufficient understanding of the natural and cultural sensitivities of the areas being promoted by tourism agencies, many of whom are located in far distant cities.

According to anecdotal evidence, some tourism activities run contrary to the natural and cultural values of the Bay, with tour operators accessing sensitive areas, such as middens or dinosaur footprint sites, without understanding their impact. This view is supported by results from a 2003 study on visitor awareness of the cultural and natural values and user impacts on nearby Cable Beach (Comte E. and Willmot M. 2003) that indicated most people using the beach did not understand Aboriginal cultural values or practices, or the impact of humans and vehicles on the coast.
Uncontrolled access to the foreshore has led to disturbance of migratory shorebirds and nesting turtles, and negative impacts on cultural sites and natural habitats resulting in destruction to cultural sites, interruption to cultural practices, and reduced availability of important coastal resources like food and medicine.

Uncontrolled camping and vehicle access has caused erosion on cliffs, vegetation destruction, unsustainable collection of firewood and the proliferation of litter. Increased boating activity that includes high speed and rapid manoeuvres disturbs and endangers wildlife (DPI 2008).

Visitor impact is one of the key management challenges at Crab Creek and other parts of the Ramsar site foreshore, affecting sensitive cultural and natural areas. Increased visitation will mean more vehicles, humans, boats, dogs and litter.

**Fishing**

Recreational, customary, and commercial fishing all take place around Roebuck Bay and in its tidal creeks. The mangroves of Roebuck Bay are key fish and prawn nurseries. Coastal habitats support a high number and variety of fish including salmon, barramundi, emperor and snapper.

For Aboriginal people fishing is an essential part of the culture and customary way of life, with sea foods providing an important dietary component. The growing influx of recreational fishers with bigger and faster boats with long range capacity and sophisticated equipment will pose considerable threats to this way of life.

Concern has been expressed about the difficulty nowadays for local residents to ‘get a feed’ from the foreshores around the Bay (LGDP 1996). It has been anecdotally reported that the size and stocks of some species are diminishing; examples given included threadfin salmon, mudcrabs, blood cockles and other shellfish such as the razor clam. As the ECD records on p.108 (Bennelongia 2009), the impact not only from human pressures, but from levers like cyclones needs to be understood, to enable stocks to be managed effectively.

Commercial fishing was identified as a pressure on Roebuck Bay by participants at the RBWG workshops (Lambert & Elix 2004). Within sections of the Bay, there are two Kimberley gill net and barramundi fishery licences allowed to operate, and two state-wide fisheries allowed to operate; the specimen shell fishery, and the marine aquarium fishery.

Roebuck Bay is also part of the waters of the pearl oyster managed fishery and has seven pearl oyster leases issued to 2 companies. The Kimberley region has a small number of trawlers fishing for prawns, and commercial vessels catch Spanish mackerel, barramundi, threadfin salmon and shark. Commercial fishers use nets and lines, and have quotas that limit their catch. It was noted however, that there are knowledge gaps about local fish stocks, with some respondents stating that further work was required to determine where and how sustainable commercial fishing may operate to ensure that the dietary and cultural needs of local residents are protected into the future.

Recreational fishing is a key pastime for many residents and visitors to Broome with people fishing from boats, the Port jetty, muddy creek banks, rocky foreshores and sandy beaches in and around Roebuck Bay. The annual sailfish competition draws many people to town and fishing charters are also very popular. While there are catch limits and restrictions on how people fish, many believe that fishing regulations need to be reviewed and limits reduced, and greater enforcement is needed to preserve fish stocks.

An influx in the number of people with small boats has already increased the pressure on local and state governments to provide improved boat launching facilities, with some aspirations to a lifestyle marina at the entrance to Roebuck Bay also expressed from time to time. A marina has the potential to further increase pressures on the Bay due to an increase in human activity, including boat movements and fishing, waste management, and bilge and wastewater disposal.

### 5.2.5 Population

The effects of population pressures world-wide filter through to Roebuck Bay. Along with this are the unique population characteristics of Broome e.g. itinerant young and mobile non-indigenous people, and an Aboriginal population of young, and relatively poor longer-term residents. The predicted population trends and people’s social, cultural and economic use of Roebuck Bay all pose challenges for the future.

The population of the world is currently just under 7 billion, with more than 45% living under the East Asian-Australasian Flyway (EAA 2009). Birds passing through these heavily populated, fast growing regions must compete with humans for habitat and space.

Destruction of coastal wetlands throughout East Asia is [also] jeopardizing the migratory shorebirds ... inter-tidal organisms in the tidal flats are their main food source during migration; in the spring and fall, the birds stop at these wetlands and acquire the energy for further migration. The removal of tidal wetlands is a serious threat to these birds (Kim, Jung W2006, p.107).

These problems are expected to worsen as the human population grows, predicted to reach 9 billion worldwide by 2040 (Worldometers 2009).

The Kimberley region in Western Australia has a fast growing population with the vast majority of residents living in Broome. In 2007 the region had 34,270 people, and is expected to reach 57,900 by 2021 and 70,000 by 2031 (Faragher 2009). The Kimberley has a unique population demographic, with a younger population than elsewhere in WA. This is due largely to the high proportion of Indigenous people (47.7% in 2006) who form the majority of the region’s long-term residents. The median age of the Kimberley Indigenous population in 2001 was 21 years, while the median age of the region’s non-Indigenous population was 40 years. (KDC 2009)

The region also has a significant population of young non-Indigenous people most of whom are itinerant or short-term residents (KDC 2009). Anecdotal evidence suggests there is a significant disparity in socio-economic circumstances between Indigenous and non-Indigenous people, and this is reflected in the differing needs, priorities and values of the
two groups. For example, Aboriginal people tend to use coastal areas to hunt and gather food and to maintain cultural practices, while non-Indigenous people’s use favours relaxation, recreational fishing, boating, commercial exploitation, exploration, outdoor adventure and water sport pursuits.

In recent years, an increase in Indigenous people moving into Broome from outlying communities has occurred. This is largely as a result of changes to the Federal Government’s CDEP (Community Development Employment Project) and the development of Broome as the regional centre for service delivery e.g. health, employment, welfare, training and education.

Added to the increases in resident population, Broome also experiences a substantial growth in visitor numbers during the dry season, when according to the Broome Visitor Centre, Broome’s population ‘swells to over 45,000 per month’. During the wet season visitor numbers are said to be increasing sharply as well.

Broome’s population increased by 55 per cent in the 10 years between 1995 and 2005. Today, in 2009, the Broome Shire is said to support around 15,000 permanent residents. (It should be noted that Broome population figures vary between an estimated 14,000–18,000 plus depending on the source). By 2028, Broome’s resident population is projected to double, according to the Western Australian Planning Commission (WAPC 2008). Many of these people are expected to be housed in the proposed new development area at Broome North.

**Broome North**

The development will cater for growth in population and the tourism industry as well as potential increased demand from the resources industry through projects such as the proposed Kimberley LNG hub. The project will provide the vast majority of Broome’s medium to long term land supply, and has capacity for several thousand homes as well as schools, workers accommodation, tourism, light industrial and commercial/retail opportunities. (Landcorp 2009)

With more people, comes more pressure. Along with Broome’s population growth come demand for services and infrastructure creating additional stress on coastal areas. Among the main challenges associated with this growth will be the management of stormwater runoff to Roebuck Bay, and the protection of cultural resources around the foreshore.

### 5.2.6 Climate change

Global climate change is likely to cause changes to the entire East Asian-Australasian Flyway, often with unpredictable results on migratory shorebirds.

**Local manifestations of global climate change that are likely for Roebuck Bay include:**

- Increased rainfall during the wet season months (Mankala) and more rainfall during the dry season, which may cause changes to groundwater flows and storm water runoff. This would affect water quality in the Bay, which may benefit some species to the detriment of others. Increased sediment loads would smother flora and benthic fauna.

Increased temperatures, resulting in a milder winter during the dry season, (Barrgana), and an increase in peak summer temperatures would affect the balance of nature in the Bay. For example a warmer environment would favour some species to the detriment of others, and evaporation rates are expected to increase. By 2030 the annual average number of days over 35°C in Broome is expected to grow from 54 to between 64 and 119 days (Dept of Climate Change 2009).

- Changes to the six Yawuru seasons that are part of the current pattern of events and rule the natural order of all ecosystems in and around the Bay (Lands M & Mann M, 1990), and the consequent occurrence and availability of food, medicine and cultural resources.

- Increased frequency and severity of weather events such as cyclones, fires, floods, droughts and tsunamis. Increases in extreme storm events are expected to cause more flash flooding, which will affect industry and infrastructure such as water supply, sewerage and stormwater drainage, transport and communications, and may challenge emergency services and health services (Dept of Climate Change 2009).

- Rising sea levels and increased coastal flooding and erosion, particularly during the equinox high tides in September and March each year and storm surges during the wet season months.

- Impact on fringing vegetation from changing levels of freshwater and salinity.

- Loss of, or changes to, protective vegetation and landforms in coastal areas and the species that rely on them.

### 5.2.7 Diseases and invasive organisms

Many diseases that affect humans and wildlife are present in countries to our north and in the eastern states of Australia but absent from the Kimberley. This is likely to change as the movement of people and animals to the region increases. For example, Japanese encephalitis is now endemic in New Guinea and Torres Strait Islands and there is a high probability that it will soon enter the feral pig population in northern Australia and find its way to other native animals. Were that to happen, it would be impossible to eradicate (Garnett et al, 2008).

Avian influenza or bird flu (influenza A virus subtype H5N1) poses another risk. It can cause illness and even death in birds and other animal species, as well as humans who come into close contact with them. It has been found in 62 countries worldwide since first reported in 2003 and it is still entrenched in South-East Asia and China (FAO 2009). While it mainly affects poultry, it also poses a threat to other birds including migratory shorebirds.

In Broome, monitoring for the virus in the migratory shorebirds on Roebuck Bay has been undertaken since 2004 by Australian Quarantine and Inspection Service (AQIS) Veterinary Officer Dr John Curran, with the assistance of volunteers. To date there have been no cases of the virus reported in the shorebirds (Dr John Curran, pers. comm., August 2009).
According to Dr Curran the trigger for the spread of the H5N1 infection in Asia is understood to be intensification of the production of poultry to feed a rapidly growing population.

The potential for marine invasive organisms to be introduced into Roebuck Bay is also a cause for concern. For example, the Black-striped Mussel, which was first found in the Port of Darwin in 1998, would have serious consequences for the marine environment and marine-based industries, including pearling if it became established here. In other parts of the world where it has become established it fouls hulls of ships, including water inlet and outlet pipes, as well as other hard underwater surfaces common to harbours. It is a significant competitor with native marine species, smothering oysters and competing for space with benthic organisms (Dept of Fisheries 2009). Given the number of shipping movements between Darwin and Broome, it may be considered a potential and increasing risk.

Cane toads (Bufo marinus) have the potential to damage the Bay in ways that are as yet unclear. They have already changed the biological landscape of Queensland, Northern New South Wales and the Northern Territory in disastrous and irreversible ways and will have a similar impact if they reach Western Australia (Stop the Toad website August 2009). Cane toads are known to survive in saline environments with up to 40% seawater (Liggins & Grigg, 1985). Cane toads have a significant effect on native wildlife. They are nocturnal and compete with native animals for food. They eat almost anything they can swallow (Australian Museum website 2009). Most of their food is living insects: beetles, bees, ants, winged termites, crickets and bugs are eaten in abundance. Marine snails, smaller toads and native frogs, small snakes, and small mammals are also occasionally eaten. The tadpoles of cane toads eat algae and other aquatic plants. They also filter organic matter from the water. Toads poison small native animals that prey on them, such as snakes, lizards, turtles, and crocodiles. Birds that prey on cane toads include crows, White-Faced Heron, Tawny Frogmouth, and Bush Stone-Curlew. Predators of cane toad tadpoles include dragonfly nymphs, water beetles and freshwater turtles. (Australian Museum website July 2009).

According to Lee Scott-Virtue, archaeologist and historian, Kimberley Specialists and Kimberley Toad Busters Inc. (July 2009):

It is important to recognise that the pristine terrestrial and aquatic habitat systems of the Kimberley are already under threat. Current land care and resource management policies undertaken by land and resource managers have had a detrimental impact on Kimberley biodiversity. Most of our plant and animal biodiversity is in a fragile state. The impact of the cane toad, if allowed to happen, will literally destroy one of the last unique biodiversity wilderness frontiers in Australia.

At a local level, the invasive species of greatest concern is the blue-green algae Lyngbya. Since 1995 Lyngbya has occurred on Roebuck Bay in abundance. It has the potential to adversely impact on animals (e.g. dugong and turtles) and local fishers have found that Threadfin Salmon move out of Lyngbya infested areas. Lyngbya has been found to smother seagrasses and mangrove communities. In Queensland it has been found on occasions to be highly toxic with significant risk to human health through direct contact. There are also concerns that consumption of contaminated sea food could harm humans. There is little understanding of the triggering mechanisms for Lyngbya despite considerable research into the topic undertaken in other areas of Australia, according to Dr David Deeley (Acacia Springs Environmental 2009).

It is clear that both diseases and invasive organisms have the capacity to interact in unpredictable ways and affect the local ecology in adverse ways, making it a challenge to plan to effectively manage these pressures on Roebuck Bay.

5.3 Assessment of the threats and pressures

Management of the Roebuck Bay Ramsar site aims to maintain the ecological and cultural values of the area for the longer term. Recreational and commercial activities should be provided for where these activities are compatible with maintaining the Ramsar values.

5.3.1 Framework for Assessment

To assess the compatibility of the uses in and around Roebuck Bay, it is important to undertake a risk assessment that considers the range of existing and potential threats to and pressures on the Ramsar site’s key values and associated ecological, cultural and social implications. This preliminary draft management plan uses a Framework for Assessment adapted from Ramsar guidelines, which was initially used in the development of a management plan for the Mangalagun (Crab Creek) area. The framework used can be found in Section 10.

The Framework for Assessment uses terms such as temporal scale, spatial scale and trophic level. Threats or pressures continuing over a longer time frame are often of greater concern than short term pressures (temporal scale). The spatial scale looks at pressures that have effects on a large area which often poses a greater concern than localised pressures. The trophic level at which a pressure occurs (put simply, the feeding level in the food chain), is also important in order to identify species that are affected by the pressure, and the impacts to those species lower down in the food chain. Greater concern may arise when a potential impact is assessed as likely to result in a cascading effect on the whole ecosystem.

RBWG members, at a stakeholder workshop in 2008, identified the probability and frequency of pressures and threats occurring, and from this identified broad priorities that needed to be addressed. This then resulted in the grouping of priorities into 10 management themes, (outlined in Table 5.1), that were then assessed using this framework.

5.3.2 Scale of Manageability

While it is recognised that pressures, whether global, regional or local, can impact adversely on the values for which the Roebuck Bay Ramsar site
is recognised internationally, those undertaking on-ground management tend to place more emphasis on pressures and threats that occur locally, because these are the issues that can best be addressed locally through appropriate management.

Bennelongia (2009) in the Ecological Character Description (p.85) identified the threats that can be managed (i.e. the levers that can be changed) to influence the ecology of Roebuck Bay and summarised these as:

- Urban run off
- Industrial pollutants
- Recreational activities – land based
- Recreational activities – water based
- Agricultural activities
- Groundwater extraction
- Port development and dredging
- Oil spills.

They went on to say that each of these levers ‘is thought to be exerting only a relatively small influence on Roebuck Bay at this time’.

Issues of scale and manageability were addressed in the draft management plan for Mangalagun (Crab Creek), recently developed by Sharon Griffiths & Associates and Acacia Springs Environmental (2009). That approach showed both time and spatial scales are equally relevant to other areas of the Ramsar site, and is therefore adopted in this preliminary draft management plan (see Figure 5.3.2).

Management responses (strategies and actions) that are required to address the pressures or threats coming from a scale broader than Roebuck Bay and Broome, may be beyond the scope of local management effort, and will need to be dealt with by implementing different strategies and actions. For example, storm water runoff emanating from Broome has the capacity to adversely impact the Bay’s ecosystem. Accordingly, education, awareness-raising, advocacy and leveraging are strategies that can be used to draw attention to actions that need to be taken at other levels.

Building on the process used for Crab Creek, the focus of the management effort is thus on:

- Managing human pressures on cultural and natural heritage
- Reducing foreshore erosion at Crab Creek and elsewhere in and adjoining the Ramsar site
- Raising awareness and educating visitors to the Ramsar area
- Using advocacy and leveraging, to ensure decision-makers understand the Ramsar values and rightfully consider the best information available when decisions are made that impact on Roebuck Bay
- Ensuring water quality is maintained or enhanced; Considering the provision and placement of public amenities to direct visitation;
- Identifying and raising awareness of coastal vulnerability and possible impacts flowing from climate change.

