



Shorebirds of the Burnett Coast: surveys of critical high tide roosts

David Milton and Sandra Harding
Queensland Wader Study Group



**Burnett Mary
Regional Group**



**Queensland
Government**
Environmental
Protection Agency
Queensland Parks
and Wildlife Service



Shorebirds of the Burnett Coast: surveys of critical high tide roosts

David Milton and Sandra Harding
Queensland Wader Study Group

June 2007

For Burnett-Mary Regional Group for Natural Resource
Management

Enquiries should be addressed to:

Dr David Milton,
Qld Wader Study Group,
336 Prout Rd.,
Burbank 4156 Qld
AUSTRALIA
Email: pitta@gil.com.au

Distribution list

BMRG

EPA

Calliope Shire

Isis Shire

Miriam Vale Shire

Burnett Shire

Hervey Bay City Council

National Library

Other regional groups

Important Notice

© Copyright Queensland Wader Study Group (QWSG)

All rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of QWSG.

The results and analyses contained in this Report are based on a number of technical, circumstantial or otherwise specified assumptions and parameters. The user must make its own assessment of the suitability for its use of the information or material contained in or generated from the Report. To the extent permitted by law, QWSG excludes all liability to any party for expenses, losses, damages and costs arising directly or indirectly from using this Report.

Use of this Report

The use of this Report is subject to the terms on which it was prepared by QWSG. In particular, the Report may only be used for the following purposes.

- this Report may be copied for distribution within the Client's organisation;
- the information in this Report may be used by the entity for which it was prepared ("the Client"), or by the Client's contractors and agents, for the Client's internal business operations (but not licensing to third parties);
- extracts of the Report distributed for these purposes must clearly note that the extract is part of a larger Report prepared by QWSG for the Client.

The Report must not be used as a means of endorsement without the prior written consent of QWSG.

The name, trade mark or logo of QWSG must not be used without the prior written consent of QWSG.

Shorebirds of the Burnett Coast: surveys of critical high tide roosts

CONTENTS

1.	PROJECT SUMMARY	8
2.	PROJECT BACKGROUND	10
2.1	Need	10
2.2	Regional context.....	10
2.3	Roles of participants	12
3.	SURVEYS OF BEACHES ON FRASER IS	14
3.1	Background.....	14
3.2	Survey of eastern Fraser Is beaches	15
3.3	North-western Fraser Is high tide survey	16
3.4	South-eastern Fraser Is high tide survey.....	19
3.5	Conclusions	23
4.	SHOREBIRD HIGH TIDE ROOST MAPPING ON THE COAST	24
4.1	Survey approach.....	24
4.1.1	Aerial reconnaissance	24
	<i>Coast from Town 1770 to Pt Vernon.....</i>	<i>24</i>
	<i>Northern BMRG region from Tannum Sands to Eurimbula NP</i>	<i>37</i>
4.1.2	Ground surveys.....	38
4.1.3	Data collation and analysis	39
4.2	Summaries of high tide roost surveys for each shire	39
4.2.1	Calliope Shire	40
4.2.2	Miriam Vale Shire	40
4.2.3	Burnett Shire.....	47
4.2.4	Isis Shire	52
4.2.5	Hervey Bay City	54
4.3	Assessing priorities for management of coastal shorebirds and their habitats	57
4.3.1	Prioritisation process	57
4.3.2	Criteria and method for assessing risk	57
4.3.3	Estimated overall risk at each roost and priorities for management.....	58
	<i>Dr Mays Is, Elliot River mouth (ERMI)</i>	<i>60</i>
	<i>Gables Point Rocks (GAPR) and Pt Vernon (PVER)</i>	<i>61</i>
	<i>Bundaberg Port swamp (BPSW).....</i>	<i>61</i>
4.3.4	Summary of priorities for managing coastal shorebird roosts between Tannum Sands and Pt Vernon.....	62
5.	SURVEY OF BREEDING RESIDENT SHOREBIRDS.....	70
5.1	Introduction.....	70

5.2	Islands in Great Sandy Strait.....	70
5.3	Coast from Tannum Sands to Pt Vernon	72
5.4	Management recommendations for breeding resident species	75
5.4.1	Beach Stone-curlew	75
5.4.2	Pied Oystercatcher	76
5.4.3	Sooty Oystercatcher	76
5.4.4	Red-capped Plover	77
5.4.5	Little Tern	77
6.	INNER REEF ISLAND SURVEYS.....	79
6.1	Lady Elliot Island	79
6.2	Lady Musgrave Is.....	82
6.3	General conclusions and recommendations.....	84
7.	SHOREBIRD MONITORING PLAN FOR THE BURNETT COAST	86
7.1	Constraints	86
7.2	Proposed monitoring program.....	86
7.3	Indicative budget	87
8.	ACKNOWLEDGEMENTS	88
9.	REFERENCES.....	89
	APPENDIX A – LOCAL GOVERNMENT SHOREBIRD FACTSHEET	90

Table 3.1. — Low tide counts of shorebirds on Fraser Is ocean beach from Hook Point to track to Dilli Village Driving north (from road exit on beach to Dilli Village track) (Date: 27 – 28 December 2005; Tide: 11:42am low, tide falling; Counters: Sandra Harding, David Milton; Weather 27 th : cloud cover 2, no rain, wind 5 – 10 knots, NE; Weather 28 th : cloud cover 0, no rain, wind 5 knots, NE).....	15
Table 3.2. — Counts of shorebirds on north-western beach of Fraser Island from Wathumba Creek to Rooney Point at high tide. Locations are given in degrees and decimal minutes. (Note: Observations from boat during falling tide (High tide 2.26m at 8:45am); Counters – Sandra Harding, David Milton, Don and Lesley Bradley; Date: 1 st January 2005; NF = no position taken).....	17
Table 3.3 — High tide counts of shorebirds on southern section of east coast beach on Fraser Island. Count recorded on 23 December 2005 by QPWS ranger, Ivan Thrash. Counts recorded on 2 Jan 2006 by QWSG members Sandra Harding and David Milton.	21
Table 4.1 — Roosts from Town of 1770 to Pt Vernon identified during aerial survey on 30 — 31 December 2005. Waypoints refer to red tags on maps in Appendix A. (Note: High tide on 30 December was 8.30 am at Gladstone (4.3m) and 8.17 am at Burnett Heads (3.17m). High tide on 31 December was 9.16 am at Gladstone (4.43 m) and 8.37 at Burnett Heads (3.28m)).....	25
Table 4.2 — Ground counts of three roosts made during survey period 28 – 31 December 2005. These ground counts are of sites surveyed from air but were all made on falling tides well after the time of high tide. The only site not counted during the aerial survey was Bundaberg Port Swamp (QWSG site: BPSW), which was not counted from the air due to being visited on the ground prior to the aerial survey.....	32
Table 4.3 — The highest total count of shorebirds and the maximum number of species seen at each roost in Calliope Shire. The data includes QWSG records collected at other times besides the BMRG surveys. Roosts with over 1000 birds are highlighted in grey and roosts with 300 – 1000 birds are shown in bold.	40
Table 4.4 — The numbers of each species of shorebird counted at roosts in Calliope Shire during the October 2006 and March 2007 surveys (Nos = total number counted and N = the number of roosts where the species was seen).	41
Table 4.5 — The highest total count of shorebirds and the maximum number of species seen at each roost in Miriam Vale Shire. The data includes QWSG records collected at other times besides the BMRG surveys. Roosts with over 1000 birds are highlighted in grey and roosts with 300 – 1000 birds are shown in bold.	41
Table 4.6 — The count of each shorebird species from the Pancake –Middle Creek system during the two surveys in October 2006 and March 2007. (Nos = total number; N = number of roosts where the species occurred; Shaded cells = species in internationally significant numbers and bold = species in nationally significant numbers).	45
Table 4.7 — The total number of each species counted at high tide roosts in Miriam Vale Shire during the October 2006 and March 2007 surveys. (Nos = total number; N = number of roosts where the species occurred; Shaded cells = species in internationally significant numbers and bold = species in nationally significant numbers; Signif = the percentage of the flyway or national population).	46
Table 4.8 — The highest total count of shorebirds and the maximum number of species seen at each roost in Burnett Shire during the surveys. The data includes QWSG records from these roosts collected at other times besides the BMRG surveys. Roosts with over 1000 birds are highlighted in grey and roosts with 300 – 1000 birds are shown in bold.....	49
Table 4.9 — The number of each shorebird species seen at the Bundaberg Port reclamation area (QWSG Site code: BPSW) during four surveys between December 2005 and March 2007.	50
Table 4.10 — The total number of each species counted at high tide roosts in Burnett Shire during the February and October 2006 surveys. (Nos = total number; N = number of roosts where the species occurred; Shaded cells = species in internationally significant numbers and bold = species in nationally significant numbers; Signif = the percentage of the flyway or national population).	51
Table 4.11 — The highest total count of shorebirds and the maximum number of species seen at each roost in Isis Shire. The data includes QWSG records collected at other times besides the BMRG surveys. Roosts with over 1000 birds are highlighted in grey and roosts with 300 – 1000 birds are shown in bold.	52

Table 4.12 — The total number of each species counted at high tide roosts on the coast of Isis Shire during the February and October 2006 surveys. (Nos = total number; N = number of roosts where the species occurred; Shaded cells = species in internationally significant numbers and bold = species in nationally significant numbers; Signif = the percentage of the flyway or national population).....	53
Table 4.13 — The highest total count of shorebirds and the maximum number of species seen at each roost in Hervey Bay City. The data includes QWSG records collected at other times besides the BMRG surveys. Roosts with over 1000 birds are highlighted in grey and roosts with 300 – 1000 birds are shown in bold.....	54
Table 4.14 — The total number of each species counted at high tide roosts on the coast of northern Hervey Bay City during the February and October 2006 surveys. (Nos = total number; N = number of roosts where the species occurred; Shaded cells = species in internationally significant numbers and bold = species in nationally significant numbers; Signif = the percentage of the flyway or national population).	54
Table 4.15 — The shorebird species in the BMRG region from Tannum Sands to Pt Vernon and their listing on either the JAMBA/CAMBA Migratory bird Agreements or considered threatened or rare under current Queensland or federal legislation (June 2007). Scientific names follow those listed in the JAMBA/CAMBA agreements and are not necessarily the same as recognised in the current taxonomic literature.	59
Table 4.16 — The list of shorebird roosts in the QWSG database (including those counted since 1994), their maximum count of shorebirds, presence of migratory or threatened species, land management agency responsible and an assessment of their relative risks (known by QWSG) to habitat loss from human modification, disturbance by people or predation by feral animals (cats, dogs, foxes). Each risk category are assessed for its likelihood of occurring within the next year and the consequence for shorebird populations within the BMRG study region from Tannum Sands to Pt Vernon. Roosts with high overall rank are highlighted in bold . (Note: Land management agencies in this table can differ from those implied in previous tables as the previous tables summarise the status of each roost within the boundaries of each local government and not whether the local authority is responsible for the management of each roost).....	63
Table 6.1 — The maximum number of each species of shorebird and other waterbird counted on Lady Elliot Is during high tide surveys between 22 – 24 December 2006.....	81
Table 6.2 — The maximum number of each species of shorebird during two counts on Lady Musgrave Is on 23 January 2007.....	84
Figure 2.1 — Map of the project coastal survey area from Tannum Sands south to Pt Vernon.	12
Figure 3.1.— A lone Red Capped Plover is pictured (right of centre) navigating the 4WD tracks on Fraser Island's south-eastern beach.....	14
Figure 3.2 — Terns roosting near Rooney Point on north west coast of Fraser Island.....	19
Figure 3.3 — High tide shorebird roost on south-eastern beach of Fraser Island north of Hook Point.	20
Figure 4.1 — Picture (left) of Elliott River south bank roost number 17 (waypoint 021). Picture (right) of Gregory Islands in the Burrum River Roost number 30 (waypoint 32).	24
Figure 4.2 — Photograph of roost 15 (waypoint 17) in the mouth of Elliot River taken by Milton during the aerial survey of December 2005.	31
Figure 4.3 — Photograph of Roost 16 (waypoint 020) Elliott River north bank claypan.....	35
Figure 4.4 — Photograph of Roost 35 Bundaberg Port dredge spoil ponds, Burnett Shire Council	35
Figure 4.5 — Photograph of roost on western side of O'Reagan Creek mouth, Hervey Bay City Council	35
Figure 4.6 — Sandra Harding and pilot with Cessna fixed wing plane used in aerial reconnaissance of the northern BMRG region in February 2007.	37
Figure 4.7 — Surveying and mapping new roost sites in the northern BMRG region in March 2007. Local resident, Brian from Turkey Beach at new roost site in Worthington Ck (left) and QWSG members Dawn and Peter counting shorebirds on sand spit in Colosseum Inlet.....	38
Figure 4.8 — The Bundaberg Port Corporation dredge spoil pond with breeding Black-winged Stilt in left foreground (left) and adjacent ephemeral wetlands (right) with feeding Sharp-	

tailed Sandpipers during the December 2005 survey when 2,500 shorebirds were counted on the site	48
Figure 4.9 — View across Elliot River mouth from Elliot Heads boat ramp to Dr May’s Is on falling tide (left) and Pied Oystercatcher nest on island taken in October 2006 during survey.....	48
Figure 4.10 — Sharp-tailed Sandpiper at Bundaberg Port dredge spoil pond in December 2005.	50
Figure 4.11 — Mouth of O’Reagans Ck roost from the east looking south up the creek to the houses of Dundowran.....	56
Figure 4.12 — View looking southeast from helicopter during the aerial reconnaissance survey in December 2005 towards Toogoom Ck (centre) and Toogoom town. Shorebirds use all the claypan areas in the foreground as roosting habitat on different tides.....	56
Figure 5.1 — Map of nesting resident shorebirds or observations of breeding behaviour during an extensive survey of islands in the Great Sandy Strait during September 2006.	71
Figure 5.2 — Map of the breeding records of resident shorebird species in the northern Burnett Coast from Tannum Sands to Rodds Peninsula.	72
Figure 5.3 — Map of the breeding records of resident shorebirds and Little Tern along the coast between Town of 1770 and the mouth of the Burnett River.	73
Figure 5.4 — Map of the breeding records of resident shorebirds in the southern Burnett Coast from the Burnett to Burrum Rivers.	74
Figure 5.5 — Location of breeding resident shorebird nests in the southern Burnett Coast from Burrum R to Pt Vernon.....	74
Figure 5.6 — Photograph of adult Beach Stone Curlew (left) and their nest on Dr May’s Is in the mouth of the Elliot River in October 2006 (Photographs: Ivell Whyte)	75
Figure 5.7 — Pied Oystercatcher chick in nest on Big Woody Is in the Great Sandy Strait in September 2006 (Photograph: Lesley Bradley)	76
Figure 5.8 — Photographs of Sooty Oystercatcher nesting habitat (left) where the nest is located behind the rock in centre right of the photograph. Photograph on the right shows the simple nest scrape with two eggs taken during the September 2006 survey of islands in the Great Sandy Strait (Photographs: Lesley Bradley and Ivell Whyte).....	77
Figure 5.9 — Adult male (left) and female Red-capped Plover protecting their small chick on sand spit at Littabella Creek in October 2006 (Photograph: Lesley Bradley).....	78
Figure 5.10 — Adult female Red-capped Plover showing distraction display to lead counters away from her nest on the western side of the Kolan River mouth in October 2006 (Photograph: Lesley Bradley).	78
Figure 6.1 — Map of Lady Elliot Is showing the locations of the key shorebird roosting points mapped (RP in blue) and breeding colonies of Roseate (red) and Black-naped Terns (yellow). Blue hatched area approximates the extent of buildings for the Lady Elliot Is Resort.....	79
Figure 6.2 — Photograph of Lady Elliot Is showing the resort on left of airstrip (left) and a immature Pacific Golden Plover foraging among the buildings in the resort.....	80
Figure 6.3 — Pacific Golden Plover, Bar-tailed Godwit (left) and Ruddy Turnstone (left and right) roosting among <i>Casuarina</i> forest on south-western side of Lady Elliot Is.	80
Figure 6.4 — Roost of Ruddy Turnstone and Roseate Terns (blue: RP5 on Fig 6.1) (left) and Roseate Tern nesting colony (red on left) and in photograph at right. Note in aerial photograph on left, the track to beach that is heavily used each day by guests from the resort to reach glass-bottom boats that leave for coral reef viewing.	82
Figure 6.5 — Map of Lady Musgrave Is with the main beach used by shorebirds for roosting at high tide shown in red along with the main camping ground shown in yellow	83

1. PROJECT SUMMARY

Surveys of resident and migratory shorebirds were undertaken by Queensland Wader Study Group (QWSG) volunteers along the Burnett Coast, inner reef islands (Lady Elliot and Lady Musgrave Is) and Fraser Is between December 2005 and March 2007. All shorebirds were counted in these regions and the locations of all high tide roosts on the coast were mapped. The total of population of shorebirds in the region was in excess of 28,000 birds of 31 species. These shorebirds were recorded at over 150 high tide roosts that were spread across five local government areas and several national parks. The largest population of shorebirds were found in Miriam Vale Shire with 10,500 shorebirds of 29 species. Internationally significant numbers of three species (Eastern Curlew, Grey-tailed Tattler and Red-capped Plover) and nationally significant numbers of another (Whimbrel) occur in the shire. The largest populations occur in Pancake Ck, between Middle Is and Rodds Peninsula (3,700 shorebirds of 16 species) and this system supports almost 1.5% of the Flyway population of Grey-tailed Tattler. Another important area for shorebirds identified during the project was the south eastern beach of Fraser Is, which supported 3,900 shorebirds of 11 species. Nationally significant numbers of Grey Plover were found at Hook Pt and the proposed closure of this section of the beach will enhance its value as an important high tide roost.

The surveys of shorebird high tide roosts undertaken along the Burnett Coast extended from Tannum Sands, near Gladstone, south the Point Vernon in the northern Great Sandy Strait. These surveys complemented earlier surveys by QWSG in the Great Sandy Strait south of Point Vernon. The Queensland Wader Study Group has now completed the mapping of coastal high tide roosts along 400 km of coast in the Burnett-Mary and adjacent catchments. Roosts were initially identified by aerial and ground reconnaissance and then visited to count the shorebirds and map their extent with a GPS. These maps were digitised on a Geographic Information System (GIS) by staff from the Burnett-Mary Regional Group for Natural Resource Management (BMRG). The GIS layers generated were then made available to the planning departments in the five relevant local governments (Calliope, Miriam Vale Shire, Burnett Shire, Isis Shire and Hervey Bay City Councils) and the EPA. Besides mapping, the habitat characteristics of each roost and threats to its viability were described and incorporated into the GIS through a linked table. Also included in the linked table are summaries of the shorebird counts made by QWSG. A shorebird fact sheet (Appendix A) has also been developed to help inform local government planners of the utility of the GIS and its relevance to their planning processes.

In addition, a survey of resident shorebird breeding on islands in the Great Sandy Strait was undertaken in September 2006 in partnership with the Queensland Environmental Protection Authority. Islands in the Straits were visited and the locations of all shorebird nests were mapped. A total of 29 nests of three species of shorebird were found, including 9 nests of the threatened Beach Stone-curlew and 2 nests of the threatened Sooty Oystercatcher. The other species, Pied Oystercatcher was found nesting on several islands. Woody island was the most important island for nesting shorebirds, followed by Little Woody Island. Nests were mostly found on upper beaches or amongst rocks above tidal influence. Disturbance by day visitors to the islands appear to be the greatest threat to their nesting success.

Surveys of the coastal high tide roosts in the northern half of the Burnett Coast in October 2006 also found shorebird nesting activity in suitable habitats throughout the region. Beach Stone-

curlew and Pied Oystercatcher nested on Dr Mays Is in the mouth of the Elliot R. Pied Oystercatcher and Red-capped Plover also nested on sand spits in the mouths of Littabella Ck and Kolan R. The large population of the resident Red-capped Plover in the northern Burnett Coast indicates that the region supports a significant breeding population of this species. Other breeding records of significance included Little Tern nesting at the mouth of Baffle Ck.

Shorebird populations on the inner reef islands, Lady Elliot and Lady Musgrave Is, were small compared with the adjacent coast. Lady Elliot Is supported the largest number of shorebirds, including nationally significant numbers of Ruddy Turnstone. Ruddy Turnstone were almost absent from coastal habitats along the Burnett Coast due to their preference for more rocky intertidal areas. Immature Ruddy Turnstone and Pacific Golden Plover have habituated to humans on Lady Elliot Is and forage among the buildings of the Lady Elliot Is resort. Other species also used unusual habitats for roosting including *Casuarina* forest.

A semi-quantitative method is developed to inform an assessment of the threats to the viability of shorebird roosts and indicate priority roosts that need management intervention. This approach was modified from more formal risk assessment methods developed for other applications and involves expert assessment of the likelihood and consequence of threats to each roost. The project identified three categories of threat to roost viability, namely loss of habitat due to humans, excessive disturbance leading to abandonment and predation from feral animals or pets. Each of the 141 roosts that were surveyed were assessed for the likelihood and consequence of each of the three categories of threat occurring in the next year. Likelihoods and consequences were ranked between 1 (low) to 3 (high). The sum of these ranks was then weighted separately for the presence of threatened or migratory shorebirds. The overall ranks can vary between 3 and 162, depending on the level of threat.

The overall ranks varied from 6 to 84 and four roosts had obviously higher ranks than the rest. These roosts included Dr Mays Is and (Burnett Shire), Gables Pt Rocks and Pt Vernon (Hervey Bay City) and Bundaberg Port swamp (Port of Brisbane Corporation). The first three roosts had both threatened and migratory shorebirds present and were highly disturbed. The Bundaberg Port swamp was at moderate risk of habitat loss due to its use as a dredge spoil pond. Recommendations for possible management actions to reduce these threats are provided and include better signage and monitoring at the three highly disturbed roosts or active management of water exchange in the swamp.

2. PROJECT BACKGROUND

2.1 Need

Shorebirds are a large group of birds that comprise about 10% of the bird species that occur in Australia. The group includes many migratory species that fly up to 20,000 km each year from their breeding grounds to their wintering sites. Migratory shorebird species mostly breed in the arctic and sub-arctic regions of the northern hemisphere and spend the non-breeding season in the southern hemisphere. There are eight regional shorebird flyways recognised around the world. Australia forms the southern end of the East Asian-Australasian Flyway. An estimated 3 million migratory shorebirds in the East Asian-Australasian Flyway spend their non-breeding season (September – April) in Australia.

In Australia, most migratory shorebirds live on the coast, feeding in intertidal areas that become available as the tide recedes. Their daily lifecycle is governed by this tidal cycle and they feed both day and night when this habitat is not covered by the sea. At high tide, the birds take the chance to sleep, preen their feathers and digest their food. In order to do these activities in safety, they roost in groups at suitable sites that are close to the feeding grounds, provide a clear view of ground and aerial predators and are away from unnecessary disturbance. The strong demand for coastal land for residential development in Australia has meant that the birds are competing for the same habitats that attract people to the coast. Many coastal cities are thus located in regions with large (>20,000) shorebird populations that need to roost in areas in high demand for development by people.

These shorebirds have received protection in national legislation because of their migratory lifestyle that spans several countries and continents. For migratory shorebirds spending their non-breeding season in Australia, there have been several agreements (JAMBA – Japan-Australia Migratory Bird Agreement; CAMBA – China Australia Migratory Bird Agreement; KRAMBA – South Korea Australia Migratory Bird Agreement) that oblige the contracting countries to protect shorebirds and their habitats. These migratory species receive further protection by being listed under the federal *Environmental Protection and Biodiversity Conservation Act*. Development applications that can potentially significantly impact on these bird species or their habitats can trigger federal intervention into the development process and even halt the development. To enable local and regional governments to better plan their coastal development, critical migratory shorebird habitats need to be identified and mapped. This is particularly important for the high tide roosts as these are almost always above the high tide mark and in areas popular for development by people.

2.2 Regional context

The Burnett-Mary Regional Group for Natural Resource Management (BMRG) is responsible for coordinating community-driven natural resource management along a large section of the southern Queensland (Fig. 2.1). The Queensland Wader Study Group (QWSG) surveyed and mapped high tide shorebird roosts in the Great Sandy Strait and along the coast of the southern section of the BMRG region. The project covered the area from Tin Can Bay to Point Vernon

in Hervey Bay with funding from NHT through the WWF-managed National Shorebird Project (Harding et al 2005). Data collected during this project was provided to the relevant local councils for inclusion in their planning databases. This work was intended to better inform the council planners responsible for developing the planning schemes for their council area. QWSG has evidence that this has helped improve the outcome for shorebirds of several subsequent coastal developments in the area.