Areas of manageability for Crab Creek (and Roebuck Bay)

**Figure 5.3.2 Scale of Manageability**

**Areas of manageability for Crab Creek (and Roebuck Bay)**

- **Within 6 mths**
  - Identify, raise awareness of climate change coastal vulnerability
  - Ensure the provision of public amenity (e.g. ramps, toilets, water, shade etc.)
  - Reduce human pressures on cultural heritage, shorebird disturbance etc.
- **Within 1 yr**
  - Raise awareness through information packs for visitors, decision makers and managers
- **Within 2 yrs**
  - Identify, raise awareness re climate change coastal vulnerability
- **Within 5 yrs**
  - Ensure the benchmarking and management of fisheries, eg threadfin
  - Ensure the benchmarking and management of water quality of inflows, pollution control
- **Within 10 yrs**
  - Ensure impacts of Lyngbya are understood and managed
  - Ensure benchmarking and management of habitats to reduce disturbance, species loss
- **Within 20 yrs**
  - Ensure the benchmarking and management of foreshore erosion at Crab Creek and elsewhere in and adjoining the Ramsar site
  - Ensure impacts of Lyngbya are understood and managed
- **Within 50 yrs**
  - Ensure the benchmarking and management of fisheries, eg threadfin
  - Ensure the benchmarking and management of habitats to reduce disturbance, species loss
- **100 yrs or more**
  - Ensure the benchmarking and management of fisheries, eg threadfin
  - Ensure the benchmarking and management of habitats to reduce disturbance, species loss
  - Support establishment of Indigenous Ranger program.

**Extent of CCMP**

- Within 6 mths
- Within 1 yr
- Within 2 yrs
- Within 5 yrs
- Within 10 yrs
- Within 20 yrs
- Within 50 yrs
- 100 yrs or more

**Extent of RBWG**

- Encourage members to assess, advise and place conditions on development proposals
- Promote and participate in national climate change adaptation and avoidance strategies
- Ensure the provision of public amenity (e.g. ramps, toilets, water, shade etc.)
- Reduce human pressures on cultural heritage, shorebird disturbance etc.

**Scale of manageability**

- **Crab Creek foreshore**
- **Crab Creek + catchment**
- **Broome plus Crab Creek**
- **Roebuck Bay waters**
- **Roebuck Bay + catchment**
- **Kimberley**
- **Western Australia**
- **Australia**
- **Planet**
5.4 Key management issues

The management issues of greatest concern because of their importance in conserving the ecological character of the Ramsar site have been discussed in several forums (Lambert & Elix 2004, Lambert & Elix 2006, Griffiths et al 2008, Bennelongia 2009).

Subject to further consultation with key stakeholders and in particular the Traditional Owners and as shown in Table 5.1, these management issues can be summarised as:

- Managing shorebird disturbance and habitat loss
- Changing water quality and flows
- Pressures and impacts associated with urban development
- Impacts associated with activities at the Port of Broome including its support role for the mining industries
- Pressures of a rapidly growing tourism industry and uncontrolled access to key sites
- Impacts on spiritual, cultural and sustenance values of Aboriginal people
- Loss of recreational amenity and value
- Coastal vulnerability to the influences of climate change.

The Table 5.4 Roebuck Bay Key Values & Management Issues - September 2009 addresses the links between the conservation of these values and the management issues to be addressed, and can be found at Section 10.

5.5 Knowledge gaps

Gathering essential baseline data is important to effectively manage the Ramsar wetland, and indeed the whole catchment that connects to it, in order to monitor any future changes that may affect the ecological character of the Ramsar site or reduce the cultural and natural values of Roebuck Bay.

Significant research work has been undertaken over many years in relation to understanding and protecting migratory shorebirds and their habitat; much of this facilitated by Birds Australia and the Broome Bird Observatory and undertaken by volunteers.

Data from research undertaken in recent years should guide and assist future management. This includes tasks such as community monitoring of Lyngbya and seagrass beds (as the principal food source for both sea turtles and dugong in the Bay), monitoring of nesting turtles, mud-sampling, study of the disturbance to shorebirds, monitoring of dugong numbers, and research of inshore dolphins such as the unique Australian Snubfin Dolphin.

Water quality monitoring has been undertaken outside the Ramsar area by Broome TAFE and the Dept of Fisheries. Bennelongia has identified the information gaps and recommended actions to address the water quality in the ECD on p114.

To date a number of research needs have been identified by RBWG stakeholders, including:

- Water quality monitoring in the Bay
- Coastal vulnerability assessment
- Monitoring Lyngbya to identify triggers to its spread and ensure the impacts are understood and managed
- Erosion monitoring
- Impacts from recreational and commercial fishing on fish stocks.

Knowledge gaps and research needs are also identified in the ECD Table 24 on p.113 (Bennelongia, 2009) and this table is given in full in Section 10.

One gap identified in the ECD is that there is insufficient information to set a baseline for most fish species. There are knowledge gaps in understanding sustainable management of coastal sea food stocks across northern waters e.g. research is needed to understand fish population right across the Kimberley (DoF 2009). Another gap identified is that there is insufficient information on which to determine whether or not the Ramsar site meets the requirements of Criterion 9 for Ramsar recognition: a wetland that supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species, i.e. not a bird species.
An account is given of the complex legislative and policy framework for the management of the Ramsar listed wetlands in WA.

In the land tenure, policy and legislative framework section, the various management responsibilities and the Acts from which they come, are broadly discussed. Some commonly known locations, reserves, zones and leases around the Bay are identified, along with their tenure and purpose. The situation both within the Ramsar wetland, and beyond the Ramsar site is that there are a diverse range of owners and managers, all with varying roles and responsibilities for the land and waters and the resources within them.

As much of the coastal country within and adjacent to the study area was subject to a Native Title (NT) determination, an outline of NT is provided. It notes that flowing from the determination, is an imminent agreement between the key stakeholders, principally the State of WA and the Yawuru Native Title Holders, that will result in major decisions likely to affect the management of the area under study.
6.1 Land tenure, policy and legislative framework

The Western Australia’s former Auditor General, in his report, Management of Ramsar Wetlands in Western Australia the Legislative and Policy Framework (AOG 2006) stated:

The legislative and policy framework for the management of Ramsar wetlands in WA is a complex arrangement involving international agreements, Commonwealth and State legislation, agreement and policy, and numerous government agencies.

6.1.1 The Ramsar wetland

For the Ramsar wetland, the management rests with the State Government ‘under a complex legislative and policy framework that includes a Commonwealth-State Bilateral Agreement. However, the Commonwealth as the signatory to the convention is ultimately responsible for Australian commitment and compliance with the convention.’ (OAG 2006).

The Auditor General’s report goes on to say:

- The framework generally supports the protection of Ramsar wetlands though some difficulties are nevertheless evident.
  - Ramsar wetlands have limited recognition in Western Australian legislation or policy. As a consequence, they are not afforded special consideration as expected of territory recognised as internationally important.
  - DEC as the lead agency does not have authority over all Ramsar sites because the sites are not vested in the Commission. Under the Conservation and Land Management Act 1984 (CALM Act), DEC only has management authority over territory vested in the Commission.
  - There is a lack of agreement between the Commission and DEC as to responsibility for the prioritisation and finalisation of management plans. (OAG 2006)

Basically what this means is that although in Western Australia the Department of Environment and Conservation (DEC) is charged with implementing international obligations for the Ramsar site, it has no legal authority under State legislation to do so on sites that are not ‘part of DEC estate’ i.e. vested in the Conservation Commission of Western Australia. Roebuck Bay’s Ramsar site is not part of the DEC estate.

Particular tensions exist in relation to the intertidal area between the high and low water marks of Roebuck Bay. Although this area is the property and legislative responsibility of the Western Australian Government, there is constant tension between the State and Commonwealth governments, especially when it comes to determining who has jurisdiction over any resources found in this area.
While the WA State Government has authority over the marine areas within the Roebuck Bay Ramsar site, as well as over much of the landward section, management responsibilities rest with several different agencies (see Bennelongia 2009, p.32).

The Department of Fisheries is responsible for areas below the low tide mark and for ensuring sustainable recreational and commercial harvesting of fish populations.

Department of Water is responsible for licensing, regulation, protection of water quality and the preparation of policies and plans to ensure safe and sustainable surface and ground water supplies, under legislation that includes the Water Boards Act 1904, Water Services Licensing Act 1995 and the Water Agencies (Powers) Act 1984. (Bennelongia 2009).

The WA Department of Regional Development and Lands, State Lands Services, has management responsibility for Unallocated Crown Land (UCL), but the Department of Environment and Conservation has been delegated responsibility for management of the Ramsar site and has responsibility for flora, fauna and wildlife protection, and fire management on UCL.

For Roebuck Bay’s Ramsar wetland, the key elements of the legislation and policy framework are the Ramsar Convention, the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), WA’s Conservation and Land Management Act 1984, (the CALM Act), the Environmental Protection Act 1986, and a 2002 Bilateral Agreement for delivery of moneys provided under the Natural Heritage Trust and WA’s Wetland Conservation Policy. (Auditor General 2006). These are graphically illustrated here in Figure 6.1.

6.1.2 Beyond the Ramsar site
Outside the Ramsar site, but interacting with it, pastoral leases surround most of the Bay. The exceptions are the north-eastern part, where the town of Broome is located, Fall Point where the Broome Bird Observatory is situated, and a mining tenement to the north-west.

A range of leaseholders is responsible for the day-to-day management of activities such as pearling and aquaculture, commercial fishing, tour boat operations (including hovercraft) and the Broome Bird Observatory.

On reserved lands where there is a management order the body that holds the management order normally carries the ultimate responsibility for management. Two examples are: the Shire of Broome is responsible for the care, control and management of a road or recreation reserve and the Water Corporation is responsible for a water reserve. There are other situations where those that have a lease have the power under the management order to sub-lease land to others e.g. the Aboriginal Lands Trust (ALT) who may exercise their power and sub-lease to a local Aboriginal corporation.

Table 6.1 identifies some commonly known locations, zones, reserves and leases within the study area and around the Bay.

Figure 6.1: Legislation and Policy framework for the Ramsar Wetland (adapted from ?)
### RESPONSIBILITIES

#### ROLES AND MANAGEMENT

Table 6.1

<table>
<thead>
<tr>
<th>Name or Number</th>
<th>Tenure</th>
<th>Purpose</th>
<th>Vesting/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roebuck Plains Station #3114/0499</td>
<td>Owned and operated by the I.C. (Informal request from TOs to have it divested to Yawuru, as required under legislation.)</td>
<td>Established under the Land Fund and Indigenous Land Corporation Act 1995</td>
<td>Abuts Roebuck Bay. Lease covers 283.459 ha</td>
</tr>
<tr>
<td>Thangoo Pastoral Lease #3114/0635</td>
<td></td>
<td></td>
<td>Lease of 172.834 ha South of Rookebu Plains Station and abuts Roebuck Bay</td>
</tr>
<tr>
<td>Port Management Authority land Reserve #28650</td>
<td>200 ha described as Reserve 28650 and is zoned Port Zone in TP54</td>
<td>The waters in and around the port are part of Dampier Harbour. Location 409 vested in BRPA, by the Crown. Under Part Port Authorities Act 1999 Broome Port Authority oversees all activities within its boundaries (BRPA 2009b).</td>
<td>Numerous lease holders in Port area. Detailed in the Table 1.1 on p3 of the BPA (2009b)</td>
</tr>
<tr>
<td>Reserve #35743 Near port</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserve #35493 Gravel 38 hectares Shire of Broome</td>
<td></td>
<td></td>
<td>Information sought. TBC</td>
</tr>
<tr>
<td>Wattle Downs Leasehold to Yawuru Aboriginal Corporation. This is currently on a 6 month rolling lease, until the results of the Yawuru and State negotiations are known.</td>
<td></td>
<td></td>
<td>Update sought. TBC East of Crab Creek Road.</td>
</tr>
<tr>
<td>Gubanyana (Campsite) A section 91 licence exists over one area (a camping licence) at Gubanyana. The State is the lessor.</td>
<td></td>
<td></td>
<td>At Crab Creek abuts Roebuck Bay</td>
</tr>
<tr>
<td>Broome Bird Observatory on Reserve #41066 It is leased, lease #2020/100, for 7 years to Birds Australia (expiry 31/01/2013), from DEC</td>
<td>Gazetted for the purpose of a Broome Bird Observatory. Permitted uses are ‘Field laboratory for study of birds, training and education purposes.’</td>
<td>Located 25 kilometres east of Broome, on 2.8 hectares of land near Fall Point at Mangalagun (Crab Creek).</td>
<td></td>
</tr>
<tr>
<td>The intertidal zone The Minister for Transport pursuant to s9 of the Marine and Harbours Act 1981 (the MHA) seabed is purportedly vested in Minister</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Roebuck Bay are 7 pearl oyster leases issued to 2 companies (DoF 18/11/09) 21 yr leases issued under the P earling Act 1990, administered by the Dept of Fisheries (WA)</td>
<td>On the leases pearl oysters (Pinctada maxima) are held in panels suspended from surface longlines</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 6.1.3 Native Title

The land and waters around Roebuck Bay have been subject to Native Title claims and Native Title (NT) determinations in the Federal Court, and in recent years, negotiations relating to Native Title rights, agreements and compensation.

The Native Title rights and interests of Indigenous people were first recognised by the High Court of Australia in the 1992 Mabo case. Native Title is the communal, group or individual rights in land and waters according to traditional laws and customs. These may be rights of ownership, possession and use of traditional country.

People who hold NT may have the right to continue to practice certain of their laws and customs over land and waters so long as those activities are consistent with Australian law. This could range from living, hunting, gathering, fishing, ceremonies, access rights, use and occupation and visiting to protect important places. It often includes the right to be consulted about activities or decisions that could affect the enjoyment of NT rights and interests. (ALGA 2000).

In 2006 a Native Title determination was brought down after Yawuru people were successfully able to demonstrate continuous and unbroken connection to the area. This ruling recognised the Yawuru people’s common law rights and gave exclusive possession rights to about 5,000 square kilometres around Roebuck Bay. The decision also gave non-exclusive rights to areas of ‘waterways, coastal waters and beaches’, and other areas of common public use including much of the intertidal mudflats. Yawuru people’s rights to take natural resources for personal, domestic and non-commercial communal needs were also recognised. Ecological Character Description (Bennelongia 2009).

Under the Federal Native Title Act 1993, acts or activities that affect NT are termed ‘future acts’ and key stakeholders need to be aware that there are procedural requirements that must be satisfied before, for example, a road is declared or access is constructed to a certain area. (DIA n.d.)

A practical option may be to make an agreement with the registered NT holders about the use, access to, or management of land. This is termed an Indigenous Land Use Agreement (ILUA). The advantage of an ILUA is its flexibility, being able to tailor an agreement to suit the needs of the parties involved. Another advantage is that the Court is not involved, and once the agreement is finalised the parties can apply to have it registered, after which it becomes binding. (ALGA 2000)

Much of the land and water in and around Broome is subject to negotiation between the Yawuru Native Title Holders and the area’s land owners and managers. (The Native Title determination is shown at Figure 6.2). Recently, in-principle agreements between the State Government of WA and Yawuru Native Title Holders Aboriginal Corporation have been announced. These are said to include joint management, in some coastal areas and collaborative initiatives with other key stakeholders, such as the Shire of Broome and the Department of Environment and Conservation. It is reported that this agreement may be in the form of an ILUA with Yawuru and other key stakeholders.
Much of the area covered by this preliminary draft management plan for the Roebuck Bay Ramsar site will be influenced by the outcomes from the terms of these agreements.

6.1.4 Heritage protection

The Roebuck Bay area has significant cultural and natural heritage values in need of protection.

The protection of areas of cultural heritage significance is covered by both State and Commonwealth legislation and local government policy. This may include legislation such as the Heritage of Western Australia Act 1990 and the Aboriginal and Torres Strait Islander Heritage Protection Act 1984.

Listing in the relevant registry of heritage places is said to offer some protection through the obligations of Commonwealth agencies under the Australia Heritage Commission Act 1975.

The natural heritage places are partly protected by the Australian Heritage Commission Act 1975 and the Environment Protection and Biodiversity Conservation Act 1999. Other areas may be offered protection by State legislation or international agreements such as the Ramsar Convention.

While the WA Auditor General’s report (OAG 2006) makes some suggestions for investigating options to obtain clear authority for Ramsar sites not vested in the Conservation Commission (including options such as MOUs between relevant agencies and DEC and the vesting in the Commission) it also advocates that any new or amended legislation should provide clear responsibilities for sites.

The Heritage Council of WA is WAs state advisory body on heritage matters and focuses on not just buildings and sites but places. The Act requires local government authorities and State Government agencies to seek the advice of the Heritage Council if they are considering development of a place that is entered in the Register of Heritage Places that is maintained by the Heritage Council. Advice can also be sought from the Heritage Council in regard to proposed development of non-registered places.

Most of the foreshore areas around Roebuck Bay contain significant cultural heritage sites, both registered and unregistered. These vital areas are often the same places that are highly sought after for recreation purposes. For example at Mangalagun (Crab Creek) heritage features may be on Crown land held under a lease or a reserve, an Aboriginal Reserve under the control of the Aboriginal Lands Trust, on a road reserve under the management of the Shire of Broome, or on freehold land or Unallocated Crown Land. For each of these places different and specific factors need to be considered.

The Aboriginal Heritage Act 1972 was introduced to protect all Aboriginal heritage. This includes all places and objects that are important to Aboriginal people because of connections to culture. Under this Act it is an offence for anyone to excavate, destroy, conceal or in any way alter an Aboriginal site or any object, without the permission of the Minister for...
Indigenous Affairs (Department of Indigenous Affairs, January 2002). All Aboriginal sites whether registered or not, are protected by Federal and State laws.