The BMRG natural resource management plan (Country to Coast – a healthy sustainable future) lists objectives such as the protection conservation and enhancement of biodiversity in the regions coastal, marine and estuarine environments and to engage the community in natural resource management (NRM) activities. In order to assist the BMRG to achieve this objective the QWSG aims to identify and record the locations and wherever possible, the geographic extent of migratory and resident shorebird roost sites on the Burnett Coast (from Tannum Sands in the north, to Point Vernon in Hervey Bay (Figure 2.1). Further, we aim to engage regional stakeholders in planning, mapping, counting and future management through training and open communication.

Previously the QWSG together with Baymap developed a GIS map of roost sites for the southern Great Sandy Strait from Coongul Creek, Fraser Island (25° 58' S, 153° E) to southern Tin Can Bay (25° 58' S, 153° E). This was achieved with support from the Natural Heritage Trust World Wide Fund for Nature (WWF) Shorebird Project and the Queensland EPA. Currently shorebird roost sites are not counted in the immediate region north of Point Vernon and knowledge of these sites is limited. This project will consolidate existing information in the southern GSS and identify sites and develop awareness of shorebird roosts on the Burnett Coast which is the remainder of the BMRG planning area.

The project contained the following elements:

- Identify the locations (latitude, longitude) of roosts through preliminary examination including liaising with local birders and bird groups as well as BMRG, Qld EPA and QPWS staff;
- Confirm preliminary information and identify further sites via ground, sea and aerial reconnaissance;
- Collate information to enable the coordination of QWSG volunteers and local birders for ground-truthing of sites;
- Map the location and wherever possible the extent of migratory and resident shorebird roosting and breeding habitat along the Burnett Coast;
- Map the locations of migrant and resident shorebird roosting and resident shorebird breeding sites on Fraser Island (north of Wathumba Ck on the west coast and the east coast south from Dilli Village to Hook Point);
- Identify and map the locations of migrant and resident shorebird roosting and resident shorebird breeding sites of the southern bay islands of the Great Sandy Strait and other sites that could not be finalised in the previous WWF-led study;
- Identify risks to individual roosts and provide management recommendations, and
- Raise public awareness and build community capacity through knowledge sharing activities such as on-ground mapping and counting exercises and information seminars.



Figure 2.1 — Map of the project coastal survey area from Tannum Sands south to Pt Vernon.

Where there can be ongoing monitoring of some sites this will be encouraged, to develop a more comprehensive knowledge of the roosts sites and their importance. In order to do this, the project utilised the knowledge and skills of the volunteers of the QWSG in partnership with the BMRG, the Queensland Environmental Protection Agency (EPA) and the Hervey Bay Bird Watchers association.

A major component of the project is to map the extent of migratory and resident shorebird roosting sites and to identify breeding sites on the Burnett Coast up to Tannum Sands. Outcomes of the project will be used to enable local governments to make more informed management decisions about their coastal lands. This may assist local industry and communities to use, conserve and restore “the diverse and highly valuable natural resources of the vast Burnett Mary region” (BMRG 2005, p. 1).

The project was made possible by Federal Government funding programs such as the Natural Heritage Trust and the National Action Plan for Salinity and Water Quality. It is supported by the Queensland Government through EPA in-kind support and specific financial contributions. Regional Local Governments contribute through sharing knowledge and assistance with information dissemination.

2.3 Roles of participants

The project was a collaboration between the Queensland Wader Study Group (QWSG), Hervey Bay Birdwatchers, Queensland Environmental Protection Agency (and Parks and Wildlife Service) (EPA) and the Burnett-Mary Group for Natural Resource Management (BMRG). Project coordination was undertaken by QWSG with funds provided by BMRG and the EPA.

QWSG members undertook all the fieldwork at coastal sites as volunteers in collaboration with volunteer local birdwatchers, including many members of the Hervey Bay Birdwatchers. EPA staff in the region also volunteered their time to help with these surveys of coastal sites. EPA field staff on Fraser Is and EPA patrol boat crew helped with the surveys of breeding sites for resident shorebirds. BMRG provided the Geographic Information System (GIS) technical support and incorporated all the field data into a single GIS system for the region. They also facilitated and coordinated QWSG liaison with local councils once the GIS had been completed.

3. SURVEYS OF BEACHES ON FRASER IS

3.1 Background

As part of their regional planning processes, the Queensland Environmental Protection Agency (EPA) requires information on species of conservation concern in order to better inform planning for different land uses in the region. This list of species of concern includes all migratory shorebirds as well as resident shorebirds that are identified to be under threat in Queensland. Most of Fraser Island is a national park, but the EPA has limited data on its use and value for shorebirds. The EPA intends to close the south-eastern section of the Fraser Is coast to vehicular traffic in the belief that this will improve survival and condition of migratory and resident shorebirds using this area. Fraser Island Resource Ranger, Ivan Thrash had observed large aggregations of shorebirds at Hook Point during other beach patrol activities. However, he was only able to count and verify the species composition of the aggregations on an ad hoc basis. More systematic surveys of these shorebirds were required and the important roost locations needed to be identified and mapped.

Shorebird surveys are always governed by tidal movements. That is to say that shorebirds rest on the high tide and feed when the tides are lower as this is when feeding habitats, such as intertidal mudflats, sandy beaches and claypans are exposed. Given this, shorebird species counts are best obtained at high tide when birds assemble at roosting grounds and are less dispersed and thus more easily counted.

Notwithstanding this convention, surveys of shorebird activity at lower tides are also useful as they help us to recognise risks to feeding and nesting shorebird habitats. Several species do not aggregate at high tide and thus need to be counted at low tide in order to obtain estimates of their abundance. To obtain as much information as possible, low tide surveys were undertaken during the reconnaissance by Harding and Milton. They inspected the south east beach from Hook point to Dilli Village the results of this survey is detailed in Table 3.1.



Figure 3.1.— A lone Red Capped Plover is pictured (right of centre) navigating the 4WD tracks on Fraser Island's south-eastern beach.

3.2 Survey of eastern Fraser Is beaches

Table 3.1. — Low tide counts of shorebirds on Fraser Is ocean beach from Hook Point to track to Dilli Village Driving north (from road exit on beach to Dilli Village track) (Date: 27 – 28 December 2005; Tide: 11:42am low, tide falling; Counters: Sandra Harding, David Milton; Weather 27th: cloud cover 2, no rain, wind 5 – 10 knots, NE; Weather 28th: cloud cover 0, no rain, wind 5 knots, NE).

Species	Number	Date	Time	Behaviour	GPS coordinates
Sooty oystercatcher	1	27 Dec 05	10.00	Feeding wet sand	25.62592 153.08765
Pied oystercatcher	2	“	“	“	“
Masked Lapwing	2	27 Dec 05	10.05	In creek (second creek)	25.61752 153.08984
Crested Tern (juv)	2	27 Dec 05	10.07	Roosting	25.60183 153.09445
Masked Lapwing	2	27 Dec 05	10.15	In creek (first creek – Geerowweea Ck)	25.56848 153.10535
Red-capped Dotterel (1 juv)	3	27 Dec 05	10.20	In creek	25.55127 153.11211
Whimbrel	1	“	“	“	“
Sanderling	3	27 Dec 05	12.33	At water's edge feeding	25.74052 153.08530
Red capped Dotterel (breeding plumage)	1	27 Dec 05	12.42		25.75184 153.08862
Little Tern	2	“	“	Foraging	“
Sanderling	11	27 Dec 05	12.44		25.74912 153.08821
Red-capped Dotterel (breed pl)	1	27 Dec 05	12.56		25.66314 153.07973
Crested Tern (adult and juv)	2	27 Dec 05	13.07	Roosting	25.58508 153.09987
Red capped Dotterel	1	27 Dec 05	17.10	At creek entrance	25.5393 153.11682
Red capped Dotterel (1 juv)	4	27 Dec 05	17.30	At creek mouth	25.53457 153.11887
Red capped Dotterel	2	28 Dec 05	12.27	Feeding waters edge	25.78095 153.08128

Species	Number	Date	Time	Behaviour	GPS coordinates
Sanderling	5	28 Dec 05	12.28	Feeding	
Pied Oystercatcher	4	“	“	“	
Sooty Oystercatcher	1	“	“	“	
Red capped Dotterel	8	“	“	“	
Sanderling	13	28 Dec 05	12.29	Feeding	25.79288 153.08008
Crested Tern	100	28 Dec 05	12.33	Roosting	25.79405 153.07938
Little Tern	7	“	“	“	“
Common Tern	50	“	“	“	“
Sanderling	17	28 Dec 05	12.37	Feeding	25.79545 153.0704

The most abundant shorebird species on the south-eastern Fraser Island beach was the migratory Sanderling (Table 3.1). However, the resident Red-capped Dotterel (Figure 1) was the most widespread, occurring along the entire beach in pairs or family groups. The density of Pied Oystercatchers was also much lower than expected for this length of beach with a plentiful supply of their main food, pippies. Other birds that used the beach for roosting included three species of tern as well as Silver Gull

3.3 North-western Fraser Is high tide survey

Milton and Harding with the help of local Hervey Bay environmental advocates and bird enthusiasts, Don and Lesley Bradley undertook high tide shorebird counts along the closed western beach on Fraser Island from Wathumba Creek north to Rooney Point (see Figure 3.2). The Bradley's kindly provided their boat, "Tern Loose", and time to ensure the identification of isolated sites on Fraser Island's north west beaches. With this contribution, the survey team was able to gain access to some otherwise difficult to get to shorebird habitats. This made possible the completion of high tide species counts from Wathumba Creek to Rooney Point on the north western coast of Fraser Island.

Table 3.2. — Counts of shorebirds on north-western beach of Fraser Island from Wathumba Creek to Rooney Point at high tide. Locations are given in degrees and decimal minutes. (Note: Observations from boat during falling tide (High tide 2.26m at 8:45am); Counters – Sandra Harding, David Milton, Don and Lesley Bradley; Date: 1st January 2005; NF = no position taken)

Species	Number	Time	Notes	GPS coordinates
Pied Oystercatcher	2	9:10	Roost at mouth of small creek S of Wathumba Ck	25 00.59 153 12.317
Pacific Golden Plover	11	9:10	“	“
Lesser Sand Plover	126	“	“	“
Large Sand Plover	40	“	“	“
Red-capped Plover	26	“	“	“
Bar-tailed Godwit	2	“	“	“
Red-necked Stint	425	“	“	“
Silver Gull	2	“	“	“
Caspian Tern	1	“	“	“
Little Tern	29	“	“	“
Crested Tern	2	“	“	“
Pied Oystercatcher	2	9:40	South bank of Wathumba Ck downstream from campground	24 58.93 153 13.701
Masked Lapwing	2	“	“	“
Pacific Golden Plover	29	“	“	“
Lesser Sand Plover	8	“	“	“
Large Sand Plover	4	“	“	“
Red-capped Plover	8	“	“	“
Eastern Curlew	13	“	“	“
Whimbrel	31	“	“	“
Common Greenshank	18	“	“	“
Bar-tailed Godwit	60	“	“	“
Great Knot	6	“	“	“
Red-necked Stint	190	“	“	“
Pacific Golden Plover	6	9:50	North bank of Wathumba Ck	24 58.738 153 13.609
Lesser Sand Plover	4	“	“	“
Red-capped Plover	2	“	“	“
Eastern Curlew	52	“	“	“
Whimbrel	20	“	“	“
Bar-tailed Godwit	19	“	“	“

Species	Number	Time	Notes	GPS coordinates
Red-necked Stint	13	“	“	“
Silver Gull	1	“	“	“
Pied oystercatcher	2	10.00	250m north of Wathumba Creek	NF
Pied oystercatcher	4	10.02		24 57.860 153 13.783
Silver Gull	16	10.02		“
Lesser Sand Plover	2	10.02		“
Pied Oystercatcher	2	10:07	Beach north of Wathumba Ck	24 57.375 153 13.868
Whimbrel	268	“	“	“
Bar-tailed Godwit	67	“	“	“
Silver Gull	2	“	“	“
Red-capped Dotterel	2	10.15	Separate from last	NF
Whimbrel	3	10.19		25.56848 153.10535
Red-capped Dotterel	2	10.19		“
Whimbrel	6	10.25		24 54.033 153 13.042
Eastern Curlew	6	10.25		“
Silver Gull	1	10.25		“
Whimbrel	7	10.26		24 53.839 153 12.924
Bar-tailed Godwit	1	10.26		“
Pacific Golden Plover	11	10.26		“
Pied Cormorant	36	10.26		“
Red-capped Dotterel	2	10.26		“
Whimbrel	1	10.38	Separate from last	NF
Whimbrel	2	10.41	Separate from last	NF
Whimbrel	1	10.43	Separate from last	NF
Silver Gull	4	10.45		24 49.283 153 9.120
Eastern Curlew	2	10.45		“
Whimbrel	8	10.45		“
Whimbrel	2	10.47	Separate from last	NF
Pied Oystercatcher	2	10.47	Separate from last	NF
Crested Tern	43	10.50		24 48.991 153 7.566
Pied Oystercatcher	2	10.50	“	“
Caspian Tern	1	10.50	“	“
Red-capped Dotterel	4	10.50	“	“

Species	Number	Time	Notes	GPS coordinates
Crested Tern	320	10.55		24 49.032 153 7.038
Common Noddy	3	10.55	“	“
Pied Cormorant	6	10.55	“	“
Red-capped Dotterel	1	10.55	“	“
Crested Tern	170	11.00	“	24 48.946 153 7.024
Whimbrel	6	11.00	“	“
Bar-tailed Godwit	7	11.00	“	“
Eastern Curlew	2	11.00	“	“
TOTAL SHOREBIRDS	1549			

A total of 2184 shorebirds and terns were identified along the entire section of beach surveyed along the western coast of Fraser Is from south of Wathumba Ck to Rooney Pt (Table 3.2). Of these, 1549 were shorebirds of 12 different species. The majority of these shorebirds were found roosting either at the mouth of Wathumba Ck, or at the mouth of a small un-named creek about 0.5 km to the south. The most abundant shorebird species seen were the migratory Red-necked Stint (615) and Whimbrel (355). These two species accounted for over 62% of all the shorebirds counted. This is an exceptionally large number of Whimbrel for an area of this size in Queensland as the species only occurs in low densities in most parts of the state. These numbers of Whimbrel may well be nationally significant as they represent 0.6% of the total East Asian Australasian Flyway population.