The significance of areas of cultural heritage may not come to light until management or development is underway and many sites may not be widely known or in fact registered. This could be for a number of reasons; vegetation or other features may obscure archaeological material, archaeological deposits or burials may be present but under the land surface, or the Aboriginal community or individuals may express concerns about potential environmental impacts at sites they then identify as places or features of ethnographic significance (DIA n.d.).

The precautionary principle needs to be applied in planning to effectively manage the Roebuck Bay area and its Ramsar site, i.e. key stakeholders should always assume the need to find out and seek approvals before taking any action. With the diverse nature of Aboriginal sites and interests in both land and waters, it is difficult to establish specific procedures to follow that can be applied to every circumstance that may be encountered. However, any proposed work or development that may impact on heritage or Native Title interests should be discussed with the relevant people or agencies early in the proposed planning, e.g. Yawuru Native Title Holders through their Prescribed Body Corporate (PBC).

The roles and responsibilities and the enabling legislation affecting Roebuck Bay and the Ramsar wetland, is provided in more detail on page 31 in the Ecological Character Description (Bennelongia 2009). Perhaps it can be best summarised by quoting from page 17, in the Draft Peel–Yalgorup System Ramsar Site Management Plan (Peel–Harvey Catchment Council 2008).

DEC has a shared responsibility for managing Western Australia’s Ramsar sites. Under a bilateral agreement with the Australian Government, DEC assumed the responsibility for managing the State’s Ramsar wetlands and implements management programs where funds are available.

STRATEGIES TO MANAGE PRESSURES AND THREATS

Approaches that might be taken to eliminate, reduce, manage or mitigate against threats and pressures to Roebuck Bay are outlined in nine management strategies.

• Education and awareness raising
• Advocacy and leveraging
• Employment of Aboriginal Rangers
• Collaboration and coordination
• Development of policies and procedures
• Zoning
• Development of public facilities and infrastructure
• Research
• Enforcement

Positive strategies are encouraged i.e. raising visitor awareness; using signs and public amenities to draw visitors away from sensitive cultural and environmental areas; using research and monitoring to gain information to fill the knowledge gaps; and utilising Aboriginal rangers patrolling around the Bay to assist and direct visitors, to care for the country while passing on their culture, and to provide an eyes-on-the-ground presence. Enforcement, while needed, is considered a less effective management strategy in the longer term.

The zoning of areas is discussed and various levels of zoning, for both land and sea that are in common use, are overviewed.

The need for clear direction to assist the many people using and managing the Bay may be addressed by the development of agreed procedures or policies e.g. codes of conduct or operational procedures.

Maintaining the Roebuck Bay Working Group’s (RBWG) collaborative approach with key stakeholders is encouraged. To achieve informed and better decision making at all levels, the recommendation is that RBWG use its power of influence and advocate for the Bay.

Suggested time scales for implementing some of the strategies and actions is given, and an indication of the scale of management effort required.
These strategies were identified in the main, from the responses during the development of the management plan for Mangalagun (Crab Creek) and through the assessment of management themes using the Framework for Assessment (see Section 5.3.1), and also from what stakeholders have been saying during consultation over the previous five years.

Threats to the natural and cultural values of the Roebuck Bay Ramsar site are primarily the result of human activities, therefore a range of management strategies to effectively manage human behaviour is proposed. They are:

- Education and awareness raising
- Advocacy and leveraging (using collective power to gain an advantage)
- Employment of Aboriginal Rangers
- Collaboration and coordination
- Development of policies and procedures
- Zoning
- Development of public facilities and infrastructure
- Research
- Enforcement

By working collaboratively to implement the management strategies, stakeholders will be encouraged to actively promote a range of responses and approaches. Community monitoring and public participation will continue to be vitally important in meeting the management objectives for the Ramsar site.

Rarely will a single approach or strategy achieve a given management objective. (See Section 2.2 for details of the objectives). Effective management usually results from a combination of strategies and actions that cross-link and overlap. The following example highlights the management strategies used recently by the Roebuck Bay Working Group (RBWG) to address one aspect of shorebird disturbance.

The helicopters operating from the Broome International Airport were disturbing the roosting migratory shorebirds. RBWG members working on ground near Mangalagun (Crab Creek) were informally monitoring the impact of helicopter movements on the birds. With support of the RBWG members, (advocacy/leverage) the problem was taken to the Airport management and to the companies using the helicopter services to raise their awareness and to seek a solution. This collaboration resulted in a mutually-agreed arrangement whereby an alternative helicopter path (zone) was identified. However in order to ensure all the pilots are aware of the bird’s needs and our Ramsar obligations, and to ensure policies and the agreed procedures were adhered to, an informative brochure was developed by Department of Conservation and Environment (coordination and education). This will be distributed to all the commercial helicopter companies and helicopter pilots, to keep them advised. Key stakeholders hope these strategies and actions will reduce the impacts on the birds, and the Broome International Airport owners, will if necessary enforce this agreement.
Strategy 7.1 Education and awareness raising

Education and awareness raising activities are key management responses that will need to be initiated and applied at a broad and local level in order to influence change.

Raising awareness through education and communication strategies will need to be directed at a range of people including residents and visitors to Broome (all users of Roebuck Bay), and decision-making authorities who are often remotely based in other parts of Australia. When decisions are made that have the capacity to impact negatively on the Ramsar site for example on a foreshore development proposal, the informing and alerting of decision-makers to the vulnerability of Roebuck Bay should result in better outcomes generally for the Bay.

Some important trends were considered in selecting the education and awareness raising strategy and particular actions under this strategy. These trends were set down in the Draft Crab Creek Management Plan May 2009 and further detailed in the draft Implementation and Action Plan (Griffiths September 2009). Some important considerations were:

- the raised expectations of visitors who come from more developed areas, for better visitor information, guided tours, directional signage, and basic public amenities
- a growing interest toward Aboriginal culture, and a desire by many visitors to have a ‘cultural’ experience
- an increasing number of international visitors who may require signage and information in clear, user-friendly formats incorporating international symbols
- more elderly travellers and an increased number of self-drive visitors are coming to undeveloped areas around the Bay e.g. Crab Creek; high turnover of agency staff in Broome and the Kimberley with a subsequent loss of corporate knowledge. This necessitates consistency in attention to presenting the issues, understanding the ramifications, the past history and the ‘big picture’ overlays, before decisions affecting Roebuck Bay are made
- volunteers are a significant source of labour and expertise in both research and on-ground work around the coastal areas of Broome
- transient visitors are less likely to develop a sense of ongoing commitment and more enjoyable by effective signage. Visitors can be alerted to the presence of Lyngbya, its potential harmful effects, and the treatment if affected. Information about the risks associated with dehydration, sunburn, crocodile habitat and tidal inundation can also be provided.
- community events such as annual Celebrate the Bay days, school and community presentations e.g. from scientists and cultural custodians, field days and informative field surveys can be undertaken with guidance from credible guides, scientists and Traditional Owners.
- Interpretative information and public art (e.g. a sculpture or installation) could be located at foreshore park areas in town that explains or interprets Roebuck Bay’s history, natural and cultural values, in an interesting and/or attractive artistic form.
- Tourist information such as publication of DVDs, pamphlets and guides. These may include information to educate and raise awareness about coastal food resources and their vulnerability from over exploitation and how to help sustain species. Before venturing out to remote locations around the Bay, visitors need to be aware of what public facilities are available. This could be achieved through the Broome Visitor Centre, signage at the intersection of Broome Highway and Crab Creek Road, brochures distributed in places that tourists frequent such as resorts and fishing tackle shops.

In the short term, good information will make the visitors’ stay safer and more enjoyable, and will direct visitation to less sensitive areas, thus reducing foreshore erosion, sediment erosion, and disturbance to flora and fauna (e.g. migratory shorebirds, turtles nesting and Australian Snubfin Dolphin). In the longer term, it can raise awareness and increase knowledge in the general population and thereby the possibility of changing attitudes, and modifying human behaviour such as parking vehicles off the beach and away from fragile cliffs, slowing the speed of boats to reduce the risk of harm to marine mammals, and rehabilitating and planting using local indigenous plant species to protect habitats and the fauna that depend on them.

Many of the education and awareness raising strategies are straightforward, cost effective and manageable at a local community level and within existing stakeholder budgets. They could be implemented within a reasonably short time frame and reduce human pressures as people increase their understanding of the area and its values, and respond with appropriate use. Within nine months or so information could be collated and made available through information packs, self guided pamphlets or other media, serving to raise the awareness of residents, visitors, decision-makers and managers. Within a year, a signage plan could be developed that rationalised signage around the Bay and recommended a consistent, attractive and informative approach. For more detail see the Crab Creek Management Plan Implementation and Action Plan – draft. (Griffiths September 2009).

Strategy 7.2. Advocacy and leveraging

As the membership of the RBWG is broadly representative of most sectors of the Broome community, there are valuable opportunities for member organisations, agencies and individuals to advocate for the Bay and to leverage resources for its management and protection.

Raising the awareness of decision makers, (authorities who commonly make decisions from remote offices in places such as Perth or Canberra,) will need to be applied at a broad and local scale to influence change
since many of the issues, impacts and decisions that influence the Ramsar site originate beyond the jurisdiction of the RBWG. Accordingly, they may be best dealt with through advocating for the Bay and leveraging the power of RBWG to get things done.

When decisions are made that have the capacity to impact negatively on Roebuck Bay, for example coastal development proposals or commercial marine operations, the informing and alerting of decision makers to the values and vulnerability of Roebuck Bay should result in better outcomes generally for the Ramsar site.

Strategy 7.3 Aboriginal rangers
Due to the increasing visitor numbers and early signs of adverse impacts on natural and cultural assets around the Bay, it is increasingly important to get land and sea management initiatives in place, particularly Aboriginal Ranger programs.

The recognition of Native Title and customary rights over the area has provided increased impetus for Aboriginal people to care for their country in more formal ways. An Aboriginal Ranger programme has been operating successfully in coastal areas throughout the Shire of Broome, along the Dampier Peninsula from Beagle Bay to Ardyaloon and in Minyirr Park in the Broome town site, south to Bidyadanga. This programme could well be replicated for Roebuck Bay.

This management response has continued to be highly regarded by key stakeholders during the five year management planning process undertaken by RBWG. They recognised the effectiveness that a land and sea Ranger presence can have (visible stewardship), guiding and informing visitors, monitoring sensitive cultural and natural areas, and carrying out tasks such as maintaining public facilities and signage, reducing weeds, enforcing policies or regulations, and providing on-ground response or troubleshooting in the event of such things as accidents or bush fires.

Apart from the vital aspect of cultural transmission that Ranger programmes encourage and promote, Rangers can provide guided tours, visitor advice, and other measures to enhance people’s experience of Roebuck Bay. This may also help reduce the pressures on the environment and Rangers may provide additional information about tidal movements, when to take certain species for food (fish and crabs), turtle nesting, bush tucker availability, bird feeding and roosting, routes to take, areas to avoid, and directing people to facilities.

The Rangers could undertake monitoring on behalf of Government agencies, for example monitoring for water quality for the Department of Water and the Shire of Broome, or for seagrass, marine mammals, shorebird populations, weed infestations, threats to fauna, and the presence of Lyngbya for the Department of Environment and Conservation. Another possibility is monitoring for compliance (or enforcement of legislation) with, for example, fish size, bag limits, customary takes, litter, Shire by-laws (camping or dog control) and monitoring vehicle access. To have the greatest effect, Rangers will need to have a visible presence during peak recreation times such as weekends and evenings.

Recruiting Rangers from the local community, in particular those who have a cultural responsibility and connection with the area, will be better supported and more effective. Rangers would be directed by and responsive to Yawuru Traditional Owners and custodians for the area. This transmission up and down from on-ground issues to broader governance matters should encourage more appropriate decision making and effective management.

Strategy 7.4 Collaboration and coordination
The aim of the collaboration and coordination strategy is to attract and maintain involvement by a wide range of stakeholders in managing and attracting resources to the Roebuck Bay’s Ramsar site and catchment area.

In the past, the management of Broome’s coastal areas has suffered from a lack of coordination between the decision-makers, enforcement agencies and the community. Traditional Owners recognising the problem identified the need for:
- a central point for collecting and disseminating information
- coordinating the preparation of funding submissions and administering grants
- overseeing the numerous on-ground coastal projects in and around Broome
- facilitating and supporting a coordinated approach to joint management.

This resulted in the establishment of the Shire of Broome Coastal Park Management Committee, an initiative of Traditional Owners represented by the Rubibi Working Group and the Shire of Broome that focussed on the Cable Beach coastal reserves (Griffiths 1999).

A community-based group for coordinating the management of the whole of the coastal area within the Shire of Broome would be a worthwhile initiative to consider.

Since 2004, the RBWG has made a concerted effort to work in a collaborative way to ensure the best prospects for managing the Roebuck Bay area, and thus ensuring the cost-effective use of human, financial and capital resources for management. The group members identify issues, ensure greater cooperation in the operations of those responsible for the wise use of the Bay, and together are better able to monitor compliance and implementation of actions and strategies.
RBWG would seem to be an appropriate body to fulfil the requirements for a Community Advisory Committee for the Marine Parks and Reserves Authority, if in future a marine park or reserve is established for Roebuck Bay.

While a range of agencies and organisations involved have various management responsibilities for natural and cultural environments and assets, it is often volunteers and community groups who have no management responsibility but who have a sense of stewardship or care and passion for the coast who undertake much of the on-ground management actions around the Bay. Importantly when people participate hands-on they gain an appreciation and understanding of the ecosystem links, the cultural significance, and gain an understanding of technical terms like ‘protecting biodiversity’ (Griffiths 1998). Continuing to foster this opportunity at Roebuck Bay and bringing people together to understand nature and culture in the company of their peers can be a huge motivator in caring for the marine and terrestrial areas.

Promoting and inspiring responsible use of the environment and doing this in partnership with others is vital. An important management strategy is to work in a coordinated and collaborative manner with key stakeholders, using agreed policies or procedures to ensure effective decisions are made and to promote greater transparency, reduce uncertainty and duplication, and maximise the outcomes from the limited resources available.

Collaboration and coordination is needed to effectively underpin other strategies such as research, the development of policy or procedures for across-the-board implementation, zoning considerations, the establishment of a Ranger programme, securing resources to undertake management actions, applying leverage to make things happen so that decisions are taken that are in the interests of protecting Roebuck Bay’s key values.

**Strategy 7.5 Policy and procedures development**

Land and sea owners/managers should consider the establishment of policies and procedures to define the ground rules for those charged with implementing the management strategies and carrying out the actions for Roebuck Bay. This is particularly important with the broad interests and large number of agencies, groups and people who have management roles and responsibilities for the Bay.

Policy development should form part of the management and administrative framework, and provide guidance for operational decisions and set out clearly the roles and responsibilities of each stakeholder, leading to better decision making, wider stakeholder involvement and commitment and more efficiency in managing the work and resources (including human resources) equitably and with greater accountability and transparency.

Clear policy and procedures can foster increased community participation in decision making and rally more support for on-ground action. Policy and procedures come in many formats and may be formal (through legislation) or informal: an organisation’s operational procedures, user manual, code of conduct, or a brochure such as the Roebuck Bay Interim Management Guidelines (RBWG 2009). When policy or procedures are set down plainly with the expectations and responsible agencies evident, people then know what they are expected to do, why they are doing it, when they are to do it, and for whom.

Procedures and policies should be developed to guide users of Roebuck Bay, for example fishers, vehicle drivers, tour operators, boat owners, researchers and volunteers. Some are already in use, for example DEC has whale watching guidelines, the Department of Fisheries has the Barramundi and Threadfin Salmon Accord 2007-2012, (DoF 2007). From colloquial evidence, existing policies, procedures or legislation that may need to be reviewed and revised include fishing rules, boating regulations, by-laws for off-road vehicles and fire restrictions. The Navigable Waters Regulations for waters around the Bay may need to be revised and restrictions set on boat speeds or access prohibited to certain areas in order to reduce coastal erosion, protect cultural sites, take pressure off marine mammals, and protect the safety of people.

Whether it be legislative changes or the development of policies or procedures, all need to be implemented, monitored and regularly reviewed to ensure they are meeting the management objectives e.g. to improve the sustainability of food stocks, to reduce pressures, or to ensure more effective management by stakeholders to conserve the values of the area.

RBWG should continue to work collaboratively with land and sea owners or managers to ensure the development of agreed policies and procedures that guide and support the wise use of the Roebuck Bay’s wetland and foreshore areas.

**Strategy 7.6 Zoning**

The creation of precincts or zones can enhance a user’s experience, protect the very resources they wish to sustain, and provide safety and certainty. Rather than being viewed as restrictive, they can be promoted as ‘zones of opportunity’, as in the coastal park, Minyirr Park (Griffiths 1998).

On land, the strategy of zoning or precincts is essentially used to steer high impact use away from sensitive environmental and cultural areas and towards areas close to public infrastructure and those less valued such as degraded areas. Zoning can assist in the separation of conflicting uses, and provide for specific uses such as commercial or recreational activities, or for education and research purposes.

Areas on land and sea may need to be subject to closure or restricted access, or to exclude people at key times e.g. during periods when shorebirds are feeding and resting/roosting prior to their migrations, or for the implementation of stronger management controls over coastal resources to protect fish, dugong, cockles etc. Experience in Broome (Griffiths 1998) has shown that while these restrictions may be effective management tools they require considerable commitment by a diversity
of stakeholders and ongoing monitoring and enforcement. This is where a Ranger program can be most effective.

Zoning, be it specific areas for limited or a wide range of uses, and the creation of precincts in order to wisely use the coastal areas, has been identified in the findings from a wide range of planning, scientific and other research projects for the Broome area undertaken over many years.

During stakeholder consultation for the Crab Creek management planning it was also suggested that greater restrictions on access by non-residents may be necessary to ensure sustainability of cultural resources and coastal food stocks and that some areas may need to be set aside for Aboriginal use only. Conversely some areas may need to be no-fishing zones for a period of time in order to allow the fish to breed and grow up without disturbance, thus ensuring sustainable stocks for a longer period of time.

The use of fishing closures, access close-offs, restrictions and zoning need to be carefully considered. These can be seen by users as unwarranted and negative i.e. controlling or taking away. By the use of complementary management strategies such as a long-term media campaign to educate uses prior to restrictions, and by providing some visitor amenities this may help to reduce resistance and indeed foster support for zoning.

Zoning for land and sea
General information is provided here on a range of zones that may be appropriate for designations on land or sea, based upon current and anticipated pressures around Roebuck Bay.

This preliminary draft plan is not proposing a marine park, but is mindful of both the proposal for a protected marine area in the Bay, and for coastal reserves under the control of Yawuru and/or DEC currently under negotiation. Marine parks are required to be zoned with one or more specific management zones, under Section 13B of the Conservation and Land Management Act 1984 (CALM Act). These zones for example, sanctuary, recreation, special purpose and general use zones then become formally established as classified areas under the CALM Act (DEC 2007, p.16). Should the proposal for a marine park be pursued, these suggested zones could be adapted to form the basis of future planning for a marine park or for coastal reserves.

It should be noted that the use of zones may be a formal legislation backed strategy, or an informal but effective way to identify the wise use of areas.

Below is a list of suggested zones or precincts that could be applied through local planning initiatives where it covers the Roebuck Bay and Broome area. Whether precincts or zoning be incorporated into the current Shire of Broome Town Planning Scheme, or become a specific plan required for on-site work, the use of zoning as an effective management strategy should be considered.

List of zoning levels
1. No take zones
   • In no take zones all resources are protected, but fishing is permitted only for what you can eat there. No fish or resources can be taken away.
   • No take zones may include Fish Habitat Protection Areas declared under the Fishing Resources Management Act 1994.

2. Fish Habitat Protection Area (FHPA)
   • In FHPA’s no fishing, netting, spearfishing or similar activity is permitted. Therefore an area could be declared a fish habitat protection zone— a ‘Look but don’t take zone’.

3. Seasonal Closure Zone
   • Designated areas can be closed to visitors and would usually protect breeding areas for birds or turtles. This zoning could be applied to a fishing area.

4. Replenishment Area
   • Designated areas that can have special management provisions for specific areas or periods of time to allow recovery of fish stocks.

5. Special Management Zone
   • Designated areas which can have special management provisions for temporary periods to protect natural resources or prevent conflict of use e.g. recreational fishing in areas where fish breeding occurs.

6. General Use Zone
   • A general use zone allows most commercial and recreational activities including fishing and diving.

7. Preservation Zone
   • No go areas that exclude all activity except permitted scientific research.

8. Scientific Research Zone
   • Areas set aside to facilitate research may be in areas primarily near scientific research facilities where the area is relatively undisturbed by extractive industries. Only non-extractive activities such as swimming, snorkelling and diving would be permitted without written permission or in some areas no access may be permitted.

   • An area where there is increased protection and conservation but which provides for opportunities for reasonable use and enjoyment of the area, including the extraction of mineral resources where it does not compromise the conservation and preservation of the area. Fishing activities may be restricted.

10. Marine Protection Zone
    • Areas can be identified for the conservation and preservation of sensitive marine habitats through protection and management measures to ensure they are generally free from potentially damaging activities (trawling would be unlikely to be permitted) while providing for the preservation of the natural integrity and values of the area. There are also a range of zones primarily on land and foreshore areas that include Environmental Management zones, Multiple use zones, Conservation and Multi use zones, and Environmental Cultural Corridors.

There are also a range of zones primarily on land and foreshore areas that include Environmental Management zones, Multiple use zones, Conservation and Multi use zones, and Environmental Cultural Corridors.
11. Conservation Zone
   - A conservation zone could be an area which may be on Crown land or private freehold land where the purpose is to conserve and enhance the natural environment, biological diversity, resources and distinctive landscapes of the study area.

12. Conservation and Recreation Zone
   - This is the same as for conservation zone but where specified recreational activities, consistent with maintaining the environmental values, will be considered where they do not conflict with other uses.

13. Multiple Use Corridors
   - Multiple use corridors may include private and/or public owned land where a number of land use activities may occur where they do not conflict with one another and they can be developed and managed to maintain the aims, objectives and values of the corridor — maintaining and permitting water quality maintenance, habitat retention and enhancement, protection of cultural values, water conservation, extraction of basic raw materials, recreational opportunities, low key ecotourism and other similar activities.

Currently negotiations are underway between the State Government of Western Australia and the Yawuru Native Title Holders Aboriginal Corporation along with other key stakeholders such as the Shire of Broome, in order to make some legally binding agreements on how best to manage the coastal area of Broome. These agreements will be looking closely at effective management planning for both land and sea, and this will include consideration of zones whether they be parks, reserves, areas or corridors. Two likely zoning examples are detailed below.

Marine Parks and Reserves
Any initiative to establish a marine park in Western Australia would follow a similar procedure to the establishment for other marine parks around the State. The consultation would be conducted on behalf of the Marine Parks and Reserves Authority (MPRA) under the statutory planning process for new parks. The proposed marine park would be created in consultation with the Yawuru community, meeting the requirements of Native Title, and in consultation with all stakeholders who have an interest in the area. The legislation also requires that there be an approved management plan for each marine park, marine nature reserve, and marine management area vested in the MPRA. The Department of Conservation and Environment (DEC) would prepare a draft management plan, undertake consultation and when adopted by both houses of State Parliament it would come under the management and responsibility of the MPRA.

Environmental Cultural Corridors (ECCs)
A zoning concept for land, which is becoming more familiar to Broome residents through the Shire of Broome local planning strategy and designation in the Town Planning Scheme (TPS) is that of an Environmental Cultural Corridor (ECC).

The ECC zoning strategy has been used in the Broome town site and adopted in the town plan. ECCs are reserved as open space, to provide for Aboriginal cultural heritage uses, the conservation of the natural environment, fauna and flora habitats, corridors for the movement of native animals, to allow for major drainage areas and aquifer recharge, as well as for outdoor public recreation. It is proposed that the ECC initiative that links the north-south and east-west movements and Aboriginal traditions across the Broome Peninsula be extended to link with areas around the Bay (LGDP 1998).

In fact in the future development of Broome North, a 150m wide ECC connecting Dampier Creek to the coastal dunes will be zoned. ‘The ECC will comprise retained bushland with public pathways and areas for drainage that mimic natural systems.’ (Landcorp 2009)

Within an ECC can be accommodated a range of uses from exclusion zones, exclusive use zones (limited entry for cultural practices) through to multiple use zones. This avoids the need to have multiple zones to designate land uses but still can provide for the necessary management direction and requirements.

In some areas these zones (ECCs) may take the form of coastal or regional parks. One such is Minyirr Park, that fringes the Indian Ocean from Wirkinmirre (Willie Creek) past Cable Beach around Minyirr (Gantheaume Point) to Mangalagun or Crab Creek. (LGDP 1998). The Minyirr Park area includes land currently vested in the Port and being considered by the WA State Government for inclusion in the NT agreement (See Section 6). It is understood that the ECCs and their boundaries identified on the Shire Town Planning Scheme No.4 will be reassessed in the forthcoming local planning strategy expected to be completed in late 2009.

Around Roebuck Bay, the use of buffer zones in adjacent developments should also be promoted in order to maintain the visual amenity of the Bay’s foreshores, to reduce the risks to people and property and to accommodate the vagaries from natural events. Whether termed ECCs or coastal protection zones, protective setback buffer zones around Roebuck Bay should be considered because of the potential for inundation from the impacts of severe weather events, particularly in light of changes in the climate.

Zoning is a flexible management tool that can accommodate evolving uses in and around Roebuck Bay. The timing and implementation, and the nature and extent of zoning should all be considered within the context of the other management strategies.

Strategy 7.7 Development of infrastructure and public facilities
This management response follows the assessment of the growing pressure from human impacts particularly on the coastal foreshores around Broome. The focus of this strategy is to consider the provision of signage and a range of possible public amenities as a method to draw people away from sensitive cultural and natural areas located in popular recreational hotspots such as Mangalagun (Creek), Entrance Point and Guwarri (Town Beach).

Public facilities and signs can attract and guide people to more appropriate areas to visit. The development of appropriately sited
roads and walk trails can funnel visitors to centralised areas, such as interpretive shade shelters, picnic areas and to toilet facilities, thus making on-ground management more efficient with less resources used. While attractive, well maintained facilities will tend to attract more visitors; strategically placed amenities would however help to reduce pressures on more sensitive areas and encourage visitors away from vulnerable areas. This has positive implications for the protection of cultural sites (e.g. middens), erosion control, litter reduction, reduced disturbance to roosting shorebirds, plant and habitat protection, and can reduce the human impacts on coastal resources such as mud crabs, oysters and bait fish.

The trends show that visitors often expect better public facilities like signage, toilets, shade and seating, drinking water, BBQs, information boards, rubbish bins, recycling provisions, car parks, boating launching facilities, camping grounds, established walking trails, roadside laybacks and coastal vantage points, camera viewing areas and bird hides. Visitors will be drawn to appropriately sited public facilities.

The planning and provision of public amenities around Roebuck Bay is also linked to:

- Water sourcing and disposal — public facilities usually require water and waste water services
- Well sited developments with a minimum footprint, located in areas that will reduce the possible impact on important habitats and local species
- Requirements for all developments to have all the required heritage clearances and approvals
- Increased visitor interest in Roebuck Bay, as access restrictions to Cable Beach for vehicle and commercial enterprises exert additional pressures on other areas of coast.

The consideration of public amenities such as signage, designated roads and walktrails, shade, toilets, drinking water and bird hides, for key areas and recreational hotspots around the Bay is recommended within eighteen months, as shown on the scale of manageability in Section 5. An overall land use plan, a site plan, and a signage plan for Roebuck Bay foreshore areas, should also underpin this consideration.

In order to reduce human pressure in areas highly impacted by visitors on the northern beaches, particularly Mangalagun (Crab Creek), the installation of directional signage should be possible within two years, as well as the provision of visitor information in advance of going onto Crab Creek Road from the Broome Road. More detail on recommended actions can be found in the implementation and action plan (Griffiths September 2009).

Within five years, the provision of further public facilities in the broader catchment needs to be assessed in relation to its potential to help contain human impacts on Roebuck Bay, considering facilities such as car parks, roads, and boat ramps.

Strategy 7.8 Research

Gathering baseline data and understanding its implications is vitally important for managing the Ramsar site, Roebuck Bay and its catchment. Much of the valuable information collected on shorebirds and their necessary habitat has resulted from the collaborative research efforts of community groups, national and international organisations, research scientists and special interest groups. Where possible, research should be multidisciplinary and participatory involving people with a range of skills, knowledge and experience ranging from for example, Traditional Owners, botanists, environmental and marine scientists, ecologists, planners, anthropologists, geologists, archaeologists, sociologists, coastal engineers, ornithologists, to naturalists and volunteers.

While significant research work has been undertaken over many years, particularly on migratory shorebirds and their habitat, there are critical components still to be understood, and benchmarks to be set by which the changes to the ecological character of Roebuck Bay can be measured. These gaps in knowledge and research needs were identified in the Ecological Character Description (Bennelongia 2009) and by the Department of Fisheries (DoF 2009) and are detailed in Section 5.

Existing research activity that provides important information to aid understanding of the Roebuck Bay system should be supported. Data from research undertaken in recent years, such as community monitoring of Lyngbya, seagrass beds, dugongs and turtle nesting, the Kimberley Inshore Dolphin Conservation Project, mud sampling at Crab Creek, and the study of biota, water quality, and shorebird disturbance should help guide and assist future management. This research should provide scientific information to complement traditional knowledge and local anecdotal evidence.

The timescale for the research strategy should continue long-term beyond 20 years. (See Figure 5.3.2).

Research will be needed to keep abreast of changes particularly to the physical environment, and to ensure the sustainability of the area’s key habitats and ecosystems. Importantly, monitoring and research will be needed to ensure any changes in the Ramsar site are within the acceptable limits. (More information on this is provided under Limits of Acceptable Change in Section 3).

Management actions will need revision and new strategies devised in response to ongoing findings from research and monitoring.

Strategy 7.9 Enforcement

Compelling people to abide by legislation or imposing penalties or fines is needed on occasions, or required in specific situations — to ensure visitor safety, to protect significant sites and vulnerable species, and to act as a deterrent. However, management strategy enforcement is often costly, complex and less effective in the longer term. Enforcement also tends to alienate people from the environment and the authorities.
With the growth of visitation to ‘untouched’ areas and the increased interest in adventure, wilderness eco and cultural tourism has come the need for trained identifiable Aboriginal personnel to control and monitor the activities of people using the coast. Aboriginal Rangers, as well as Shire of Broome Honorary Rangers could be utilised to provide a softly-softly approach to enforcement by patrolling the Roebuck Bay area. The involvement of the general public with an eyes-on-the-ground approach to monitoring should also be encouraged, for example through a Friends of Roebuck Bay group.

It could be expected that Rangers both on land and on the Bay, would spend a fair part of their time assisting visitors and protecting the coastal reserves and resources from careless or inappropriate use. Patrols of the popular recreation areas and beaches around the Bay, and carrying out professional tasks like administering first aid or directing people to water or facilities will basically contribute to public safety and visitor enjoyment as well as assisting in the protection of Roebuck Bay by reducing human pressures and mitigating threats.

With enforcement come the possibility of physical and verbal confrontation from disgruntled people, and the ability to respond swiftly and appropriately is often accentuated by the remoteness of the coastal areas. In the short term, consideration should be given to the development of Ranger positions to include training to deal with this risk, i.e. conflict resolution and positive management techniques, as well as developing clear policy and operational procedures to guide Rangers in their work, roles and responsibilities, and to secure the appropriate back-up when needed from say Police, Shire Rangers, or Fisheries inspectors. Enforcement will also require increased numbers of rangers to patrol together around the coastal areas in order to meet occupational safety requirements.

It is hoped that minimal enforcement will be necessary once key stakeholders for Roebuck Bay have given the community sufficient and positive information about the Bay’s values and appropriate behaviours to protect those values, and have ensured that prior information on the consequences of disregarding regulations and laws have been effectively communicated.

The aim of the strategies above and the actions that flow from them, is to eliminate, reduce, or mitigate against the threats and pressures on Roebuck Bay, and thereby to achieve progress toward meeting the management objectives and the vision set down in Section 2.

The eight key objectives cannot however be achieved in isolation from other statutory and non-statutory management measures both from within and external to, Roebuck Bay.

The management of the Ramsar site, and indeed the whole Bay, must be seen as part of a complementary suite of management practices that includes the management of adjacent town site areas, fisheries management, wildlife protection, water quality monitoring, environmental impact assessments, cultural heritage clearances, maritime transport and safety measures, as well as community cooperation and participation.

The status of the preliminary draft management plan is outlined.

Recommended actions to implement the preliminary draft management plan are given. This includes as a priority, consultation with Yaawuru Native Title Holders and other key stakeholders. Also that coordination of the plan’s implementation be undertaken by the Roebuck Bay Working Group (RBWG), as well as ensuring regular monitoring and review of the management plan and its strategies and actions.

Stakeholders are reminded to utilise the existing RBWG planning documents from which the preliminary draft has originated in order to effectively put into action the first stage of management planning, working initially from the existing Crab Creek Implementation and Action Plan.

Implementation action includes reviewing the current priorities and resource situation particularly when changes to the operational environment are known. Measurable targets and timelines will need to be set for objectives and actions, and agreement sought on who will carry out the actions and when.

The need for baseline information on key aspects of the Bay is stated, to enable the setting of bench marks and realistic targets and for effective monitoring, and to meet national and international obligations for the Ramsar site. It notes that realistically it could take years to gather all the information.

A twice yearly review of the strategies and actions by the RBWG is recommended, to monitor the plan’s progress and timing this to link findings into resource opportunities. Time frames for the review of the whole management plan and to meet the Ramsar requirements is discussed.
IMPLEMENTING THE MANAGEMENT PLAN

A preliminary draft management plan for the Roebuck Bay Ramsar site is the output required in the first stage of a two stage management planning process. It is prepared for comment by members of the Roebuck Bay Working Group (RBWG) after revision following a peer review undertaken by the RBWG Steering Committee in November 2009.

The focus of a second stage which is outside the brief for this current work is to undertake a consultation process and a public comment period. Then to consider the results from that process to finalise the management plan for Roebuck Bay. Resources for the second stage have yet to be secured.