Figure 3.2 — Terns roosting near Rooney Point on north west coast of Fraser Island.

3.4 South-eastern Fraser Is high tide survey

Ground-truthing on Fraser Island confirmed shorebird roosting sites identified by QPWS rangers. Further consultation with Fraser Island resource ranger Ivan Thrash presented historical records of consistent shorebird numbers at several sites along the eastern beaches of

Fraser Island. As well, Mr Thrash was able to provide recent count data of the North Spit roost (see Figure 3.3). The area known as North Spit on the south east beach of the island is situated approximately five kilometres north of Hook Point and may be one of Fraser Island's main shorebird roosts (see Figure 3.3). The south-eastern beach has heavy four wheel drive vehicle traffic except at high tide. High tide vehicle traffic poses a significant risk to shorebird survival at these beach roosts (I Thrash 2005, pers. comm. 28 December).

These two roosts on Fraser Island hold exceptional numbers of shorebirds and terns at high tide (Table 3.3). They are quite remote from shorebird feeding habitat and have probably developed because of the excessive disturbance found at the nearest existing roost at Inskip Pt. Harding and Milton saw large numbers of shorebirds leaving the Inskip Pt roost as the tide rose and fly north-east along the Fraser Island coast. The identification of these roosts confirms that these birds seen leaving Inskip Pt have chosen to roost on the adjacent Fraser Is coast because there is less disturbance at these sites at high tide.

The numbers of Grey Plover counted by Thrash on 23 December 2005 are among the largest single counts made of this species in Australia. It represents almost 2.3% of the total Flyway population and makes the site internationally significant. The large numbers of terns that also use the site are also internationally significant, especially the large numbers of the two migratory species (Common and Little Terns).

At present, the Hook Pt beach roosts are still vulnerable to disturbance and vehicle strikes as the birds use the beach close to the high tide line. At the North Spit, there has been much sand deposition. The species roosting there are found further from the main vehicle traffic zone.



Figure 3.3 — High tide shorebird roost on south-eastern beach of Fraser Island north of Hook Point.

Table 3.3 — High tide counts of shorebirds on southern section of east coast beach on Fraser Island. Count recorded on 23 December 2005 by QPWS ranger, Ivan Thrash. Counts recorded on 2 Jan 2006 by QWSG members Sandra Harding and David Milton.

Site	Date	Tide Time	Tide Ht (m)	Count Time	Latitude	Longitude	Species	Count
Beach N Hook Pt	2 January, 2006	9:36	2.26	11:00 – 11:30	25.78396	153.07969	Grey Plover	20
							Red-capped Plover	2
							Whimbrel	2
							Bar-tailed Godwit	1323
							Red Knot	15
							Great Knot	300
							Brahminy Kite	1
							Crested Tern	2
							Grey Plover	30
							Lesser Sand Plover	377
North Spit	2 January, 2006	9:36	2.26	9:30 – 9:50	25.76163	153.08693	Large Sand Plover	107
							Red-capped Plover	6
							Bar-tailed Godwit	33
							Sanderling	12
							Little Tern	474
							Grey Plover	570
							Lesser Sand Plover	580
							Large Sand Plover	190
							Ruddy Turnstone	3
							Whimbrel	2
North Spit	23 December, 2005	13:30	1.52	13:00 – 13:45			Grey-tailed Tattler	15
							Bar-tailed Godwit	243
							Sanderling	50
							Common Tern	3400
							Little Tern	1000

3.5 Conclusions

A total of 5,500 shorebirds were counted along the two sections of the Fraser Is coast. The south-eastern section between Dili Village and Hook Pt had the most shorebirds (3,900) during the survey period. These counts of roost sites on Fraser Island have established important new roosts that are now incorporated into the QWSG, EPA and BRMG databases. The surveys of shorebirds on Fraser Island have shown that both the south-eastern and north-western beaches are important for shorebirds. One migratory species, Grey Plover, was present in internationally-significant numbers at North Spit on the south-eastern beach. Another migratory species, Whimbrel, was also found in nationally significant numbers on the north-western beaches. The abundance of both species on Fraser Island is higher than anywhere else in south-eastern Queensland. This makes these sites of great regional importance for these species. The surveys established that the area of the south-eastern Fraser Is beach that is planned to be closed to vehicular traffic is an important roost site for internationally-significant numbers of shorebirds. Closing the beach to vehicular traffic will reduce disturbance and increase the survival of these shorebirds by minimising car strikes.

Long term monitoring by QPWS staff on Fraser Is has shown a steady decline in the numbers of the resident Pied Oystercatchers that occur along this section of the beach. Beach Stone Curlew have bred along this section of the beach in the past (I. Thrash pers. comm. Dec 2005). Thus reduction or removal of vehicular traffic along the south-eastern beach may also allow more resident shorebirds to return and breed after the threat of vehicle strikes is removed.

4. SHOREBIRD HIGH TIDE ROOST MAPPING ON THE COAST

4.1 Survey approach

4.1.1 Aerial reconnaissance

Coast from Town 1770 to Pt Vernon

The first step in mapping the high tide shorebird roosts along the coast of the BMRG region north of Point Vernon was to undertake an aerial reconnaissance survey. This can be most effectively done with a helicopter. Funding for the helicopter reconnaissance was provided by the EPA Southern region through Kirsten Wortel. Over two half-days in December 2005, the survey team of Milton and Harding identified 39 shorebird roost sites along the mainland coast from Eurimbula National Park north of the Town of 1770 south to Point Vernon in Hervey Bay. From the helicopter, the team was able to assign approximate GPS coordinates, make general roost descriptions and classify the major shorebird species within each observed roost (see Table 4.1).

An approximate count of shorebird species present at each location was also made. The aerial survey covered the area between 1770 and Burnett Heads on 30 December, 2005 and from Burnett Heads, south to Pt Vernon on 31 December, 2005 (Figure 4.1). Total flying time was approximately five hours. However, almost half of this air time was spent travelling to the start of each day's survey.

On-ground counts of four roosts (numbers 15, 16, 33 and 35) were undertaken by Milton and Harding between the 28 and 31 December 2005. See Table 4.2 for details of these species counts.



Figure 4.1 — Picture (left) of Elliott River south bank roost number 17 (waypoint 021). Picture (right) of Gregory Islands in the Burrum River Roost number 30 (waypoint 32).

Table 4.1 — Roosts from Town of 1770 to Pt Vernon identified during aerial survey on 30 — 31 December 2005. Waypoints refer to red tags on maps in Appendix A. (Note: High tide on 30 December was 8.30 am at Gladstone (4.3m) and 8.17 am at Burnett Heads (3.17m). High tide on 31 December was 9.16 am at Gladstone (4.43 m) and 8.37 at Burnett Heads (3.28m)).

Roost number	Roost name	Waypoint Number	Aerial (Y/N)	Roost description	QWSG Site code	Latitude	Longitude	Species	No of birds	Time
1	Opp boat ramp – 1770 A5		N	Sand beach at the eastern end of Eurimbula NP opposite 1770 town	NS335			Medium waders	30	7.55
2	Upper 1770	1	N	Bank in small salt pan behind mangroves	NS36	24.2102	151.8615	Medium waders	60	7.57
3	Broadwater on Blackwater Creek	3	Y	Mangrove roost on west bank opposite hut		24.442	152.0071	Grey-tailed Tattler	20	8.15
4	Mitchell Creek mouth	2	Y	Sand bank inside Mitchell Creek/Broadwater		24.4283	152.0006	Eastern Curlew Unidentified Terns	25 >50	8.17
5	Baffle Creek	4	Y	Inside sand spit on south side of mouth of Baffle Creek	NS07	24.4283	152.0006	Eastern Curlew	50	8.23
6	South bank Baffle Creek	5	Y	Mangrove roost in small creek on southwest side of first channel inside mouth of creek		24.526	152.0587	Grey-tailed Tattler	15	8.28
7	Littabella Creek	6	Y	Sand spit on north side of mouth		24.5907	152.1176	Eastern Curlews Terns	15 25	8.35
8	Kolan River	7	Y	Western edge of sand		24.6439	152.1728	Eastern Curlew	2	8.43

Roost number	Roost name	Waypoint Number	Aerial (Y/N)	Roost description	QWSG Site code	Latitude	Longitude	Species	No of birds	Time
	north side			promontory on the inside north bank of Kolan R mouth						
9	Kolan River mouth S side	8		Sand spit at the mouth of Kolan R on the estuary side		24.6536	152.1898	Eastern Curlew Unidentified Tern	50 400	8.45
10	Skyring Estuary north bank	9	Y	Beach on north bank of Skyring Estuary mouth and mangroves behind		24.7218	152.2923	Bar-tailed Godwit Sand Plover Whimbrel Grey-tailed Tattler	5 2 21 15	8.50
11	Skyring Estuary south bank	10	Y	Sand spit inside south side of estuary opening		24.727	152.3022	Bar-tailed Godwit Eastern Curlew	100 5	8.52
12	Skyring Estuary mangroves	12	Y	Mangroves on south side of south side of Skyring Estuary east of Estuary mouth, birds dispersed inside mangroves		24.7483	152.3428	Whimbrel	26	8.57
13	Skyring Estuary Island	11?	Y	Beach on south side of island well inside mouth of estuary		24.7352	152.335	Sand plover/ Golden Plover	50	9.05
14	Burnett River rock wall beach	16	Y	Sand beach inside of north bank rock wall, west of ocean beach	RKWB	24.7536	152.3945	Small/medium waders	70	9.15

Roost number	Roost name	Waypoint Number	Aerial (Y/N)	Roost description	QWSG Site code	Latitude	Longitude	Species	No of birds	Time
				adjacent to rock wall						
15	Elliott Heads sand bank	17	Y	Sand bank south of rocks in middle of Elliott River mouth		24.926	152.4912	Bar-tailed Godwit Unidentified Terns	30 60	7.40
16	Elliott River north bank claypan	20	N	Sand beach on northern edge of claypan at the upper end of the second inlet		24.9157	152.4735	Easter Curlew Whimbrel	15 6	7.45
17	Elliott R beach south side	21	N	Sand beach of south side of river 200m upstream from north bank claypan roost		24.9372	152.4743	Bar-tailed Godwit Golden Plover	50 20	7.47
18	Elliott R south bank mangroves	22	N	Mangrove roost down stream of north bank claypan roost on south side of river		24.934	152.4796	Whimbrel	25	7.48
19	Coonarr Creek north bank	25	Y	Sand beach on inside mouth of north bank of Coonarr Ck		24.9686	152.4879	Golden Plover Eastern Curlew	5 1	7.53
20	Coonarr Creek mangroves	23	N	Mangrove roost on north bank approx 300 m inside mouth of Coonar Ck after large sand basin		24.9704	152.4829	Whimbrel	3	7.54
21	Coonarr Creek sand island	24	Y	Sand bank in mouth of Coonar Ck		24.9716	152.4892	Pied Oystercatcher	2	7.56

Roost number	Roost name	Waypoint Number	Aerial (Y/N)	Roost description	QWSG Site code	Latitude	Longitude	Species	No of birds	Time
								Crested tern	12	
22	North bank Theodolite Creek	26	Y	Sandy beach inside mouth of north side of Theodolite Creek		25.0693	152.545	Lesser Sand Plover	100	8.02
								Eastern Curlew	1	
23	Theodolite Creek North bank mangrove	27	Y	Mangrove roost about 400 m inside mouth of Theodolite Ck north bank, birds well inside mangroves away from edge		25.0713	152.5361	Grey-tailed Tattler	10	8.04
								Whimbrel	65	
24	Upper Theodolite Creek claypan	28	N	Claypan on south bank behind mangroves after creek turns sharply north, south of the line of the north bank		25.0741	152.5224	Bar-tailed Godwit	35	8.07
25	Theodolite Creek south bank mangroves	29	N	Mangroves lining south bank upstream of first small channel to south		25.0775	152.5249	Whimbrel	4	8.08
26	Theodolite south bank tributary	30	N	Mangroves lining western side of first small tributary inside of south bank of Theodolite Ck		25.0785	152.5437	Grey-tailed Tattler	40	8.09
27	Burrum River north bank	31	Y	Sand beach on north bank at point where beach turns northwards		25.173	152.6199	Bar-tailed Godwit	150	8.13
								Eastern Curlew	20	

Roost number	Roost name	Waypoint Number	Aerial (Y/N)	Roost description	QWSG Site code	Latitude	Longitude	Species	No of birds	Time
28	Gregory Island, Burrum River	32	Y	Mangrove roost half way along the most northern island along south side of river, where island is at its most narrow (island starts opp Walkers Point town)		25.1769	152.5789	Unidentified Terns Grey-tailed Tattler	20 40	8.16
29	Burrum River south bank claypan	33	N	Small bank in middle of claypan behind mangroves on south bank opp eastern end of Gregory islands		25.1894	152.5845	Bar-tailed Godwit	100	8.18
30	Toogoom Creek north bank claypan	34	N	Claypan approx 1km north of Toogoom Ck and approx 400m inland from coast birds roosting in shallow water among sparse mangroves		25.2315	152.6439	Bar-tailed Godwit Caspian tern	40 6	8.21
31	Toogoom Creek north side	36	Y	Mangrove roost in loose aggregation of mangroves on coast north of mouth of Toogoom Ck adjacent to house		25.2396	152.6632	Grey-tailed Tattler	26	8.22

Roost number	Roost name	Waypoint Number	Aerial (Y/N)	Roost description	QWSG Site code	Latitude	Longitude	Species	No of birds	Time
32	Toogoom Creek claypan	35	N	Claypan behind mangroves on north side of Toogoom Ck upstream past first large southward turning bend		25.2499	152.6533	Eastern Curlew Unidentified Terns	50 20	8.24
33	Dundowran Creek mouth	37 (N side)	Y	Sand spit on south side of Dundowran Ck mouth, birds also roost on sand bank on north side of creek mouth if disturbed		25.2652	152.7206	Mixed waders	300 (see count sheet)	8.28
		38 (S side)				25.2673	152.7303			
34	Eli Creek claypan	39	N	Claypan in mangroves on eastern side of middle reaches of Eli Creek		25.2671	152.8083	Bar-tailed Godwit Grey-tailed Tattler	60 10	8.44
TOTAL	Combined	1-39						All species	2360	



Figure 4.2 — Photograph of roost 15 (waypoint 17) in the mouth of Elliot River taken by Milton during the aerial survey of December 2005.

Table 4.2 — Ground counts of three roosts made during survey period 28 – 31 December 2005. These ground counts are of sites surveyed from air but were all made on falling tides well after the time of high tide. The only site not counted during the aerial survey was Bundaberg Port Swamp (QWSG site: BPSW), which was not counted from the air due to being visited on the ground prior to the aerial survey.

Roost number(s)	Roost name	Waypoint Number	QWSG Site code	Tide Time	Tide Ht (m)	Count Time	Latitude	Longitude	Species	Count
15 - 16	Elliott Heads to Riverview	19 - 22	ELRI	6:25	2.91	11:50 – 12:45	24.9224	152.49113	Pacific Golden Plover	34
									Lesser Sand Plover	10
									Red-capped Plover	2
									Ruddy Turnstone	7
									Eastern Curlew	40
									Whimbrel	34
									Grey-tailed Tattler	8
									Terek Sandpiper	2
									Bar-tailed Godwit	29
									Little Egret	3
35	Bundaberg Port swamp	Not counted	BPSW	7:06	3.01	9:50 – 10:45	24.76851	152.39282	Red-capped Plover	50
									Black-winged Stilt	361

Roost number(s)	Roost name	Waypoint Number	QWSG Site code	Tide Time	Tide Ht (m)	Count Time	Latitude	Longitude	Species	Count
									Red-necked Avocet	8
									Sharp-tailed Sandpiper	1351
									Red-necked Stint	715
									Curlew Sandpiper	10
									Australian Pelican	27
									Little Pied Cormorant	1
									White-faced Heron	1
									Australian White Ibis	2
									Royal Spoonbill	19
									Osprey	1
									Silver Gull	15
									Gull-billed Tern	1
									Caspian Tern	8
33	O'Regan Ck mouth	37	DDCK	8:49	3.92	11:00 – 11:45	25.2652	152.7206	Pied Oystercatcher	7
									Lesser Sand Plover	1

Roost number(s)	Roost name	Waypoint Number	QWSG Site code	Tide Time	Tide Ht (m)	Count Time	Latitude	Longitude	Species	Count
									Red-capped Plover	2
									Eastern Curlew	34
									Whimbrel	14
									Grey-tailed Tattler	97
									Bar-tailed Godwit	295
									Great Knot	269
									Red-necked Stint	12
									Silver Gull	22
									Caspian Tern	2
									Crested Tern	5



Figure 4.3 — Photograph of Roost 16 (waypoint 020) Elliott River north bank claypan



Figure 4.4 — Photograph of Roost 35 Bundaberg Port dredge spoil ponds, Burnett Shire Council



Figure 4.5 — Photograph of roost on western side of O'Reagan Creek mouth, Hervey Bay City Council

The aerial survey of the coast identified a large number of new shorebird roosts that had not been previously documented. All creek and river mouths supported shorebird roosts and these varied in size depending on the amount of feeding habitat available. A total of 2360 shorebirds of several species were identified during the survey (Table 4.1). This survey provides an initial estimate of the number of birds roosting in this region. Follow-up counts of some sites from the ground (Table 4.2) show that the aerial surveys under-estimate the number and diversity of species found at each site. Thus, the figures obtained from the aerial survey may be less than half the total number of shorebirds present in the survey area. This is why counts of shorebirds from the ground are needed to accurately identify species and count the numbers of birds present at each site. Shorebird numbers appear to be higher in the southern part of the survey area – south from the Burnett River mouth. This is probably because of the slightly higher tidal range in this area and the larger area of intertidal mudflat available for feeding.

Of particular significance is the large number of shorebirds that were present at the artificial dredge spoil pond on the Bundaberg Port lands (Table 4.2 – QWSG site: BPSW). This site was counted prior to the aerial survey on a falling tide. At this time, it contained almost as many birds as was counted during the entire aerial survey of the rest of the coast. The species present included both resident and migratory species as well as evidence of large numbers of breeding Black-winged Stilt. Some species, such as the Sharp-tailed Sandpiper prefer freshwater or brackish non-tidal habitats and rarely feed in intertidal areas. This was the only coastal site where this species was seen during the reconnaissance survey. During subsequent visits, the site varied greatly in the number of birds that used the site. The number of birds within the dredge spoil ponds appeared to be related to the frequency and extent of tidal flushing the Bundaberg Port allowed. The reconnaissance visit coincided with a recent large-scale flushing and followed heavy local rainfall. These events reoxygenate the water and allow large populations of small invertebrates to flourish in the ponds.



Figure 4.6 — Sandra Harding and pilot with Cessna fixed wing plane used in aerial reconnaissance of the northern BMRG region in February 2007.

Northern BMRG region from Tannum Sands to Eurimbula NP

The October 2006 survey only visited and mapped known roosts between Tannum Sands and Town of 1770, including all roosts already recorded in the QWSG database. The total count was about 60% of that recorded by summing up roost totals from existing counts at these roosts. This result suggested that there were multiple roosts present in this region that had not been

covered by the survey. We decided to undertake additional aerial reconnaissance of this region prior to the March 2007 survey in order to verify that all roosts in the area were being counted and had been mapped (Figure 4.6). The aerial reconnaissance was undertaken with a Cessna fixed wing plane from Gladstone in mid February 2007. The date of the aerial survey (2 – 3 February 2007) coincided with tides of similar height to those predicted for the March 2007 survey dates (17 – 22 March). Thus, all shorebirds seen could be expected to use the same roosts during the March survey weekend. This strategy proved successful, with an additional 15 roosts being identified from the air.

4.1.2 Ground surveys

The coast from Tannum Sands to Pt Vernon extends for over 250 km and contains many areas remote from convenient access points. In order to survey and map all high tide roosts QWSG broke the coast up into two sections, based on the initial aerial reconnaissance (Section 4.1). The two sections were arbitrarily separated at Moore Park, west of the Burnett R mouth. Each section was surveyed twice, with southern section counted and mapped in February and October 2006. The northern section was surveyed and mapped in October 2006 and further mapping was undertaken in March 2007.

On each survey, each group of counters were assigned a site, or group of sites that were able to be covered within one high tidal cycle. Each group were provided with an aerial photograph of each roost (provided by Kirsten Wortel from the EPA). They also completed forms with details of roost habitat characteristics and any threats identified as well as a count form. Each survey was chosen to coincide with either a new or full moon spring tide during the survey weekend. It was planned that all roosts would be surveyed and mapped over the same two day period to avoid potential double counting of birds that move between adjacent roosts. However, some groups had several roosts to survey and map and these could not be completed within the weekend. In these cases, surveys continued for up to another two days before they were all done.



Figure 4.7 — Surveying and mapping new roost sites in the northern BMRG region in March 2007. Local resident, Brian from Turkey Beach at new roost site in Worthington Ck (left) and QWSG members Dawn and Peter counting shorebirds on sand spit in Colosseum Inlet.

Coordination of the survey teams was undertaken on behalf of QWSG by Kirsty Balmer. Kirsty identified local and QWSG members with an appropriate skill mix to undertake the surveying at

each roost. Considerable skill and judgement was required to construct effective survey teams. Some groups required a high level of bushmanship or boating and 4WD skills to safely access each roost and complete the surveying and mapping on the designated high tides. Many roosts had only been identified by air and had to be accessed by 4WD or by boat. Many roosts were behind dense stands of fringing mangroves and needed considerable boating or bush skills to negotiate access and return while the tide was favourable. No accidents occurred during the entire study and the worst incident recorded was a broken propeller from hitting a submerged rock.

4.1.3 Data collation and analysis

Once the surveys were completed, the forms were sent to QWSG for collation. New roosts were assigned a unique name and 4 letter roost code. The shorebird count data were entered into the QWSG count database. Summaries of the counts at each roost, habitat descriptions and threats were then added to the table of roost details that was attached to the GIS layer generated for each roost. Maps and the coordinates for each roost waypoint were sent to the BMRG GIS officer for digitising and overlaying on satellite imagery of the area in question. When all roost mapping had been completed after the March 2007 survey, the table of roost details was finalised and was forwarded to the GIS officer for attachment to the polygon generated for each roost.

All data was stored centrally with QWSG on a MS Access database. Summaries were generated by making queries of the database. Maps of the locations of roosts and breeding resident species were generated with ArcGIS 9.2 GIS software. To help classify roosts into broad categories of their relative importance to shorebirds, we have divided them into three size categories using criteria of Driscoll (1996; 1997) to allow comparison with previous studies. These arbitrary groupings appear to have some biological relevance as there are few roosts that have total numbers of shorebirds similar to the cut off values. These categories were: small - < 300 birds; medium: 300 – 1000 birds and large: >1000 birds. All roosts with 300 – 1000 birds were highlighted in bold in the tables and those over 1000 birds were also bolded, but have the row also highlighted in grey.

4.2 Summaries of high tide roost surveys for each shire

Following the two aerial reconnaissance surveys that covered the entire region, we now had a comprehensive picture of the distribution of shorebird roosts. The three ground surveys had successfully surveyed 99% of the roosts along the coast from Tannum Sands south to Pt Vernon at least twice. A total of 155 roosts are now known from the study area and 126 new roosts were mapped and counted by volunteers. The 29 roosts that were not mapped in this study either could not be located or were found to be staging roosts that were identified during previous surveys on neap tides. The remaining roosts are all critical high tide roosts that are used by shorebirds on spring tides. We discuss the significance of the survey results for each shire and summarise the important roosts for species that occur in the survey region in internationally significant numbers.