For implementation to be successful, high priority must be given to consultation with the Yawuru people (the Traditional Owners), and other key stakeholders such as the Department of Environment and Conservation (DEC) and the Shire of Broome.

8.1 Status of the preliminary draft plan

While the preliminary draft plan for the RBWG has no specific statutory basis, (see Section 6), when adopted by the RBWG, the plan (that represents the findings from community-driven and values based management planning carried out over the past five years) will provide stakeholders with sufficient information and identified actions to enable them to move forward in conserving the cultural and ecological values of Roebuck Bay.

8.2 Implementing the preliminary draft

Firstly, the preliminary draft must be discussed with the relevant land and sea owners and managers such as Yawuru Native Title holders, and other key stakeholder such as the Department of Environment and Conservation and other WA State Government entities, and the Shire of Broome.

Extensive consultation and management planning work has already been done by RBWG and others. This includes, in the last two years, the preliminary draft plan, the public release of the Interim Management Guidelines (IMGs), the Ecological Character Description for Roebuck Bay (the ECD), a Draft Management Plan for Crab Creek, and the Crab Creek Management Plan Implementation and Action Plan — draft. These documents together have sufficient information to direct the management effort in the interim until a final Roebuck Bay Management Plan is available.

This preliminary draft plan, informed by the main working documents above, should be used by RBWG to guide stakeholders in managing Roebuck Bay and through this the Ramsar site.

How to proceed

The implementation of this preliminary draft plan requires RBWG to:

- consult with the land owners and managers
8.2.1 Coordination

It is recommended that the RBWG be utilised as the coordination point for ensuring the membership is kept up to date on the progress of the implementation of the plan. This coordination role should include the oversight of agreed actions, progress on agreed tasks and regular reporting to the RBWG members.

The membership of the working group should also bring relevant and new information about Roebuck Bay and the Ramsar site to the RBWG meetings, and use the meetings to notify stakeholders of any opportunities or constraints that may affect management of the Bay, e.g. financial resources, on-ground labour, research opportunities and volunteer involvement.

It is at the RBWG meetings where stakeholders can discuss what the challenges are, and consider the environment in which they must operate. Stakeholders can collectively decide how best to work within these constraints and to maximise opportunities that will more effectively coordinate the local effort to manage the pressures that threaten Roebuck Bay’s cultural and natural values.

This collaborative approach would provide a transparent process and hold agencies, groups and individuals to account to the wider community, and indeed meet their local, regional, national, and international obligations for Roebuck Bay.

At the time of writing this preliminary draft plan, the future tenure and management roles and responsibilities for Roebuck Bay and its Ramsar site are not publicly known. It is recommended however that the collaborative approach RBWG has successfully established be maintained.

It is the ‘whole of community’ approach and the ability for the RBWG to coordinate that may well drive the effective management of Roebuck Bay into the future. The RBWG should act as the overseer for the management plan, at least in the interim period until tenure around Roebuck Bay is finalised and the roles and responsibilities are clear.

8.2.2 Action Planning for the Ramsar site

Actions for managing Roebuck Bay originated from the Interim Management Guidelines (IMGs) detailed in Section 2. Management strategies and effective actions were proposed following assessment of the management themes in the Crab Creek planning work. This resulted in the Crab Creek Management Plan Implementation and Action Plan - Draft, produced for the RBWG (Griffiths S., September 2009).

It is suggested that the forementioned Implementation and Action Plan - Draft, be revised as the basis for an Action Plan for the wider Roebuck Bay area. Mangalagun (Crab Creek) and the Ramsar site are all interlinked having Roebuck Bay and its catchment in common. Therefore this preliminary plan should be read and considered in conjunction with the previous work undertaken for the RBWG.

To devise a workable plan of action for the Roebuck Bay Ramsar wetland, the first step is to engage the key stakeholders in consultation, to gain agreement on process, and to seek relevant information about such things as possible resources, or any changes that are on the horizon that have ramifications for the management of Roebuck Bay.

A revised Implementation and Action Plan should set down the strategies and actions to deal with the pressures and impacts that endanger the Ramsar wetland’s ecological character and cultural values.

This may be achieved by first considering the objectives and setting targets, that is, turning them into measurable objectives. Then within each of the management strategies set down in Section 7, the RBWG should identify key actions, targets and time frames (indicators of progress and success), and reach agreement on who will take responsibility for specific tasks. This work of turning management plans into actions that can be measured that began through the Crab Creek planning project will also need revision once tenure and management issues are finalised and the roles and responsibilities clarified.

In order to develop an Action Plan for the Roebuck Bay Ramsar wetland, identifying the current priorities and establishing targets and indicative time lines will be needed.

8.2.3 Priorities

RBWG is well placed with such a broad and representative membership to identify current management priorities and to plan for the foreseeable future. These priorities should meet the objectives set down in Section 2, to work towards protecting the cultural and natural values of Roebuck Bay, but also help to meet Australia’s obligations to maintain the ecological character of the Ramsar wetland within it.
Benchmarks and targets
As highlighted in the ECD for Roebuck Bay (Bennelongia 2009, p.105), to ensure that the key values of the Ramsar wetland are maintained, management plans will require baseline or benchmark conditions to be set, against which changes can be assessed. Variations both over time and in the extent of change, as discussed in the ECD on pages 105-107, will need to be taken into account in setting benchmarks.

It is essential to get key baseline information in the areas where this is lacking, in order to effectively monitor the health of Roebuck Bay’s Ramsar listed wetland. However, as stated in Bennelongia on page 106,

In theory, limits should be set that cover most components (e.g. species abundance and diversity, water quality etc) and processes (e.g. primary production, carbon cycling) of the ecosystem. In reality, it is often more effective to set limits that address specific management objectives, can be readily measured and are not unduly expensive to monitor. Therefore, in establishing limits of acceptable change for the Roebuck Bay Ramsar site, the current study [the ECD] focused on those components and processes that are:
• Key Ramsar values of the site
• The primary determinants of ecological character
• Easy to monitor.

This quote highlights the fact that it is not a short term or easy task to set all the baselines for the Roebuck Bay Ramsar wetland. For some key aspects it will take many years.

A useful starting point for defining the Limits of Acceptable Change (LAC) for the environmental characteristics of the Ramsar site is to be found in the ECD (Bennelongia 2009). A summary of those LACs, from Table 22, p108 is provided in the attachments. Other benchmarks will be needed for other values of the Ramsar site. When these benchmarks are known and the threats and pressures considered, this will drive the priorities for management of the Ramsar site.

Along with developing measures for the stated objectives in Section 2, the setting of targets or key performance indicators associated with the strategies and actions is an important task if the plan is to be effectively monitored.

Some basic targets for actions which focused on local management effort have already been identified for part of the Ramsar site. They are presented in Section 7 of the Crab Creek Management Plan Implementation and Action Plan – draft. (Griffiths & Associates, 2009)

8.2.4 Resources
Identifying the resources needed and the likelihood of securing them is a responsibility shared by members of the RBWG. It is encompassed in the stated aims of the working group i.e. to advance and advocate integrated management planning and to advance initiatives to produce a community based management plan. The majority of members are well positioned to identify and secure the various resources that will be needed for managing the Bay according to the agreed plan.

In order to maximise resource opportunities, the review and revision of the management plan and its strategies and actions, is best timed to link in where possible, with forward plans and budgets of the key management agencies, and the likely funding bodies.

The RBWG’s role is also well established to undertake the coordination and advocacy needed to ensure the management plan is implemented. However additional resources will be needed. In particular human resources will be required to enable the RBWG to carry out this coordination role, in order to maintain a collaborative process, to ensure RBWG’s availability to stakeholders and the general public, and to provide timely response to enquiries relating to the management of Roebuck Bay.

8.2.5 Monitoring and evaluation
Effective monitoring and evaluation are vital processes to ensure adaptive management.

While Australia is obligated to ensure changes impacting on Ramsar sites are kept within acceptable limits as outlined in Section 3, some essential benchmarks are not yet available. It is however possible and important, to set measurable objectives and targets associated with the actions to enable effective monitoring.

Three tasks need to be undertaken by RBWG:
– Actively seek and promote research on those prime areas where baseline information is lacking on Roebuck Bay
– Reach agreement on how the draft management plan and the Action Plan will be monitored and the results evaluated, and by whom
– Regularly evaluate and revise the management plan and the Action Plan flowing from it, based on new information and being mindful of the operational environment in which management will be undertaken e.g. the political climate and resource opportunities.

A useful starting point for defining the acceptable limits (LAC) for the environmental characteristics of the Roebuck Bay Ramsar wetland can be found in the ECD (Bennelongia 2009, p.108, Table 22). Other LAC will need to be defined for other values of the site.

Table 24 of the ECD (Bennelongia 2009, p113) – which can be found in Section 10 Attachments— summarises the monitoring and research needed. It identifies the key environmental components and processes that will require monitoring to meet the Ramsar obligations and shows the research needed to fill the gaps in knowledge that is required to establish a sound monitoring program. In summary, those components or processes identified included hydrology, water quality, Lyngbya and fish, as well as the stated priorities: sediments structure and nutrient content; benthic plants; littoral vegetation; benthic invertebrates and shorebirds.

Bennelongia (2009) goes on to recommend again on page 113, that a minimum 4 years of baseline data should be collected ‘to help identify which parts of the Bay are most in need of management intervention and where management intervention is likely to be of most benefit’. 
Monitoring the management strategies and actions

Twice yearly, the RBWG at the ordinary meeting should monitor the implementation of the Action Plan and consider progress and results. Effective monitoring and revision of management strategies and actions, using a process of adaptive management, will enable stakeholders to be more aware of any changes or possible threats that may result in the Ramsar site falling below its Limits of Acceptable Change, as explained in Section 3.3.

Reviewing and revising the management plan

Under the Ramsar requirements, the management plan needs to be reviewed within a seven year period. It is vital that dates for reviewing the preliminary draft management plan for Roebuck Bay’s Ramsar site are set and adhered to, for an adaptive management process to function effectively. New priorities often arise when greater pressures than were foreseen occur, e.g. oil spill or the appearance of new invasive pests. Conversely, new opportunities for funding or resource allocations may arise. Increased pressures, the changes in the operating environment and resource availability are all factors that need to be responded to and harnessed in order to maximise the effectiveness of management. Such factors in the operating environment will of course influence the strategies to be adopted and the priorities for action.

By adopting the recommended biannual reviews of the Action Plan and with information to inform management planning being gathered and considered by the RBWG at six-monthly intervals, the process of reviewing the management plan should not be onerous. Indeed, this preliminary draft management plan for the Roebuck Bay Ramsar site is a ‘work in progress’ and can effectively be revised by the membership of the RBWG.

8.3 Conclusion

A collaborative effort is needed to identify the achievable priorities and actions and to secure sufficient resources to implement the plan. To date, two areas of Roebuck Bay have been studied in the Working Group’s process of planning for management — Mangalagun (Crab Creek) and the Ramsar site. Much of what has been learnt through this work can be considered in relation to the other areas around Roebuck Bay: the values, the threats and pressures, and indeed the management responses to these, the strategies and actions, may well apply to other locations.

The RBWG, representing the stakeholders in Roebuck Bay, has the skills and capacity to identify the priorities and to implement and monitor the planned strategies and actions in order to conserve the natural and cultural values of Roebuck Bay, and thereby protect the ecological character of the Ramsar site.

With or without enabling legislation, maintaining a community approach to coastal management, underpinned by values based planning, will move people closer toward the vision held for Roebuck Bay.

REFERENCES

- References
- Glossary
REFERENCES


Department of Conservation and Land Management (N.D.) The Best of the Northwest - Landscape special edition (CALMA).


Department of Fisheries (2008), North Coast Bioregion State of the Fisheries Report 2007/08.

Department of Fisheries, Perth WA.

Department of Fisheries (2009), Coastal and Marine Resource Condition Monitoring - Scoping Project, May 2009. Perth WA.


ENK (2009a), Environments Kimberley, Media Release - Oil and Gas Industry - ‘Oil spill should never have happened’ and ‘The only guaranteed safeguards are large marine reserves’ 29 October 2009


Lands M. & Mann M., (1990), Yawuru Seasons, unpublished manuscript. Developed as a learning kit for Nulungu School.


REFERENCES


Rogers, Piersma, Lavaliye, Pearson, Goel, (2003), Life along Lands Edge–wildlife on the shores of Roebuck Bay Broome Dept of Conservation and Land Management


Sickert S., (2003), Beyond the lattice, Broome’s early spaces. Fremantle Press WA.


Tourism Western Australia (2008), Australia’s North West Fact Sheet Year Ending December 2008.


Vernes T, McKenzie N & Mann M., (2005), Roebuck Bay: It’s a Values Thing. Paper presented to WA State Coastal Conference - Coastal Solutions: Balancing the waves of change, Busselton, November 2005


Willing Tim, (2008), Crab Creek Vegetation Communities, unpublished notes on the Mangalangun area for Sharon Griffiths and Associates.


References to personal communication


Dr Deborah Thiele, Marepa Pty Ltd pers.com., email 7 August 09.

Dr John Curran, Veterinary Officer, Australian Quarantine and Inspection Service (AQIS) pers. comm.,

August 2009.


Other information


www.eafllyway.net EAA Flyway [11 April 09]


www.stopthetoad.org.au Stop the Toad (2009), [accessed 19 August 2009]


## GLOSSARY

**Aboriginal**  
Aboriginal rather than Indigenous is used in this plan when referring to the Traditional Owners and indigenous people from the Broome area. This is the preferred use nominated by the Yawuru Native Title Holders Aboriginal Corporation.

**Benthic**  
relating to or characteristic of the bottom of a sea, lake, or deep river, or the animals and plants that live there.

**Benthos**  
animals and plants that live on/in the sediment at the bottom of the Bay.

**Canning Basin**  
a geological basin in WA covering 506,000 sq km.

**Contiguous**  
very close or connected in space or time.

**Community**  
in this plan it refers to the broader resident community of Broome for example local agency personnel, key stakeholders, Traditional Owners, government officers, fishers, business owners, commercial operators and key stakeholders.

**Cretaceous**  
a geological system and time 144 million to 65 million years ago, during which the dinosaurs became extinct, layers of chalk were laid down, and flowering plants arose (adapted from the Encarta Dictionary).

**Ecological character**  
"the combination of the ecosystem components, processes and benefits/services that characterise the wetland at a given point in time". Defined under the Ramsar Convention (2005).

**Flyway**  
the concept of a flyway, as it is now widely used, is "based mainly on the migratory behaviour of waterbirds such as geese, ducks and shorebirds; many of these species migrate along rather well defined routes and have for decades used the same wetlands as stop-over and wintering sites". (Adapted from "Tattler").

**Invertebrate**  
animals without backbones or a spinal column, e.g. worms.

**Leveraging**  
in this plan it means to use the collective ‘power’ of the RBWG to gain advantage, or to seek a means to an end.

**Mankala**  
one of six local seasons known to Yawuru as the rainy season that occurs approximately between December and March.

**Pindan**  
in current usage pindan refers to both (a) the dominant soil type (red earthy sands, and/or (b) the vegetation type it supports. (Willing 2008).

**Rubibi**  
term used for the Rubibi Working Group, an umbrella organisation that represented the Aboriginal people of Broome.

**Trophic level**  
in ecology, it describes the position that an organism occupies in a food chain; what an organism eats and, what eats the organism. (Adapted from www.en.wikipedia.org/wiki/Trophic_Level).

**Theme**  
in this plan a theme refers to a grouping of management matters or subjects.

**Visitor**  
visitor refers in this plan, to any person coming to the study area, except those who reside within it.
• Information Sheet on Ramsar Wetlands (RIS)
• Monitoring and Research Summary
• Limits of Acceptable Change for Roebuck Bay
• Roebuck Bay Key Values and Management Issues – September 2009
• Framework for Assessment
**Attachment 10.1**

The Ramsar Information Sheet (RIS) below is for the Roebuck Bay wetland site updated in 2003 by the Dept of Conservation and Land Management (CALM). Recently the RIS has been revised during the development of the Ecological Character Description for Roebuck Bay, Bencelongo, (2009).