4.2.1 Calliope Shire

The eastern boundary of Calliope Shire (eastern side of Twelve Mile Ck) is a short distance within the study area. Thus, there are few roosts within the BMRG region that fell within the Calliope Shire boundaries (Table 4.3). Most of the eight roosts surveyed were small; the largest roost had fewer than 150 birds. The list also included one freshwater impoundment, Awoonga Dam on the Boyne River (Table 4.3).

Table 4.3 — The highest total count of shorebirds and the maximum number of species seen at each roost in Calliope Shire. The data includes QWSG records collected at other times besides the BMRG surveys. Roosts with over 1000 birds are highlighted in grey and roosts with 300 – 1000 birds are shown in bold.

Roost site	QWSG site	Latitude	Longitude	Max. count	No. species
Wild Cattle Is, Tannum Sands	WCIS	-23.94998	151.37798	50	7
Tannum Ck, Tannum Sands	TANC	-23.97775	151.39995	13	4
Colosseum Inlet lagoon	CILA	-24.03045	151.4285	138	5
Colosseum Inlet sandy beach	CISB	-24.0315	151.43278	51	6
Colosseum Inlet saltmarsh	CISM	-24.03344	151.4292	112	5
Twelve Mile Ck 1	TMC1	-24.04814	151.41614	101	4
Twelve Mile Ck 2	TMC2	-24.05233	151.4225	49	5
Awoonga Dam Pelican Bay	ADPB	-24.07417	151.3022	60	6
TOTAL = 8 roosts				574	19

A total of 19 species were recorded during the surveys at these eight roosts (Table 4.4). Of these, several were only seen at Awoonga Dam (Black-fronted Dotterel, Black-winged Stilt, Comb-crested Jacana, Masked Lapwing and Sharp-tailed Sandpiper). Most of these species prefer freshwater habitats, although Sharp-tailed Sandpiper will use coastal marine habitats on occasion. The most abundant species was Whimbrel and it was also the most widespread, being found at several roosts during each survey (Table 4.4).

4.2.2 Miriam Vale Shire

Miriam Vale shire had the largest number of roosts of the five shires surveyed, with 75 roosts (Table 4.5). The large difference in the number of roosts between shires is somewhat misleading. Miriam Vale has the longest coastline of the five shires within the BMRG region surveyed and currently has little coastal development in areas important to shorebirds. As well, all the coast of Hervey Bay City was not included in the survey. Several large roosts south of Point Vernon in Hervey Bay City were surveyed during the previous mapping project (Harding et al. 2005) and so were not included here.

Table 4.4 — The numbers of each species of shorebird counted at roosts in Calliope Shire during the October 2006 and March 2007 surveys (Nos = total number counted and N = the number of roosts where the species was seen).

Species	October		March	
	Nos	N	Nos	N
Bar-tailed Godwit	21	2	—	—
Beach Thick-knee	1	1	—	—
Black-fronted Dotterel	6	1	2	1
Black-winged Stilt	14	1	6	1
Comb-crested Jacana	21	1	—	—
Eastern Curlew	9	3	18	4
Greenshank	8	3	2	1
Grey-tailed Tattler	16	1	6	1
Lesser Sand Plover	—	—	22	1
Masked Lapwing	8	1	—	—
Pacific Golden Plover	—	—	8	1
Pied Oystercatcher	—	—	4	2
Red-capped Plover	9	2	34	5
Red-necked Stint	—	—	10	1
Ruddy Turnstone	—	—	5	1
Sharp-tailed Sandpiper	7	1	5	1
Sooty Oystercatcher	—	—	2	1
Terek Sandpiper	27	2	—	—
Whimbrel	87	1	217	5
TOTAL	234		341	

Table 4.5 — The highest total count of shorebirds and the maximum number of species seen at each roost in Miriam Vale Shire. The data includes QWSG records collected at other times besides the BMRG

surveys. Roosts with over 1000 birds are highlighted in grey and roosts with 300 – 1000 birds are shown in bold.

Roost site	QWSG site	Latitude	Longitude	Max. count	No. species
Tiber Point	NR07	-23.9899	151.43985	1	1
Morris Ck claypan Rodds Pen	MOCC	-23.99452	151.63371	26	4
Hummock Hill Is Beach 1	HIB1	-23.99478	151.4704	2	2
Hummock Hill Is Beach 2	HIB2	-23.9963	151.45528	2	1
Hummock Hill Is Rocks	HHIR	-23.9967	151.464	24	4
Rodds Peninsula W side	RPWS	-24.004	151.64378	48	5
Spit End, Rodds Peninsula	NR09	-24.0069	151.5986	480	8
Rodd's Harbour inside Morris Creek	MOCK	-24.0083	151.6333	41	5
Hummock Hill Is SW side	HHIW	-24.01392	151.45631	35	4
Morris Creek mouth	NR08	-24.0189	151.6281	55	4
Rodds Peninsula south-east	RPSE	-24.025	151.7297	1496	10
Hummock Hill Is S side	HHIS	-24.02707	151.46558	119	8
Rodd's Harbour Bird Island Rock	BIRK	-24.0283	151.625	4	2
Jenny Lind Creek	JLCK	-24.03572	151.76248	338	11
Mundoolin Rocks opp.	NR10	-24.03656	151.52063	697	13
Chinaman Ck-Jenny Lind Junction	CHJL	-24.04033	151.7475	62	3
Pancake Creek inner north	NR12	-24.04103	151.70742	253	7
Jenny Lind Ck sandhill	JLCS	-24.04181	151.75783	235	4
Pancake Ck mangroves	PCMA	-24.04243	151.73506	532	6
Boyne Ck causeway, Mundoolin Pen	CIBC	-24.04372	151.493	49	6
Mangrove Bay	NR11	-24.04968	151.58844	545	8
Rodds peninsula south	RPSS	-24.05124	151.7003	158	7
Mundoolin Rocks W side	MRWS	-24.05185	151.50841	724	14
Mundoolin Rocks South	NS27	-24.0519	151.5206	4	2
Colosseum Inlet mangrove Ck mouth	CIMM	-24.05628	151.4586	13	2
Pancake Ck upper samphire	PCUS	-24.05682	151.72766	50	2
Causeway Ck Rodds Peninsula	CSCK	-24.05701	151.68756	5	4
Rodd's Harbour sand island	RDSA	-24.05803	151.65181	15	2
E side Colosseum Inlet	CIEM	-24.05828	151.48548	11	1
Colosseum Inlet mangrove Ck 1	CIM1	-24.0593	151.4615	1	1

Roost site	QWSG site	Latitude	Longitude	Max. count	No. species
Mundoolin Rocks S beach	MURS	-24.06217	151.52524	735	14
Colosseum Inlet	COIN	-24.0667	151.4778	5	2
Colosseum Inlet mangrove Ck 2	CIM2	-24.0674	151.4539	56	2
Colosseum Inlet E claypan	CIEC	-24.06769	151.47428	260	8
Turkey Beach sand island	TUR1	-24.06905	151.65511	36	1
Colosseum Inlet mangrove Ck saltpan	CIMS	-24.06908	151.457	253	7
Middle Is eastern beach	MIBE	-24.0699	151.77099	609	3
Pancake Ck upper claypan	PCUC	-24.07005	151.72483	109	7
Turkey Beach town foreshore	TUR3	-24.07408	151.65091	31	3
Thorton Creek, Rodds Harbour	THCK	-24.07641	151.55489	33	3
Upper Thornton Ck, Rodds Harbour	THUC	-24.08867	151.57997	25	3
Turkey Beach A	NS28	-24.08936	151.66277	13	1
7 ml Ck mangroves, Rodds Hbr	SMCM	-24.09364	151.56384	40	2
Middle/Pancake Ck claypan	MIPC	-24.09377	151.71276	69	5
Middle/Pancake Creek connection	MIPN	-24.09946	151.72033	37	7
Oaky Ck Turkey Beach	OCTB	-24.1018	151.67166	123	4
Worthington Ck W bank	WCWB	-24.1021	151.6771	111	4
Upper 7 ml Ck Inlet SE	SMCS	-24.10226	151.5787	34	2
Middle Ck mangroves	MIMA	-24.11088	151.73444	47	3
Upper 7 ml Ck Inlet mangrove Is	SMCI	-24.11535	151.55896	30	1
Middle Ck sandflat	MISF	-24.11683	151.7411	59	4
Upper 7 ml Ck Inlet W bank	SMCW	-24.1173	151.5556	12	4
Middle Creek A7	NR13	-24.1225	151.7836	118	7
Middle Ck mouth island	MCMI	-24.12427	151.77659	20	4
Middle Ck N bank claypan	MINC	-24.12499	151.75895	18	4
Middle Ck S bank claypan	MISC	-24.13075	151.77068	11	2
Bustard Bay sandbank	BBSB	-24.16463	151.8754	327	6
opp boat ramp - 1770 A5	NS35	-24.1717	151.8764	1	1
Eurimbula Ck W bank	EUWB	-24.17404	151.84061	37	4
Bustard Bay beach	BUBA	-24.17428	151.86035	7	2
Eurimbula Creek	EUCK	-24.1764	151.8375	23	2
Upper Toms Ck N bank	UTNB	-24.1885	151.87985	24	4

Roost site	QWSG site	Latitude	Longitude	Max. count	No. species
Roundhill Ck mangroves	RHCM	-24.19733	151.86421	106	3
Upper Toms Ck claypan	UTCC	-24.19803	151.87006	117	6
Roundhill Ck mangrove Is	RHMI	-24.20728	151.85631	72	3
Roundhill Ck W bank	RHWB	-24.20829	151.85419	16	3
Mitchell Ck mangroves	MCMA	-24.42702	152.00143	8	1
Mitchell Ck foredune	MCFD	-24.4308	152.00412	20	1
Mitchell Ck sandbank	MCSB	-24.43966	152.0079	40	4
Mitchell Ck sandspit	MCSS	-24.44012	152.01022	15	1
Baffle Creek mouth S side	NS07	-24.51243	152.05573	95	6
Baffle Ck S mangrove bank	BCMB	-24.52668	152.05909	67	7
Littabella Ck north bank	LCNB	-24.59207	152.11609	70	9
Kolan River Ck mangroves	KRCM	-24.6494	152.17988	36	6
TOTAL = 75 roosts				10447	29

There was one large roost in Miriam Vale Shire that had almost 1500 birds (Rodds Peninsula south-east and nine medium-sized roosts that had more than 300 shorebirds. This large roost is one of a complex of multiple roosts in Pancake Ck-Middle Ck that had a total of 3454 shorebirds during the survey. This single small creek system supported over 30% of the shorebirds in Miriam Vale Shire and 15% of all the shorebirds on the Burnett Coast. This makes Pancake Ck one of the most critical systems on the Burnett Coast for migratory shorebirds.

Apart from the Pancake Ck system, all except one of the medium-sized roosts in the Shire were found west of Rodds Peninsula in the Rodds Harbour-7 ml Ck-Collosseum Inlet complex. The roosts at Mundoolin Rocks both supported the largest number of species of any of these roosts (14 spp). The only substantial sized roost in Miriam Vale Shire south of this area was the sandbanks in Bustard Bay opposite the Town of 1770 (Table 4.5).

Summary of the species composition in Pancake Ck/Middle Ck shows that this system is internationally significant for Grey-tailed Tattler and nationally significant for Whimbrel (Table 4.6). The estimated Flyway population of Grey-tailed Tattler is 50,000 (Geering et al. 2007) and so these creeks support almost 1.5% of the flyway population. The largest number were present during the northward migration (March) when birds from further south stage along the Queensland coast before migrating to the breeding grounds.

The other species present in Pancake Ck/Middle Ck in significant numbers were Lesser Sand Plover and Whimbrel (Table 4.6). The flyway population of Lesser Sand Plover is 140,000, but only 25,000 spend their non-breeding season in Australia. The number present in March represented 2.1% of the Australian population. Lesser Sand Plover were not seen in Pancake or

Middle Ck in October. This suggests that these creeks are important during northward migration to the breeding grounds.

Table 4.6 — The count of each shorebird species from the Pancake –Middle Creek system during the two surveys in October 2006 and March 2007. (Nos = total number; N = number of roosts where the species occurred; Shaded cells = species in internationally significant numbers and bold = species in nationally significant numbers).