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**Information Sheet on Ramsar Wetlands (RIS)**

*Criteria approved by Resolution 6.11, as amended by Resolution V:8 of the Conference of the Contracting Parties.*

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<td>Tim Willing, Conservation Officer, CALM, with assistance from:</td>
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<td>Chris Hassell, Broome Bird Observatory, Dungeness, Charles Sturt University, and Doug Watkins, Shorebird Flyway Officer, Wetlands International - Oceania.</td>
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<td>All inquiries should be directed to Tim Willing, DCLM, 14 Queen Street, Busselton WA 6280, Australia, (Tel: +61-9-9752-1677; Fax: +61-9-9752-1432; email: <a href="mailto:timj@calm.wa.gov.au">timj@calm.wa.gov.au</a>).</td>
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<tr>
<td>3. Country:</td>
<td>Australia</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Name of the Ramsar site:</td>
<td>Roebuck Bay, Western Australia</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Map of site included:</td>
<td>Refer to Annex III of the Explaining Notes and Guidelines, for detailed guidance on provision of suitable maps.</td>
</tr>
<tr>
<td>a) hard copy (required for inclusion of site in the Ramsar List)</td>
<td>yes</td>
</tr>
<tr>
<td>b) digital (electronic) format (optionally)</td>
<td>yes</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Geographical coordinates (latitude/longitude):</td>
<td></td>
</tr>
<tr>
<td>Latitude: (approx.)</td>
<td>13° 08' S to 18° 18' S</td>
</tr>
<tr>
<td>Longitude: (approx.)</td>
<td>122° 08' E to 122° 27' E</td>
</tr>
<tr>
<td></td>
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<tr>
<td>7. General location:</td>
<td></td>
</tr>
<tr>
<td>Includes in which part of the country and which large administrative region(s), and the location of the nearest large towns:</td>
<td></td>
</tr>
<tr>
<td>Roebuck Bay is located in the Shire of Broomy (local authority) in the State of Western Australia (population ca. 1,955 million in 2003); Roebuck Bay extends from Freeburn's Bend, immediately east of the town of Broome (population ca. 13,500 in 2001), to south of Sandy Point.</td>
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<tr>
<td>8. Elevation: (average and/or max. &amp; min.)</td>
<td></td>
</tr>
<tr>
<td>Sea level</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>119 ha</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Area: (in hectares)</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>119 ha</td>
</tr>
<tr>
<td></td>
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<tr>
<td>10. Overview:</td>
<td>Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.</td>
</tr>
<tr>
<td>Roebuck Bay is a tropical marine embayment with extensive, highly biologically diverse, intertidal mudflats. The site is internationally important for at least 20 species of migratory shorebirds with total numbers of waders using the site each year estimated at over 300,000. This makes Roebuck Bay one of the most important sites for shorebird conservation in the East Asian-Australasian Flyway.</td>
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<tr>
<td>11. Ramsar Criteria:</td>
<td></td>
</tr>
<tr>
<td>Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the Explaining Notes and Guidelines for the Criteria and guidelines for their application (adapted by Resolution VII:11).</td>
<td></td>
</tr>
</tbody>
</table>
The Criteria under which Roebuck Bay was originally nominated as a Ramsar Site were:

1. It contains a representative, rare or unique example of a natural or near-natural wetland type within the appropriate biogeographic region.
2. It supports vulnerable, endangered or critically endangered species or threatened ecological communities.
3. It supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.
4. It supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.
5. It regularly supports 20,000 or more waterbirds.
6. It regularly supports 1% of the individuals in a population of one species or a subspecies of waterbird.
7. It supports a significant proportion of indigenous fish subspecies, species or families, life history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contribute to global biological diversity.
8. It is an important food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

12. Justification for the application of each Criterion listed in 11. above:

1. The Site is a superb example of a tropical marine environment, and is one of only a dozen intertidal flats worldwide where benthic food sources support large numbers of waders.

2. Forage fish species include: Large Sand Plover (Charadrius ambustus), Oriental Plover (C. veredus), Mongolian Plover (C. mongolus), Red-capped Plover (C. ruficollis) (resident), Grey Plover (Pluvialis squatarola) and Bar-tailed Godwit (Limosa lapponica). Black-backed Stilt (Himantopus himantopus), Red Knot (Calidris canutus), Great Knot (C. tenuirostris), Red-necked Stilt (C. ruficollis) (resident), Curlew Sandpiper (Calidris ferruginea), Sanderling (C. alba) and Knot (C. canutus).

3. The Site regularly supports more than 1% of the population of at least 22 waterbird species (20 migratory and 2 resident species): Large Sand Plover (Charadrius ambustus), Oriental Plover (C. veredus), Mongolian Plover (C. mongolus), Red-capped Plover (C. ruficollis) (resident), Grey Plover (Pluvialis squatarola) and Bar-tailed Godwit (Limosa lapponica). Black-backed Stilt (Himantopus himantopus), Red Knot (Calidris canutus), Great Knot (C. tenuirostris), Red-necked Stilt (C. ruficollis) (resident), Curlew Sandpiper (Calidris ferruginea), Sanderling (C. alba) and Knot (C. canutus).
16. Hydrological values:
Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

17. Wetland Types
a) presence:
Circle or underline the applicable codes for the wetland types of the Ramsar “Classification System for Wetland Types” present in the Ramsar site. Descriptions of each wetland type code are provided in Annex 1 of the Explanatory Note & Guidelines.

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Z(a)
Inland: L • M • N • O • P • Q • R • S • Sp • Se • Tp • Ts • U • Va • W • Xa • Xp • Y • Zg • Zk(b)
Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

b) dominance:
List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

G, I, B

18. General ecological features:
Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site.

The site is one of the most important migration stopover areas for shorebirds in Australia and globally. Roebuck Bay is the arrival and departure point for large proportions of the Australian populations of several shorebird species (notably Bar-tailed Godwit Limosa lapponica), some of which fly non-stop between continental East Asia and Australia. Roebuck Bay is a rich wader feeding ground, supporting an exceptionally high (globally) macro-invertebrate biomass, including many species believed now to science (G. Pearson, pers. comm.). The Bay is also a major nursery area for marine fishes and crustaceans. Plant (and animal) formations: Low closed/forest to open-scrub (mangrove) in perform arrangement in the east and south of the Bay; low shrubland (samaritans) inland of the mangroves. Surrounding areas support low open-woodland (pindan) over grassland.

North-western Australia is the most important region for migratory waders on the continent, regularly supporting over 500,000 birds, with up to 85,000 birds using it annually. This region is considered to be the arrival and departure point for large proportions of the Australian populations of several migratory shorebird species. The major sites in the region are Eighty Mile Beach (also a Ramsar Site) and Roebuck Bay.

The largest number of waders counted at Roebuck Bay is 170,000 in October 1983 and it regularly supports over 100,000 birds. Based on this data, it is one of the most important wader site in Australia in terms of absolute numbers and the most important in terms of the number of species it supports in internationally significant numbers (Rogers per comm., 2002). Shorebird numbers are highest in the austral spring when Palaearctic migrants stop here to feed on their southward migration. The area also supports about 30,000 birds during winter, at a time of year when few adults of breeding age remain in Australia, and considerably larger numbers over summer, because many migrating birds remain in northern Australia rather than continue south (Munro et al. In press). Fewer birds stop on the north-western coast to feed on the northwards migration but, nevertheless, numbers in autumn are very high.

19. Noteworthy flora:
Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12: justification for the application of the Criteria) indicating, eg., which species (communities) are unique, rare, endangered or biogeographically important, etc. Do not include here taxonomic lists of species present - these may be supplied as supplementary information in the IIS.

Seagrass Beds: Extensive seagrass beds occur Roebuck Bay and are dominated by Halodule uninervis and Halodule wrightii (Prince 1986). The most vigorous stands grow in areas that are exposed for less than two hours at low tide. These meadows are important feeding grounds for Dugong and Green Turtle (Chelonia mydas).

Mangroves: Broome is situated in the south-west Kimberley mangrove region (Johnstone 1990). This region runs from Cape Leveque, near the northern tip of the Dampier Peninsula, south to Whistle Creek, at the northern end of Eighty Mile Beach. Eleven mangrove species are known to occur in Roebuck Bay (Semeniuk et al. 1978). Within Roebuck Bay, Johnstone (1990) divides the mangroves into a northern and southern section.

The northern section is estimated to cover 640 ha and consists of a low open to closed forest of Avicennia marina, Aegiceras corniculatum, Bruguiera sexangula and Excoecaria agallocha with some Avicennia marina understorey. The common species on the landward and seaward edge of the mangroves is Avicennia marina. Scattered shrubs and trees of Excoecaria agallocha occur on the outer fringe.

The 200 ha Tanjung section is described as mixed woodland (to 5 m) of Avicennia marina, Brugia sexangula, Ochroma latifolia and Campsispraecox. Ceriopstagal is common as closed thickets on the landward zone with some Excoecaria agallocha (Johnstone 1990).

The mangroves have highest species diversity and tallest trees in Dampier and Crab Creeks and in Yardeegarra Creek, the inlet between Bush Point and Sandy Point. In these areas there is distinct zonation of the mangroves. The typical sequence of species in landward direction is Avicennia, Rhizophora, Ceriops and samphire or salt flats (Chalmers and Woods 1987).

Landward of the mangroves are areas of bare flats that are inundated on high spring tides. The hyper-salinity of the soil in these areas inhibits the establishment of vegetation.

Sapphire flats: Sapphire also occurs landward from the edge of the mangroves. The dominant species are in this community area: Vachellia bicolor, Panicum microcarpum, Oenothera longifolia and Mimosa scabrella. These flats may be inundated by some high tides.

Saline grasslands: The saline grass plains are slightly higher in elevation than the saltmarsh flats and the soil has a lower salinity. The dominant species is Saltmarsh Couch Sporobulus virginicus, which forms a dense grassland 15-20 cm tall. Other species are Dracunculus vulgaris, Eriogonum foliosum and Salicornia. Towards the edge of the grass plains, at the interface with pindan soils, occur thickets of Melaleuca axillaris, which grow to 10 m in height.

Pindan: Pindan is the name given to the open woodland, which occurs inland from the low cliffs between Fisherman’s Bight and Crab Creek. The main tree species are: Eucalyptus dumosa, Eucalyptus ferruginea, Eucalyptus gummifera, Gomphocarpus fruticosus, Lophostemon confertifolius, Lophostemon curtivolvulus, Vitex orbiculata, Ptelea javanica, Hakea marnieriana, Hakea microcarpa, Peronaea yateyana, Allocasuarina luehmanniana and Grevillea phoenicea. The main shrub species are: Acacia vieri, Acacia rubida, Acacia solida, Acacia sieberi, Parrya kerrii, Corymbia latissima, Dillwynia stipulosa, Eucalyptus calophylla and Xanthorrhoea camaculata (Kennedy et al. 1996).

20. Noteworthy fauna:
Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12: justification for the application of the Criteria) indicating, eg., which species (communities) are unique, rare, endangered or biogeographically important, etc., including count data. Do not include here taxonomic lists of species present - these may be supplied as supplementary information in the IIS.
Waterbirds: Roebuck Bay supports internationally significant numbers of at least 22 wader species (20 migratory and 2 resident species), all of which occur in numbers well in excess of 1% of the flyway population (or Australian population, in the case of resident species). Highest counts for these species are:

<table>
<thead>
<tr>
<th>Species</th>
<th>Count</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Sand Plover</td>
<td>26,900</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Oriental Plover</td>
<td>8,700</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Mongolian Plover</td>
<td>1,067</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Red-capped Plover</td>
<td>3,300</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Grey Plover</td>
<td>1,300</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Bar-tailed Godwit</td>
<td>65,000</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Black-tailed Godwit</td>
<td>7,374</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Red knot</td>
<td>11,200</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Great Knot</td>
<td>22,600</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Red-necked Stint</td>
<td>19,800</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Curlew Sandpiper</td>
<td>6,000</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Sanderling</td>
<td>1,510</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Eastern Curlew</td>
<td>2,160</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Little Curlew</td>
<td>5,000</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Whimbrel</td>
<td>1,020</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Greenshank</td>
<td>1,000</td>
<td>(AWSG data)</td>
</tr>
<tr>
<td>Common Redshank</td>
<td>16 (C. Hassel, pers. comm.)</td>
<td></td>
</tr>
<tr>
<td>Grey-tailed Tattler</td>
<td>3,180</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Terek Sandpiper</td>
<td>1,000</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Ruddy Turnstone</td>
<td>2,060</td>
<td>(Watkins 1993a)</td>
</tr>
<tr>
<td>Asian Dowitcher</td>
<td>414 (Roger et al. 2000)</td>
<td></td>
</tr>
<tr>
<td>Pied Oystercatcher</td>
<td>150</td>
<td>(Watkins 1993a)</td>
</tr>
</tbody>
</table>

All of the migratory shorebirds are listed under the Japan – Australia Migratory Bird Agreement (JAMBA) and the China – Australia Migratory Bird Agreement (CARMABA) and are specially protected as matters of national environmental significance under the Commonwealth Environment Protection and Biodiversity Conservation Act (1999).

A total of 64 waterbird species have been recorded, including four ducks and cormorants, 11 herons and allies, 34 shorebirds and 11 gulls and terns (Broome Bird Observers, unpublished data). One or two Beach Thick-knee Esacus magnirostris occasionally occur in the vicinity of the Bay.

Waterbird Breeding: Four species found breeding in the vicinity of the Bay: Striated Heron Butorides striatus, Black-necked Stork Neochen philippinensis (sometimes breeds in taller mangroves south of Crib Creek), Oystercatcher Haematopus ostralegus, and Brahmyn Kite Haliastur indus (C. Hassel, pers. comm.). Black-winged Stilt Himantopus himantopus, Masked Lapwing Vanellus miles, Whimbrel Tringa incana, and Black Swan Cygnus atratus are known to nest at Kidneybean Clapton, in addition to several mangrove-specialised passerines in that habitat (D. Rogers, pers. comm.).

In November 1999, 29 Little Tern Sterna albifrons nests with one to three egg clutches were noted on the sand spit at the mouth of “Jack’s Creek”, just south of Yardogaarra Creek (G. Swann, pers. comm.). Nearby, Bush Point is an important roost for this species, with a flock of 1200 recorded there in April 1996 (Collins & Jessop 1997).

Shorebird Migration Stop-over: 36 migrant shorebird species occur, including vagrants and species recorded at Kidneybean Clapton such as Slinnske's Spit, Spotted Redshank, Long-tailed Stint, Pectoral Sandpiper, Rufie, Red-necked Plover and Little Ringed Plover (D. Rogers, pers. comm.). Roebuck Bay is a principal arrival site in August-October for large proportions of the Australian populations of many shorebird species, especially larger species that travel non-stop from China to Australia. There is high turnover due to shorebirds moving onwards (e.g. to southeastern Australia: some species arriving in Victoria within weeks) after feeding at the Bay to restore energy levels. However, very large numbers remain throughout summer and smaller numbers (mostly birds one to two years old) through winter. The area is also important (lower numbers) for northerly departures of waders. Massed daytime departures of shorebirds occur in March-April. Shorebird departures from the site have been successfully tracked by radar (Lane & Jessop 1985) and afternoon migration watches (e.g. Tulp et al. 1994, Hassell 2000). Most birds depart between 1600 and 1800 hours, just prior to darkness, flying north-northwest. Most birds migrate in single species flocks with an average flock size of <1000, though flocks of up to 200 are occasionally seen. Eastern Curlew, Greater Sand Plover and Great Knot are the first species to leave, commencing in the first week of March and mostly departing before the end of the month. Birds prefer to leave when tail winds are blowing at altitudes of 600-2,500 m (Minton et al., 2000).

Shorebird Banding: Banding of NW Australian shorebirds with a yellow plastic leg flag, attached to the right tibia, commenced in August 1992. This has greatly facilitated rapid visual recognition of birds captured in NW Australia as key stop-over sites and furnished valuable information in elucidating migration routes, with over 36,000 waders flagged (Minton & Jessop 1999). Lists of sightings away from flagging locations (including China, Korea and Russia) have been published at almost annual intervals in the journal Stilt.

Shorebird Species Ecology: Rogers (1999b) classified shorebirds (and others) in Roebuck Bay as belonging to seven guilds on the basis of prey choice and foraging method. In order of abundance, these are:

- tactile hunters of macrobenthos, feeding mainly in sea-edge flocks (Great Knot, Red Knot, Bar-tailed Godwit, Black-tailed Godwit, Asian Dowitcher);
- tactile hunters of microbenthos, feeding mainly along sandy sea-edges or near tidal creeks (Curlew Sandpiper, Red-necked Stint, Broad-billed Sandpiper, Marsh Sandpiper, Sharp-tailed Sandpiper);
- visual hunters of soft surface-dwelling prey, feeding mainly on reefs or mangrove fringes (Common Sandpiper, Sooty Oystercatcher, Pied Oystercatcher, Silver Gull, Ruddy Turnstone);
- visual hunters of small fast prey, mainly occurring in the sandier western parts of Roebuck Bay, often near-shore (Grey Plover, Red-capped Plover, Greater Sand Plover, Lesser Sand Plover, Grey-tailed Tattler, Terek Sandpiper);
- visual hunters of fast large prey, mostly favouring soft mudflats in N.E. Roebuck Bay (Eastern Curlew, Whimbrel, Greenshank, Striated Heron and Black-necked Stork);
- kleptoparasites (only Guil-billed Tern, which robs large crabs from Whimbrels);
- pugilistic hunters of nekton (animals of the pelagic zone) and invertebrates (animals that live on the surface film), mainly associated with crested stilts in eastern Roebuck Bay (Black-winged Stilt, Red-necked Avocet, Redf Egret, Little Egret, Great White Egret, White-faced Heron, Royal Spoonbill).

The majority of Little Curlew generally arrive at Broome in the third week of September, where birds utilise urban irrigated grassland such as sports ovals and Broome Golf Course. Departure on northward migration is more variable, usually commencing during the last week of March and extending to mid April (Collins and Jessop 2001).

Sand flaps between Dampier Creek and Fisherman Bend provide habitat for many sand-dwelling benthic animals and are an important feeding area for Terek Sandpipers. In 2000, sand flaps adjacent to Town Beach were found to be an important feeding area for both Lesser Sand Plovers and Red Knots, with high hivalse densities close inshore (D. Rogers, pers. comm.). Both these areas lie outside the Ramsar Site.
Roebuck Bay, in northern Western Australia, is a large bayside region and an important nursery area for marine fish and crustaceans. The bay is a significant habitat for benthic fauna, and the conservation of the region is important for the preservation of marine biodiversity.

**Conservation Act (1999)**: The conservation of Roebuck Bay is protected by the Conservation Act (1999), which recognizes the bay's ecological significance.

**Western Australian Museum**: The Western Australian Museum has collected information on the biology of Roebuck Bay, including the abundance of certain fish species.

**Benthic Fauna**: Studies on the benthic fauna of Roebuck Bay have been conducted by researchers associated with the Western Australian Museum, and the data collected has been used to inform conservation efforts.

**Fisheries Management**: The Fisheries Management Authority oversees the conservation and management of the fish species found in Roebuck Bay.

**Conservation Areas**: The conservation areas in Roebuck Bay are important for the protection of marine biodiversity and the preservation of the region's ecological integrity.
continue to make extensive use of the Bay's natural resources e.g. gathering shellfish, fishing and hunting dugong.

The pearling industry has been established at Broome since the 1880s, initially for mother-of-pearl, but since 1956 has focused on high value cultured pearls. Broome's pearling history has contributed greatly to its multicultural character, bringing together Aboriginal, European and Asian (notably Japanese, Chinese, Filipino and Malay) peoples. The principal cultural event in the Broome calendar is Shinju Matsuri (Festival of the Pearl), held in July-August.

Broome Bird Observatory near Fall Point was opened in 1988; it is operated by Birds Australia, has full-time wardens and is used as an educational, research and recreation facility focusing on Roebuck Bay and its environs.

Recreational fishing is important near Broome and the Fall Point coast and there are several boat-launching sites in both areas. Much of the shoreline along the eastern side of the Bay is inaccessible, other than by boat at high tide.

Low cliffs offer a panoramic view across the northern Bay and the contrast of pale blue sea, dark green mangroves and red cliffs is particularly appealing. The cliffs and Crab Creek area offer one of the best places in the world for viewing shorebirds, because of the unique combination of accessibility, high species richness, very high densities and numbers.

22. Land tenure/ownership:
(i) within the Ramsar site: The Government of Western Australia has control over marine areas of the site. A Native Title Claim, lodged over the Bay by Yawuru Aboriginal Corporation in 1994, awaits resolution. The landward sections of the site are Unallocated Crown Land, except for a small reserve gazetted for the purpose of a Bird Observatory.
(ii) in the surrounding area: Pastoral leases surround most of the Bay, excepting the northwestern end where the Broome townsite is located, and Fall Point, where the Broome Bird Observatory is located.

23. Current land (including water) use:
(a) within the Ramsar site: At present there is light recreational use of the northern part of Roebuck Bay, particularly fishing and bird watching. There is also commercial fishing, pearling and industrial use, with deepwater port facilities at Broome. Crude oil from the Bluna Oilfield, 30km north-east of Broome, is exported from Broome Port by tankers, which also deliver refined fuel products from Kwinana Refinery. Live cattle exports to Indonesia and the Philippines (74,000 head in 1995) are significant at Broome Port. Export permits for petroleum are held over the whole area and there is a mining tenement around the Bush Point area. There are several commercial pearl farm leases in the Bay.
(b) in the surroundings/catchments: Grazing of cattle occurs on pastoral leases (Roebuck Plains and Thangoo Stations). The Broome urban area (residential and industrial) is adjacent to the site, with high human population (13,500 in 2001, growing at 4-5%)

24. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:
(a) within the Ramsar site: Existing and foreseeable land uses are compatible with Roebuck Bay remaining an important site for waders. High tide wader roosts along much of the northern shore of the Bay are vulnerable to disturbance from off-road vehicles and pedestrian traffic. Careful management of increasing tourism is necessary to reduce disturbance at important roosts, especially on the accessible northern shore of the Bay.
(b) in the surrounding area: There is a proposal to construct a new international airport at a site 8 km north of the northern shore of Roebuck Bay and approximately 12 km NE of Broome. The Environmental Protection Authority has determined (EPA Bulletin 1017) that the proponent is obliged to prepare a Flora and Fauna Management Plan. The latter is to include a detailed assessment of the airport's impact on migratory waders.

Petroleum exploration may occur in future and, subject to appropriate environmental safeguards to maintain the ecological character of the wetland and habitat for waterbirds using it, will be compatible with the status of a Wetland of International Importance.

Proposed mining operations in the hinterlands behind the mangroves could result in de-watering of shallow surface aquifers, potentially affecting biodiversity values in the Bay. Similar impacts could occur from proposed intensive irrigated agriculture (e.g. for cotton) in the hinterland up to the southern part of the Bay. Industrial pollution and accidental sewage spills from the nearby township of Broome have the potential to adversely impact upon the benthic fauna, but the risks are reduced by the effect of strong tidal flushing.

The impact of commercial net fishing operations on the benthic fauna of the Bay and on indigenous fish harvests is not well understood (G. Pearson, DCLM, pers. comm.)

25. Conservation measures taken:
List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether any officially approved management plan exists and whether it is being implemented.

WWF together with the local Aboriginal group Rabbiti is implementing a shorebird conservation project involving community education and involvement in activities that will minimise the effects of human disturbance along the northern shores of Roebuck Bay. An ongoing community-based monitoring program of the benthic macrofauna has been undertaken since 1996. The site is listed on the Register of the National Estate.

Site management actions taken include:
- limiting vehicle access to beaches along the northern shore of the Bay;
- controlling human activity on the northern shore at high tide;
- developing a guided eco-tourism program by Broome Bird Observatory;
- developing an "Accident Response Plan" for the Port of Broome;
- promoting self-monitoring of dugong hunting by Aboriginal people;
- assessing full sustainability of fishing operations in the bay;
- assessing impact of hovercraft use on the intertidal flats.

26. Conservation measures proposed but not yet implemented:
E.g. management plan in preparation; official proposal as a highly protected area, etc.

There is a proposal to have a Marine Park declared in Roebuck Bay (Burbridge et al., 1991). A subsequent report (DCLM, 1994) recommended that the Marine Park boundaries should extend from the north side of Gantheaume Point to Cape Villiers, including coastal areas of pastoral lease, but excluding the jurisdiction of the Port of Broome.

Watkins (1993b) and Watkins et al. (1997) identified management issues for the site and the Department of Conservation and Land Management held preliminary discussions with the Shire of Broome in 2001 and community workshops in 2002 (Pearson, pers. comm.). Development and implementation of options for the future management of Roebuck Bay are dependent on extensive consultation with numerous community and Aboriginal stakeholders.

27. Current scientific research and facilities:
E.g. details of current research project; including biodiversity monitoring, existence of a field research station, etc.

Birds Australia (formerly the Royal Australasian Ornithologists' Union) operates an Observatory at the northern end of the wetland, which is staffed by full-time wardens and is used as an educational, recreational and research facility focussed on Roebuck Bay and its environs.
Boomee Bird Observatory and a local volunteer group undertake regular cannon netting and wader banding on a monthly basis. The Australasian Wader Studies Group conducts large scale banding of waders as part of regular expeditions at intervals of approximately 18 months to two years. These expeditions commenced in 1981. Many international participants have been involved, including Asian researchers (most sponsored by Environment Australia) seeking training in shorebird studies.

Several studies have focused on the behaviour and ecophysiology of migratory waders, including shorebird moor choice, heat avoidance behaviour and preparation for migration (Tulip and DeGroot 1994; Bartley 2000; Rogers 1999a, 1999b, 2000).

The Department of Conservation and Land Management (DCLM) in collaboration with the Royal Netherlands Institute for Sea Research (NIOZ), Curtin University of Technology, Washington Central University, the University of Western Australia, Western Australian Museum, and the Birds Australia Boomee Bird Observatory have undertaken extensive mapping of benthic invertebrate biodiversity in the mudflats of Roebuck Bay (Pepping et al. 1999; Piersma et al. 2002). The large spatial dataset generated by the research has been analysed and managed using innovative Geographic Information System (GIS) techniques (Hickey et al. 1998). The Netherlands Institute for Sea Research (NIOZ), in collaboration with DCLM, is supervising a postgraduate evaluation of the mudflats of Roebuck Bay.

Curtin University, in collaboration with DCLM, has two current postgraduate studies focused on Roebuck Bay – one on hydrology (Vogwill) and the other on the nature and distribution of sediments (Oldmadow).

Boomee Bird Observatory and EnviroKimberley, in collaboration with DCLM and NIOZ is conducting ongoing research into the sediments and benthos of the Bay with local community and Aboriginal support.

EnviroKimberley, Boomee Bird Observatory, DCLM, NIOZ, and Coastcare are preparing a photographic book on the ecology of the bay, due for release in late 2003.

28. Current conservation education:
   e.g. visits to local observation hides and nature trails, information booklet, facilities for school visits, etc.
   Boomee Bird Observatory has several walk-trails and interpretive displays, which are open to
   visitors. Telescopes can be hired and courses on the ecology of the Bay and its shorebirds are run
   periodically. Planning has commenced for a dedicated Visitor Centre to be constructed.

29. Current recreation and tourism:
   State if the wetland is used for recreation/educational; indicate type(s) and their frequency/intensity.
   Recreational use consists of fishing, crabbing, sightseeing and bird watching. One commercial
   hovercraft company has operated scenic tours in the Bay since 1990. There is also growing
   tourist use of the wetland, especially in the cooler months of the dry season (May to September).
   Boomee Airport recorded 195,000 passenger arrivals in 1999-2000.

30. Jurisdiction:
   Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept of Environment, etc.
   Government of Western Australia (territorial) and the Department of Conservation and Land Management (functional).

31. Management authority:
   Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for
   managing the wetland. Whenever possible provide also the title and/or name of the person in or person in this office
   with responsibility for the wetland.

Several State Government agencies are involved in management of the site. The key agency is the Department of Conservation and Land Management, because of the Ramsar Listing of the site.

The contact details for the management office are:

Department of Conservation and Land Management Broome Workcentre
PO Box 65, Broome, 6725, WESTERN AUSTRALIA.
Phone: +61 8 9192 1036 Fax: +61 8 9193 5027
E-mail: timwh@clm.wa.gov.au

32. Bibliographical references:
   Scientific/technical references only. If biogeographic regionalisation scheme applied (see 13 above), list full reference
   citation for the scheme.


Australian School of Environmental Studies, Griffith University, Brisbane.


Authority Bulletin 252.


Willing, T., Personal Communications, District Program Leader Nature Conservation, Broome District, Department of Conservation and Land Management.


Please return to *Ramsar Convention Bureau, Rue Maurice-28, CH-1196 Gland, Switzerland*

Telephone: +41 22 999 0170 • Fax: +41 22 999 0169 • e-mail: ramsar@ramsar.org

Table 22 Limits of acceptable change for Roebuck Bay (After Bennelongia, 2009).

<table>
<thead>
<tr>
<th>COMPONENT/PROCESS</th>
<th>KNOWLEDGE GAP</th>
<th>RECOMMENDED ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrology</td>
<td>Ground and surface water inflows to Roebuck Bay and the Ramsar site</td>
<td>Targeted study to construct water balance model.</td>
</tr>
<tr>
<td>Water Quality</td>
<td>Spatial and seasonal bioavailability of dissolved inorganic nutrients (NO₃, NH₄, PO₄), nutrient loads, residence times. Relative contribution of various point and diffuse sources to nutrient loads</td>
<td>Investigation into the actual and potential threat posed by nutrient enrichment. Determine likely 'hot spots' for eutrophication.</td>
</tr>
<tr>
<td>Sediments structure and nutrient content</td>
<td>Extent of change in sediment characteristics. Sediment nutrient stores (TOC, TN, TP), recycling and denitrification rates. Relative contribution of various point and diffuse sources to nutrient loads.</td>
<td>Penetranlity surveys Investigation into the threat posed by nutrient enrichment. Determine likely 'hot spots' for eutrophication.</td>
</tr>
<tr>
<td>Lyngbya</td>
<td>History, current extent, frequency, duration and distribution of blooms.</td>
<td>Mapping of extent, frequency and species composition.</td>
</tr>
<tr>
<td>Benthic plants</td>
<td>Current extent, biomass and health of seagrass and macroalgal communities.</td>
<td>Mapping (aerial) and condition assessment (on-ground). Build on existing monitoring program.</td>
</tr>
<tr>
<td>Litoral vegetation</td>
<td>Current extent, biomass and health of mangrove communities.</td>
<td>Mapping (aerial) and condition assessment (on-ground).</td>
</tr>
<tr>
<td>Benthic invertebrates</td>
<td>Monitoring at two locations over the past 10 years. The number of sites needs to be increased to 4 to develop a more robust data set.</td>
<td>Build on existing monitoring program but reduce sampling frequency to annual.</td>
</tr>
<tr>
<td>Fish</td>
<td>Insufficient information to set a baseline for most fish species. Unfortunately although CPUE is collected for commercial fish in Roebuck Bay (e.g. Threadfin Salmon, Barramundi) this information is not reported publicly and so cannot be used to establish baseline values</td>
<td>Surveys to establish baseline condition of high conservation value fish species.</td>
</tr>
<tr>
<td>Shorebirds</td>
<td>Monitor total waterbird numbers in the bay. Insufficient information to set a reliable baseline for most species. Extend surveys to provide species information.</td>
<td>Annual aerial monitoring count of the whole of Roebuck Bay. Annual monitoring ground count of species in 4 km section centred on Foil Point.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>BASELINE / SUPPORTING EVIDENCE</th>
<th>LIMIT OF ACCEPTABLE CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Quality – Nutrients</td>
<td>Insufficient data for most of the Bay with the exception of Dept of Fisheries monitoring at Broome Jetty. Guideline limits have been set by ANZEC/ARMCANZ (2000).</td>
<td>TN - median concentration &lt; 250 µg/L NO₃ - median concentration &lt; 30 µg/L NH₄ - median concentration &lt; 15 µg/L TP - median concentration &lt; 20 µg/L FRP - median concentration &lt; 5 µg/L</td>
</tr>
<tr>
<td>Sediment Structure</td>
<td>Penetration data from 2012.</td>
<td>Crab Creek &gt; 30 cm Fall Point &gt; 8 cm Dampier Creek &gt; 13 cm</td>
</tr>
<tr>
<td>Sediment Nutrients</td>
<td>TN and TP have been recorded around Town beach. Levels may be associated with anthropogenic factors.</td>
<td>Baseline must be identified before limits can be set.</td>
</tr>
<tr>
<td>Lyngbya</td>
<td>Lyngbya majauroi blooms first recorded in 2005 but link with anthropogenic factors is unknown.</td>
<td>Baseline data indicate sediment carbon content is correlated with invertebrate species numbers and other benthic biodiversity estimates. Insufficient information to set baseline.</td>
</tr>
<tr>
<td>Benthic Plants</td>
<td>Insufficient information to set baseline.</td>
<td>Seagrass loss &gt; 5%. (allow 3 years after cyclone for re-establishment), inter estuary guidance only.</td>
</tr>
<tr>
<td>Mangal</td>
<td>Current extent of mangal communities is 47 km². It is proposed that 5% reduction represents the limit of acceptable change, although the loss associated with cyclones is unknown and proposed limit will need to be revised as further data are collected.</td>
<td>Mangal – spatial extend through the Ramsar site &gt; 44 km².</td>
</tr>
</tbody>
</table>

**KEY SPECIES AND COMMUNITIES**

- Invertebrates: Based on monitoring of de Goeldl (2006), results per sample from a station. Data are available but not currently worked up in this format.
- Shorebirds: Existing total counts of waterbirds in late spring/summer in Roebuck Bay used to set limits (most of the waterbirds present are shorebirds).
Roebuck Bay
Key Values & Management Issues - September 2009

In preparing for the future management of the Ramsar site, it is important to identify both the key values of the Roebuck Bay area and the issues to be faced in conserving those values.

Since 2006, when the initial Issues Paper was developed for the RBWG (Community Solutions 2006), new issues have emerged and the priority of other issues has changed. These changes relate to the:

- increased shipping movements and development of Port of Broome activities in relation to the oil and gas industry, in particular as a supply base for the Browse Basin operations;
- proposal for a Marine Park or reserve in Roebuck Bay;
- the imminent resolution of Native Title agreements in relation to land and sea in and around Broome;
- implications and risks associated with climate change for Broome and surrounds;
- discovery of new information on species e.g. snubfin dolphin, new bla ca;
- increased occurrence of blue-green algae or Lyngbya;
- growing pressures due to development and reclamation of wetlands along the East Asian-Australasian Flyway, resulting in concerns about migratory shorebirds;
- impacts from ‘new’ invasive species or viruses such as Avian Influenza (Bird Flu) and Cane Toads;
- reports of diminishing stocks of cockles, mud crabs, Barramundi and Threadfin Salmon;
- burgeoning growth in Broome’s resident population, and associated requirements for housing and other infrastructure, services and amenities;
- increased visitor numbers with increased demand for recreation and entertainment;
- changes to the ‘sense of place’ as the key elements of ‘community’ also change.