Species	October		March	
	Nos	N	Nos	N
Bar-tailed Godwit	150	3	735	9
Beach Thick-knee	5	2	8	3
Eastern Curlew	140	4	62	10
Greater Sand Plover			523	3
Greenshank	18	2	54	3
Grey-tailed Tattler	648	8	729	4
Lesser Sand Plover	—	—	534	4
Little Tern	70	1	15	1
Masked Lapwing	4	1		
Pacific Golden Plover	2	1	30	2
Pied Oystercatcher	10	4	24	8
Red-capped Plover	26	5	290	7
Red-necked Stint	45	3	331	6
Sooty Oystercatcher	—	—	1	1
Terek Sandpiper	—	—	8	1
Whimbrel	305	8	318	15
TOTAL	1423	14	3662	16

For Whimbrel, the flyway population is estimated to be 100,000, of which only 10,000 spend their non-breeding season in Australia. The number of Whimbrel in Pancake Ck/Middle Ck was over 3% of the Australian population, but only 0.3% of the flyway population (Geering et al. 2007). The number of Whimbrel present were similar during the two surveys and suggests that this is the stable non-breeding population in the system.

The overall population of each species in Miriam Vale Shire further highlights the importance of the shire to the species that were most abundant in the Pancake Ck/Middle Ck system (Table 4.7). The population of Whimbrel in the Miriam Vale Shire is almost 1% of the flyway population (0.97%) and almost 10% of the Australian population estimate (Geering et al. 2007).

Table 4.7 — The total number of each species counted at high tide roosts in Miriam Vale Shire during the October 2006 and March 2007 surveys. (Nos = total number; N = number of roosts where the species occurred; Shaded cells = species in internationally significant numbers and bold = species in nationally significant numbers; Signif = the percentage of the flyway or national population).

Species	October		March		Signif (%)
	Nos	N	Nos	N	
Bar-tailed Godwit	781	14	1497	17	—
Beach Thick-knee	14	7	18	9	—
Bush Thick-knee	—	—	2	2	—
Curlew Sandpiper	19	3	39	2	—
Eastern Curlew	643	28	391	32	1.7
Great Knot	412	3	32	1	—
Greater Sand Plover	91	3	548	6	—
Greenshank	66	11	89	7	—
Grey Plover	10	2	—	—	—
Grey-tailed Tattler	795	18	852	17	1.7
Lesser Sand Plover	387	6	799	12	3.2
Masked Lapwing	18	3	6	1	—
Pacific Golden Plover	21	4	98	8	—
Pied Oystercatcher	69	24	127	32	—
Red Knot	4	1	7	1	—
Red-capped Plover	210	23	1737	34	1.8
Red-necked Stint	620	12	1140	19	—
Ruddy Turnstone	16	2	5	1	—
Sharp-tailed Sandpiper	1	1	1	1	—
Sooty Oystercatcher	4	2	5	3	—
Terek Sandpiper	132	5	92	8	—
Whimbrel	331	30	966	55	9.7
TOTAL	4644	51	8451	75	

The other two species with internationally significant populations in the Miriam Vale Shire are Eastern Curlew and Red-capped Plover (Table 4.7). The number of Eastern Curlew was highest during the October 2006 survey. This species is one of the earliest migrants (Geering et al. 2007), leaving for the breeding grounds from early February. Thus, the numbers of Eastern Curlew counted in March 2007 were lower due to some birds already having left on northern migration.

The number of Red-capped Plover counted during the March 2007 survey was over eight times that counted in October 2006. This suggests that there must have been substantial migration of Red-capped Plover from other areas into the coastal regions of the Shire or large proportions of the population were not counted during October 2006. One site not counted in October was the east coast of Middle Is, where over 600 Red-capped Plover were counted in March 2007. Other roosts also had larger numbers in March than in October. Some of these increases in the populations would have been due to successful widespread breeding by the Red-capped Plover throughout the Shire during summer (see Chapter 5).

4.2.3 Burnett Shire

There were 22 high tide roosts identified along the coast within Burnett Shire (Table 4.8). The largest single roost along the entire Burnett Coast was at the Bundaberg Port in Burnett Shire. This single roost had almost 2,500 shorebirds in December 2005. The roost was not used by as many shorebirds during three subsequent visits. At these times, the total number of shorebirds varied between 442 and 1072 birds of up to 13 species (Figure 4.8). The high species diversity at the roost also highlights its regional importance to a wide variety of species. The other river system with substantial shorebird numbers was Theodolite Ck. Only two of the eight roosts mapped and counted during the surveys are within the Burnett Shire boundaries. However, one of these was a medium-sized roost and the combined population of shorebirds in Theodolite Ck was almost 1800 birds.

The other key site within Burnett Shire for breeding of nationally-threatened resident shorebirds was Dr May's Is in the mouth of the Elliot River (Figure 4.9). This island is heavily used by tourists and fishers at both high and low tide. This will have a negative impact on the nesting success of the two species of resident shorebirds that nested there in 2006 (Beach Stone Curlew (Near Threatened) and Pied Oystercatcher (Chapter 5)).

Apart from the large roost at the Bundaberg Port reclamation area, the large Burnett River system does not support many shorebirds for a river of its size. The species that use the reclamation area are mostly species that do not feed in the coastal intertidal areas, preferring brackish or freshwater habitats (Table 4.9). The most abundant species on the reclamation were Black-winged Stilt, Red-necked Stint and Sharp-tailed Sandpiper (Figure 4.10). Only the Red-necked Stint prefers coastal intertidal habitat for feeding. This species is the smallest shorebird that migrates to Australia (Geering et al. 2007) and as such, tends to feed throughout the tidal cycle if conditions are suitable. The large number present in December 2005 indicates that these birds were feeding within the reclamation throughout the tide as few birds were seen in other intertidal habitats nearby. The reclamation ponds also provided breeding habitat for Black-winged Stilt in December 2005, with more than half the population present tending juvenile birds that were less than a month old.



Figure 4.8 — The Bundaberg Port Corporation dredge spoil pond with breeding Black-winged Stilt in left foreground (left) and adjacent ephemeral wetlands (right) with feeding Sharp-tailed Sandpipers during the December 2005 survey when 2,500 shorebirds were counted on the site .



Figure 4.9 — View across Elliot River mouth from Elliot Heads boat ramp to Dr May's Is on falling tide (left) and Pied Oystercatcher nest on island taken in October 2006 during survey.

Table 4.8 — The highest total count of shorebirds and the maximum number of species seen at each roost in Burnett Shire during the surveys. The data includes QWSG records from these roosts collected at other times besides the BMRG surveys. Roosts with over 1000 birds are highlighted in grey and roosts with 300 – 1000 birds are shown in bold.

Roost site	QWSG Site	Latitude	Longitude	Max. count	No. species
Kolan River S bank sandspit	KRSS	-24.65126	152.18616	252	11
Kolan R upper mangroves	KRUM	-24.684	152.19793	108	10
Croome Ck, Moore Pk Bundaberg	CCMP	-24.7238	152.2905	58	11
Skyring estuary mouth east bank	SEME	-24.73389	152.33556	209	11
Skyring estuary coast mangroves	SECM	-24.73428	152.37172	94	4
Skyring estuary island	SEIS	-24.73843	152.35205	113	7
Burnett R Rockwall North	RKWN	-24.75	152.383333	287	9
Burnett R Rockwall South	RKWS	-24.7581	152.40993	51	4
Groyne Gorham Park, Bundaberg Port	GGPB	-24.75955	152.41018	51	6
Oaks Beach, Burnett R	OBBER	-24.76265	152.41597	35	3
Hermans Rd Burnett R	HERM	-24.7719	152.4042	6	3
Bundaberg Port swamp	BPSW	-24.77193	152.3898	2495	13
Mary Kinross Park, Bagara	MKPB	-24.848	152.4743	53	4
Elliot R north bank claypan	ERNC	-24.9163	152.47382	29	4
Elliot River estuary	ELRI	-24.9224	152.49113	166	9
Elliot R south bank sandbar	ERSS	-24.93147	152.47691	34	2
Elliot R mouth island	ERMI	-24.93422	152.47392	193	13
Elliot R south bank claypan	ERSC	-24.93492	152.47562	121	7
Coonarr Ck mouth sandbanks	CCMS	-24.96966	152.489	37	4
Coonarr Ck upstream mangroves	CCUM	-24.97476	152.484	26	4
Theodolite Ck mouth north side	TCMN	-25.07006	152.54511	379	7
Theodolite Ck north bank mangroves	TCNM	-25.0713	152.5361	259	6
TOTAL = 22 roosts				5056	30

Other species of interest at the Bundaberg Port reclamation site included the only records of Marsh Sandpiper, Red-kneed Dotterel and Red-necked Avocet during the surveys. All of these species prefer freshwater or brackish water habitats (Geering et al 2007). Two of these species (Red-kneed Dotterel and Red-necked Avocet) are resident species that move opportunistically during the year in relation to their preferred feeding habitats. The most abundant species, Sharp-tailed Sandpiper was also in nationally-significant numbers (0.97% of Australian population).

Table 4.9 — The number of each shorebird species seen at the Bundaberg Port reclamation area (QWSG Site code: BPSW) during four surveys between December 2005 and March 2007.

Species	Dec 2005	Feb 2006	Oct 2006	Mar 2007	Maximum
Bar-tailed Godwit	—	1	3	—	3
Black-winged Stilt	361	46	151	1	361
Curlew Sandpiper	10	5	88	2	88
Eastern Curlew	—	13	2	11	13
Greenshank	—	16	11	1	16
Marsh Sandpiper	—	12	95	11	95
Masked Lapwing	—	3	2	4	4
Pacific Golden Plover	—	3	—	—	3
Red-capped Plover	50	94	30	11	94
Red-kneed Dotterel	—	—	1	—	1
Red-necked Avocet	8	—	1	—	8
Red-necked Stint	715	238	207	229	715
Sharp-tailed Sandpiper	1351	190	480	164	1351
Whimbrel	—	—	1	8	8
TOTAL	2495	621	1072	442	2760



Figure 4.10 — Sharp-tailed Sandpiper at Bundaberg Port dredge spoil pond in December 2005.

The large variations in numbers of the freshwater-dependent species between the surveys show that the water conditions have an important role in maintaining this site for shorebirds. The dredge spoil ponds during the March 2007 survey were anoxic and not used by shorebirds. During other surveys, the Bundaberg Port Corporation had released seawater into the site and flooded it, making it less attractive to shorebirds than during the initial survey in December 2005 when almost 2500 shorebirds were using the site. The lack of similar habitats available elsewhere in the region makes this site even more significant. The site could become a local attraction if the site were actively managed to maintain conditions preferred by shorebirds.

Table 4.10 — The total number of each species counted at high tide roosts in Burnett Shire during the February and October 2006 surveys. (Nos = total number; N = number of roosts where the species occurred; Shaded cells = species in internationally significant numbers and bold = species in nationally significant numbers; Signif = the percentage of the flyway or national population).

Species	February		October		Signif
	Nos	N	Nos	N	
Bar-tailed Godwit	143	4	327	7	—
Beach Thick-knee	3	1	5	2	—
Black-fronted Dotterel	2	1	2	2	—
Black-tailed Godwit	1	1	98	2	—
Black-winged Stilt	46	1	157	2	—
Curlew Sandpiper	5	1	93	4	—
Eastern Curlew	143	8	163	10	—
Great Knot	3	1	2	1	—
Greater Sand Plover	37	2	269	6	—
Greenshank	18	2	15	2	—
Grey Plover	—	—	69	1	—
Grey-tailed Tattler	14	3	142	7	—
Japanese Snipe	3	1	—	—	—
Lesser Sand Plover	327	5	62	4	—
Marsh Sandpiper	12	1	95	1	—
Masked Lapwing	3	1	13	3	—
Pacific Golden Plover	78	5	34	4	—
Pied Oystercatcher	12	6	16	7	—
Red Knot	1	1	16	3	—
Red-capped Plover	162	8	93	8	—
Red-kneed Dotterel	—	—	1	1	—
Red-necked Avocet	—	—	1	1	—
Red-necked Stint	267	4	444	7	—
Ruddy Turnstone	33	2	9	1	—
Sharp-tailed Sandpiper	204	6	556	5	—
Sooty Oystercatcher	2	1	—	—	—
Terek Sandpiper	91	2	94	5	—
Whimbrel	53	6	286	11	—
Wood Sandpiper	1	1	—	—	—

Species	February		October		Signif
	Nos	N	Nos	N	
TOTAL	1664		3062		

The 22 roosts surveyed in Burnett Shire had a wide diversity of shorebird species (30 spp) but at low densities (Table 4.10). Several species were only seen in this shire (Great knot, Marsh Sandpiper, Red Knot, Japanese Snipe and Wood Sandpiper). Wood Sandpiper is a vagrant to south-eastern Queensland, being more common in northern Australia (Geering et al. 2007). The two Knot species prefer muddy substrates to feed and are more common in the Gulf of Carpentaria. They do occur in greater numbers in Moreton Bay (QWSG database) but are most abundant north of Mackay in central Queensland. No species was present in nationally or internationally significant numbers within Burnett Shire. The more abundant shorebird species in Miriam Vale Shire (Table 4.7) had much smaller populations within Burnett Shire. This was due to the smaller areas of their preferred feeding and roosting habitats within the shire.