In December 2008, in the Ecological Character Description for Roebuck Bay ( Bennelongia 2008 p.97), identified a number of key activities that posed threats to the Ramsar site and to the values of the Roebuck Bay area. Those activities were described in the following table:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Issues</th>
<th>Contributing to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Weeds, erosion, nutrients</td>
<td>Habitat disturbance, species and habitat</td>
</tr>
<tr>
<td>Water abstraction</td>
<td>Seawater intrusion, changes to</td>
<td>Changed water quality and regimes</td>
</tr>
<tr>
<td>Urban &amp; industrial</td>
<td>Pollution through drainage,</td>
<td>Habitat disturbance, species and habitat</td>
</tr>
<tr>
<td>development</td>
<td>encroachment on habitat, increased</td>
<td>loss and changed water quality</td>
</tr>
<tr>
<td>Invasive species eg</td>
<td>Toxicity of the stage which</td>
<td>Loss of recreational amenity, impacts on</td>
</tr>
<tr>
<td>Lyngbya</td>
<td>accumulates along shore</td>
<td>species and water quality,</td>
</tr>
<tr>
<td>Recreation &amp; tourism</td>
<td>Disturbance</td>
<td>Habitat &amp; species disturbance and to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>loss of cultural values</td>
</tr>
</tbody>
</table>

The key values and management issues at September 2009 are summarised in Table 2 below, and draws upon past Values Mapping work, Interim Management Guidelines, and the Issues Paper prepared as part of the Roebuck Bay community planning process, as well as the Ecological Character Description (ECD) and an advanced draft of the Crab Creek Management Plan.

Often the activities and pressures present a common threat across many of the values, and the management issues are frequently interactive in their impacts on values.

<table>
<thead>
<tr>
<th>Key Values (a)</th>
<th>Management Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECOLOGICAL VALUES</td>
<td></td>
</tr>
<tr>
<td>- Habitat disturbance and loss</td>
<td></td>
</tr>
<tr>
<td>- Species loss &amp; decline</td>
<td></td>
</tr>
<tr>
<td>- Introduction of invasive species</td>
<td></td>
</tr>
<tr>
<td>- Climate change e.g. sea level rise, temperature rises, increased rainfall in ‘Wet’ season; increased disease &amp; vectors, greater inundation of catchments.</td>
<td></td>
</tr>
<tr>
<td>- shorebirds</td>
<td></td>
</tr>
<tr>
<td>- Disturbance of birds and their habitat</td>
<td></td>
</tr>
<tr>
<td>- Species loss &amp; decline</td>
<td></td>
</tr>
<tr>
<td>- marine mammals</td>
<td></td>
</tr>
<tr>
<td>- Disturbance and injury from boats</td>
<td></td>
</tr>
<tr>
<td>- Health of seagrass beds</td>
<td></td>
</tr>
<tr>
<td>- fish habitat</td>
<td></td>
</tr>
<tr>
<td>- Decline in water quality; relating to increased runoff, sedimentation &amp; changed flows into the Bay.</td>
<td></td>
</tr>
<tr>
<td>- fringing vegetation</td>
<td></td>
</tr>
<tr>
<td>- Loss &amp; fragmentation related to town site development, pastoral activity, changed fire regimes, introduced pests &amp; climate change</td>
<td></td>
</tr>
<tr>
<td>- Maintain health of fringing mangrove vegetation—a fish &amp; prawn nursery and crab habitat</td>
<td></td>
</tr>
<tr>
<td>- benthic organisms</td>
<td></td>
</tr>
<tr>
<td>- Changed water regimes (increased groundwater drawdown, changed freshwater flows)</td>
<td></td>
</tr>
<tr>
<td>- Species loss &amp; decline</td>
<td></td>
</tr>
<tr>
<td>- Lyngbya</td>
<td></td>
</tr>
</tbody>
</table>

TABLE

<table>
<thead>
<tr>
<th>Key Values</th>
<th>Management Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ABORIGINAL CULTURAL VALUES</strong></td>
<td>- spiritual</td>
</tr>
<tr>
<td>- Loss &amp; degradation of sites, both registered &amp; unregistered, as a result of human use pressures</td>
<td></td>
</tr>
<tr>
<td>- Ensuring Aboriginal people's access to places along the song cycle system</td>
<td></td>
</tr>
<tr>
<td>- Conflicts arising from cultural and social/recreation uses over the same area – results in increased feelings of marginalisation (anecdotal reports).</td>
<td></td>
</tr>
<tr>
<td>- Increasingly difficult for Traditional Owners and custodians to access areas to undertake cultural responsibilities.</td>
<td></td>
</tr>
<tr>
<td>- sustenance &amp; cultural</td>
<td></td>
</tr>
<tr>
<td>- Competition for diminishing resources and an increasingly mobile population</td>
<td></td>
</tr>
<tr>
<td>- Increasing restrictions to access coast &amp; cultural resources</td>
<td></td>
</tr>
<tr>
<td>- Sustainable hunting practices, especially marine mammals</td>
<td></td>
</tr>
<tr>
<td>- Widening socio-economic gap (greater need for low income families to have access to food, medicine and free recreation opportunities)</td>
<td></td>
</tr>
<tr>
<td>- Aboriginal health and wellbeing status is low and at greater risk with restricted access to sea food and cultural resources.</td>
<td></td>
</tr>
<tr>
<td><strong>Socio-Cultural Values</strong></td>
<td>- recreational</td>
</tr>
<tr>
<td>- Roebuck Bay is close, popular and accessible to town population</td>
<td></td>
</tr>
<tr>
<td>- Reduced access to coastal areas for free recreation and camping</td>
<td></td>
</tr>
<tr>
<td>- Greater access to remote areas due to prevalence of more sophisticated vehicles &amp; craft (land, sea and air travel) well-equipped with modern technology eg GPS, fish finders, freezers &amp; satellite phone</td>
<td></td>
</tr>
<tr>
<td>- Increased numbers of people using pleasure craft e.g. jet skis, speed boats, yachts, off-road vehicles and motor cycles.</td>
<td></td>
</tr>
<tr>
<td>- A growing number of boats registered in Broome (increased pressure from more people on water, more fishing, more litter, more pollution)</td>
<td></td>
</tr>
<tr>
<td>- fishing</td>
<td></td>
</tr>
<tr>
<td>- Over-fishing</td>
<td></td>
</tr>
<tr>
<td>- Competition between commercial, recreational and Indigenous harvest.</td>
<td></td>
</tr>
<tr>
<td>- Conflicting values re Aboriginal cultural practices, often not known or understood by non-Indigenous people.</td>
<td></td>
</tr>
<tr>
<td>- leisure activities</td>
<td></td>
</tr>
<tr>
<td>- Increased leisure time, &amp; therefore human pressures; and loss of amenity e.g. vehicles on beach, litter and waste.</td>
<td></td>
</tr>
<tr>
<td>- Areas used by tourists and for leisure are often those holding cultural significance</td>
<td></td>
</tr>
<tr>
<td>- boating</td>
<td></td>
</tr>
<tr>
<td>- Boat speeds and manoeuvres injure &amp; disturb marine mammals</td>
<td></td>
</tr>
<tr>
<td>- Demand for safe boat ramp for launching &amp; retrieval in the Bay</td>
<td></td>
</tr>
<tr>
<td>- Pollution from outboard motors, other motorised pleasure craft;</td>
<td></td>
</tr>
<tr>
<td>- Waste disposal.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key Values</th>
<th>Management Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Historical/Heritage</strong></td>
<td>- Natural heritage values are not generally known or understood, except in relation to migratory shorebirds</td>
</tr>
<tr>
<td>- Increased understanding and respect for the historical links between the Broome community and Roebuck Bay</td>
<td></td>
</tr>
<tr>
<td>- Lack of awareness of registered and unregistered sites around foreshores eg middens, Mangrove Point (Old jetty), flying boat wrecks, traditional fish traps, and Aboriginal burial sites.</td>
<td></td>
</tr>
<tr>
<td><strong>Sense of Community</strong></td>
<td>- Population growth and changing community profile has implications for management:</td>
</tr>
<tr>
<td>- Rapidly growing resident population, predicted to double by 2028</td>
<td></td>
</tr>
<tr>
<td>- A significant population of young, itinerant, short term residents mostly non-Indigenous</td>
<td></td>
</tr>
<tr>
<td>- Diminishing percentage of Aboriginal residents in Broome – now around 33%</td>
<td></td>
</tr>
<tr>
<td>- Widening income gap between sectors of the population</td>
<td></td>
</tr>
<tr>
<td>- Large numbers of elderly visitors during Dry season; often long-stay independent travellers who reportedly place considerable human pressure on coastal resources, and due to mobility restrictions, require easy access to Roebuck Bay.</td>
<td></td>
</tr>
<tr>
<td><strong>Economic Values</strong></td>
<td>- Rapid increase in Port activity in response to commercial interests and pressures</td>
</tr>
<tr>
<td>- Larger ships entering and leaving the Port</td>
<td></td>
</tr>
<tr>
<td>- Increased risk of contamination of water, land and air</td>
<td></td>
</tr>
<tr>
<td>- Growing risk of introduced pests &amp; diseases from increased in shipping movements (and increased international exposure)</td>
<td></td>
</tr>
<tr>
<td>- Land clearing adjacent to port causing loss of natural vegetation and increased runoff and erosion</td>
<td></td>
</tr>
<tr>
<td>- Risk of pollutants entering Bay with greater industrial activity</td>
<td></td>
</tr>
<tr>
<td>- shipping &amp; port activities</td>
<td></td>
</tr>
<tr>
<td>- tourism</td>
<td></td>
</tr>
<tr>
<td>- Tourist numbers increasing (up to 237,000 annually in Broome)</td>
<td></td>
</tr>
<tr>
<td>- Greater interest in nature-based tourism, much of which is unsupervised, or self-drive</td>
<td></td>
</tr>
<tr>
<td>- Impacts of Hovercraft unknown</td>
<td></td>
</tr>
<tr>
<td>- fishing</td>
<td></td>
</tr>
<tr>
<td>- Over-fishing</td>
<td></td>
</tr>
<tr>
<td>- Competition for take from commercial, recreational and Indigenous fisheries</td>
<td></td>
</tr>
<tr>
<td>- pearling</td>
<td></td>
</tr>
<tr>
<td>- Increase in lease areas over favoured near-shore fishing spots</td>
<td></td>
</tr>
<tr>
<td>- pastoral activities</td>
<td></td>
</tr>
<tr>
<td>- Diversification of pastoral leases to incorporate tourism increasing human pressures on the coast and water courses that lead into the Bay</td>
<td></td>
</tr>
<tr>
<td>- Increased live cattle exports causing pollution, spread of weeds, greater number of shipping movements.</td>
<td></td>
</tr>
</tbody>
</table>
10 ATTACHMENTS

1 Industrial development
- Increased industrial development in region, often with Broome Port as supply base
- Increased activity to support off-shore R&D eg minerals, oil & gas
- Increased residential & tourism developments
- Increased runoff from hardened (sealed and impervious) surfaces
- Reduction in natural areas for recreation
- Pressure on limited resources & demand for essential services eg water, power & waste disposal
- Disposal, energy provision
- Clearing of natural vegetation cover i.e. loss and fragmentation of ecosystems, increased erosion
- Use of introduced species in gardens & public landscaping
- Increased use of water & fertilisers, which may enter the Roebuck Bay system
- New wastewater treatment plant; ground water intrusion, crop management etc. Developments of higher density and closer to coast will result in even greater human pressure on the coast
- Coastal buffer zone needed between developments & Roebuck Bay.

2 Town site development
- Ensure information collected on the Bay is available to land managers and owners (and the RBWG)
- Need for cultural protocols and community/local protocols to be followed by researchers, volunteers and research organisations
- Gaps in available data
- Access to healthy coastal Country needed for cultural transmission
- Incorporating new knowledge & discoveries eg turtles recorded as nesting at Crab Creek, prevalence of snubfin dolphins etc.

10.5 Framework for Assessment
The assessment framework below has been adapted from Ramsar guidelines combined with the work on supporting sustainable management systems, by Prof. Stephen Dovers of ANU (2001), and referred to on p43 in Sharon Griffiths & Assoc and Acacia Springs Environmental (2009) Draft Management Plan for Crab Creek, Broome, Western Australia May 2009 Roebuck Bay Working Group (May 2009).

<table>
<thead>
<tr>
<th>No</th>
<th>Topic</th>
<th>Description</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Goal</td>
<td>What are the management goals for each main Crab Creek theme?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Theme</td>
<td>Which management theme?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Objective</td>
<td>What are the management objectives for various subcomponents of each theme?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Issue/impact</td>
<td>How do the issues associated with each management theme or its components play out and what is the nature of any impacts arising?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Causes of impacts/threats</td>
<td>What are the causes of the impacts so far as they are known?</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>How could things cause this to change over time?</td>
<td>Is it going to stay the same, get better or worse if we don’t do anything?</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Spatial scale of cause or effect</td>
<td>Is this something that is only occurring locally or is it occurring globally?</td>
<td>(Local [Crab Creek] • proximal [Broome/Roebuck Bay] • distal [Kimberley] • National • Global)</td>
</tr>
<tr>
<td>8</td>
<td>Temporal scale of possible impacts - Timing</td>
<td>Is the impact observed immediately, or is there a time delay?</td>
<td>(Immediate [minutes, hours] • short term [days, weeks] • medium-term [months, years] • long-term [years, decades])</td>
</tr>
<tr>
<td>9</td>
<td>Temporal scale of possible impacts - Longevity</td>
<td>Does the impact last for a short or long time?</td>
<td>(Extremely short term [minutes, hours], short term [days, weeks] • medium-term [months, years] • long-term [years, decades])</td>
</tr>
<tr>
<td>10</td>
<td>Nature of cause/s</td>
<td>Is there a single cause or are there multiple cause acting together?</td>
<td>(Discrete [single, one off] • continual [single, ongoing] + compound [multiple causes] • systemic [continuous/entrenched])</td>
</tr>
<tr>
<td>11</td>
<td>Magnitude of possible impacts on natural systems</td>
<td>How does this impact influence natural systems?</td>
<td>(Minor • moderate • severe • catastrophic)</td>
</tr>
</tbody>
</table>

Note: Ramsar terms ‘Values’ are generally thought of as ‘Ecosystem services’ or the benefits that people obtain from the ecosystem (the wetlands and their surrounding management area). These benefits may be ecological, but they may also be cultural, recreational, economic or scientific and educational. The factors that have the potential to fundamentally change these values are considered within the Ramsar framework as ‘Key components and processes’. Consideration of these interactions and the values within the system that have greatest potential to cause a reduction or loss of values helps in identifying the key management issues.
| 12 | Magnitude of possible impacts on human systems: | How does this impact influence human systems? | (Minor • moderate • severe • catastrophic) |
| 13 | Level of public concern | Are the public worried or not? | (Low • moderate • high) |
| 14 | Basis of public concern | Who is worried and why? | (Widely shared • moderate variance in understanding • disparate perceptions) |
| 15 | Reversibility of possible impacts | Can the impacts be fixed quickly or not? | (Easily/quickly reversed • difficult/expensive to reverse • irreversible) |
| 16 | Measurability of factors and processes | Can we measure causes, effects and responses? | (Well-known risk/impact • uncertainty in cause and effect • ignorance) |
| 17 | Probability of occurrence | Is this a rare event or could (does) it occur often? | (Extremely low \([-1:100,000]\), low \([1:100-1:100,000]\), moderate \([1:5-1:100]\), high \([1:1-1:5]\)) |
| 18 | Degree of complexity and connectivity | Do we understand the relationships between causes, effects and responses or are they extremely complex? | (Discrete • linear complex, involving multiple feedbacks and linkages) |
| 19 | What are the uncertainties and limits of understanding? | What things do we know and what things can’t we determine? | |
| 20 | Are there critical information gaps? | Are there important things that we have no information about? | |
| 21 | What indicators will be used to evaluate the performance of management? | What things will we use to measure whether management interventions are working? | |
| 22 | What are the indicators Limits of Acceptable Change (LAC target)? | The Ramsar guidelines (2002) require the development of LAC (Limits of Acceptable Change) targets where possible. What ones are to be used for this issue? | |
| 23 | What range of options could achieve the LAC target in combination or individually? | There may be a number of management actions that can act together to meet LAC targets, or there may be only a single management action. Which ones are possible? | |
| 24 | What resource and governance requirements are needed for each option in 23? | What money, people and organisational arrangements do we need? | |
| 25 | Deciding which are the best options in 23? | Of the possible options in 23, which are the best? | |
| 26 | What actions are required? | What things need to be done to implement the best options? | |
| 27 | What steps are required? | What steps need to occur to implement the best options. | |
| 28 | Who will undertake the action? | Who needs to undertake the actions? | |
| 29 | When will the action be undertaken? (sequencing) | There are often synergies and opportunities that accrue from running some programs together. When will the actions be undertaken. | |
| 30 | Existence of goals | What sort of goals has been established? | (Clearly stated • generally stated • absent) |
| 31 | Pertinence of management options | Are the people/agencies able to undertake the management actions assigned to them? | (Irrelevant • beyond jurisdiction • primary responsibility) |
| 32 | Availability of means | Are there sufficient people, resources, legislation etc to undertake the actions? | (Fully sufficient available instruments/arrangements/technologies • totally insufficient) |
| 33 | Acceptability of means | How is the community going to react to the actions being undertaken? | (Negligible opposition • moral/social/political/economic barriers • insurmountable opposition) |
| 34 | How will success be determined? | How will success be determined and how will the community be told? | |
| 35 | How do we improve management if future improvements are required? | How will we improve things if the management actions are underperforming? |
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