4.2.4 Isis Shire

The extent of coastline within Isis Shire is quite small and there are only two freshwater systems that flow to the sea within its boundaries. Theodolite Ck forms the northern boundary of the coastline of Isis Shire and the north bank of the Burrum River forms the southern boundary. We identified and mapped eight roosts within Isis Shire during the surveys (Table 4.11). Only one of these was on the Burrum River and the remainder occurred in Theodolite Ck. Two of these roosts were of medium size (300 – 1000 birds).

Table 4.11 — The highest total count of shorebirds and the maximum number of species seen at each roost in Isis Shire. The data includes QWSG records collected at other times besides the BMRG surveys. Roosts with over 1000 birds are highlighted in grey and roosts with 300 – 1000 birds are shown in bold.

Roost site	QWSG Site	Latitude	Longitude	Max. count	No. species
Theodolite Ck up reaches claypan	TCUC	-25.07415	152.52237	65	7
Theodolite Ck south bank spit	TCSS	-25.07471	152.54476	92	7
Theodolite Ck sandbar	TCSB	-25.07508	152.54139	412	18
Theodolite Ck south bank tributary	TCST	-25.07737	152.54317	64	2
Theodolite Ck, Woodgate	TECK	-25.07853	152.5437	389	10
Theodolite Ck Frizzells Rd claypan	TCFC	-25.08398	152.5386	51	6
Woodgate Swamp	WOGS	-25.09571	152.553	47	5
Burrum R mouth north bank	BRMN	-25.17217	152.62172	87	5
TOTAL = 8 roosts				1207	17

The largest of these roosts (Theodolite Ck sandbar) is used on neap tides and for staging during rising spring tides. It lies in the middle of Theodolite mouth and gets heavily disturbed by boat traffic and by people and their pets alighting to walk around. This disturbance is most intense

during holiday periods and on the weekend. The shorebirds have persisted in using the sandbank despite this disturbance due to its central location near the main feeding grounds in the mouth of the creek. This site could benefit from active management intervention to reduce the impacts of disturbance on the shorebirds. Appropriate signage at the boat ramp and on the low-tide edges of the sandbank would help inform the public of the importance of the site to shorebirds.

Table 4.12 — The total number of each species counted at high tide roosts on the coast of Isis Shire during the February and October 2006 surveys. (Nos = total number; N = number of roosts where the species occurred; Shaded cells = species in internationally significant numbers and bold = species in nationally significant numbers; Signif = the percentage of the flyway or national population).

Species	Feb 2006		Oct 2006		Signif. (%)
	Nos	N	Nos	N	
Bar-tailed Godwit	91	3	—	—	—
Black-fronted Dotterel	—	—	2	1	—
Black-winged Stilt	—	—	13	1	—
Eastern Curlew	32	5	13	3	—
Greater Sand Plover	20	2	—	—	—
Greenshank	2	2	1	1	—
Grey-tailed Tattler	222	5	53	1	—
Lesser Sand Plover	172	2	22	1	—
Masked Lapwing	3	1	1	1	—
Pacific Golden Plover	18	1	34	2	—
Pied Oystercatcher	8	4	16	4	—
Red-capped Plover	70	4	51	4	—
Red-necked Stint	39	2	—	—	—
Sharp-tailed Sandpiper	10	2	30	1	—
Terek Sandpiper	39	3	—	—	—
Whimbrel	66	5	25	3	—
TOTAL	792		261		

There were 16 species of shorebird recorded from coastal roosts within Isis Shire during the two surveys. The most abundant shorebird species were Grey-tailed Tattler and Lesser Sand Plover (Table 4.12). The tattlers used both the Theodolite Ck sand banks and the mangrove tree roosts along the edges of many of the mangrove-lined waterways in Theodolite Ck. In contrast the Lesser Sand Plovers prefer open sites and used only open sand banks within the area. No species were present in nationally or internationally significant numbers within the coastal region of Isis Shire during the surveys.

4.2.5 Hervey Bay City

The numbers of shorebirds along the coast of northern Hervey Bay City area are higher than seen in similar sections of the coast further north. There were medium-sized roosts at the mouth of the two small creeks south of the Burrum River (Toogoom and O'Reagans Creeks). The higher density of shorebirds reflects more productive intertidal habitats closer to the Great Sandy Strait and the fertile Mary River mouth. The largest roosts in Hervey Bay City area are south of the survey region. Mathiesson's Homestead and Mangrove Bay roosts south of Urangan each hold internationally significant concentrations of shorebirds (Harding et al. 2005).

Table 4.13 — The highest total count of shorebirds and the maximum number of species seen at each roost in Hervey Bay City. The data includes QWSG records collected at other times besides the BMRG surveys. Roosts with over 1000 birds are highlighted in grey and roosts with 300 – 1000 birds are shown in bold.

Roost site	QWSG Site	Latitude	Longitude	Max. count	No. species
Noakes Pt Burrum River	NPBR	-25.17658	152.55341	179	5
Gregory Is, Burrum River	GIBR	-25.17782	152.57906	7	1
Burrum R south bank claypan	BRSC	-25.1895	152.58571	84	2
Toogoom Ck north side claypan	TONC	-25.23117	152.64633	173	8
Toogoom Ck mouth north side	TOMN	-25.2406	152.66257	52	6
Toogoom Ck coast claypan	TOCC	-25.2474	152.6541	616	6
Gables Point Rocks Hervey Bay	GAPR	-25.248	152.82723	1336	9
Point Vernon	PVER	-25.25	152.8167	936	8
Eli Ck mouth, Hervey Bay	ELCM	-25.2649	152.8062	205	4
O'Reagans Ck, Hervey Bay W side	ORCW	-25.26521	152.7233	731	9
O'Reagans Ck, Hervey Bay E side	ORCE	-25.26684	152.73157	454	12
Eli Ck claypan, Hervey Bay	ELIC	-25.26776	152.8082	430	4
TOTAL = 12 roosts				4831	22

The two largest roosts in the Hervey Bay City area covered in the current project (Gables Point Rocks and Point Vernon) are in close proximity and together support almost 2000 shorebirds. These roosts are adjacent to the northern end of the Hervey Bay urban area and are popular recreational sites for both residents and tourists. The Hervey Bay City Council has kept their foreshore undeveloped and this has helped reduce the intensity of disturbance on shorebirds at these sites. However, the shorebirds are still regularly disturbed, particularly on weekends and holidays by people and their pets.

Table 4.14 — The total number of each species counted at high tide roosts on the coast of northern Hervey Bay City during the February and October 2006 surveys. (Nos = total number; N = number of roosts where the species occurred; Shaded cells = species in internationally significant numbers and bold = species in nationally significant numbers; Signif = the percentage of the flyway or national population).

Species	Feb 2006		Oct 2006		Signif. (%)
	Nos	N	Nos	N	
Bar-tailed Godwit	467	3	237	5	—
Beach Thick-knee	2	1	2	1	—
Curlew Sandpiper	1	1	5	2	—
Eastern Curlew	399	6	40	6	1.05
Great Knot	305	2	75	1	—
Greater Sand Plover	24	3	133	3	—
Greenshank	63	1	1	1	—
Grey-tailed Tattler	50	2	53	4	—
Lesser Sand Plover	270	2	391	3	—
Masked Lapwing	3	1	2	1	—
Pacific Golden Plover	94	3	91	3	—
Pied Oystercatcher	16	4	14	5	—
Red-capped Plover	105	5	95	7	—
Red-necked Stint	213	5	1257	4	—
Ruddy Turnstone	—	—	6	1	—
Sharp-tailed Sandpiper	3	1	—	—	—
Wandering Tattler	—	—	1	1	—
Whimbrel	50	8	126	10	—
TOTAL	2065		2529		

The composition of the shorebirds in Hervey Bay City is more typical of that found further south in the Great Sandy Strait (Harding et al. 2005). Eastern Curlew were found in internationally-significant numbers in the northern Hervey Bay City area (Table 4.14). However, the Eastern Curlew population in this region should probably be treated as the northern part of the larger Eastern Curlew population in the Great Sandy Strait. Large numbers of Eastern Curlew roost south of the main urban area at Urangan and these are likely to regularly mix with those found in the study area. Other species of note include the only record of Wandering Tattler on the mainland. This species is common on the rocky foreshores of the inner reef islands (Lady Elliot and Lady Musgrave Is (Chapter 6)). Whimbrels were still the most widespread species, but the population is smaller along this section of coast due to less of their preferred mangrove-lined creek feeding habitat.



Figure 4.11 — Mouth of O'Reagans Ck roost from the east looking south up the creek to the houses of Dundowran.



Figure 4.12 — View looking southeast from helicopter during the aerial reconnaissance survey in December 2005 towards Toogoom Ck (centre) and Toogoom town. Shorebirds use all the claypan areas in the foreground as roosting habitat on different tides.

4.3 Assessing priorities for management of coastal shorebirds and their habitats

4.3.1 Prioritisation process

The next step after having summarised the distribution and abundance of shorebirds in each of the Shires with jurisdiction over coastal areas between Tannum Sands and Pt Vernon is to develop an objective process to establish priorities for management actions. There are a number of ways these priorities can be identified and the most objective approaches come from the formal risk assessment literature. In “risk assessment” the process is designed to identify actions or events that have high risk. “Risk” is defined as a combination of the likelihood of an event occurring combined with the consequence if it does occur. For example, the likelihood of urban development adjacent to the large population of shorebirds in Pancake Ck, Miriam Vale Shire is very small. However, if such development was to occur, the consequence would be quite significant for those shorebirds.

In this section, we are trying to identify the shorebird values of each roost we have identified and rank the relative likelihood and consequence of potentially threatening processes on each. The intention is to identify shorebird habitats that have the highest priority for benefiting from active management action. This assessment is based on our expert opinion and is thus subjective. However, as a prioritisation process, it is more transparent and objective than most other approaches. The process outlined here can also be repeated with a broader range of stakeholders to obtain a consensus view of the priorities. We define “*risk*” as the probability that an event or action will have a high probability of causing a roost to become unviable for shorebirds in general or for species of greater concern.

4.3.2 Criteria and method for assessing risk

The federal *Environmental Protection and Biodiversity Conservation Act (1999)* does not value all species of shorebird equally when it comes to the assessment of “actions of significance” on our biodiversity. Migratory shorebird species have enhanced status as Australia has obligations to maintain their populations under two migratory waterbird agreements (JAMBA and CAMBA). Other species of particular concern are those whose populations have declined or are small and fragmented. These species are listed as being rare or threatened under Queensland and federal legislation and processes that impact on these species in the BMRG region should be of greater concern. High tide roosts or nesting areas for species in either group should have higher priority than sites where they do not occur. Roosts where we have identified either or both of these groups of shorebirds will receive higher weighting in the assessment of risk.

The processes that threaten the viability of shorebird roosts can be broken down into three broad categories. These categories are: (1) loss of habitat (*lh*), (2) disturbance leading to reduced ability to undertake annual migration (*d*) and (3) predation of adults or young by both native and feral animals (*p*). The viability of each roost of the 141 roosts identified within the BMRG region from Tannum Sands to Pt Vernon since 1994 will be assessed for each of these threats. The likelihood (*l*) and consequence (*c*) of each type of threat will be ranked for each roost. The likelihood of each threatening process occurring within the next year will be ranked from 1 = unlikely, 2 = possible and 3 = Highly likely. The consequence of an event once it has occurred

will be similarly ranked from 1 = little consequence, 2 = locally consequential to 3 = regionally consequential. For example, l_{lh} is the likelihood of loss of habitat for a roost within the next year and c_d is the consequence to that roost from disturbance by people or their pets.

Once each threatening process has been assessed for their likelihood and consequence at each roost, the ranks are multiplied to obtain a combined rank for that process at that site. These combined ranks are then summed to obtain an overall rank for the combined threats to each roost. These combined ranks are further weighted by the presence or absence of each of the two priority species groups – migratory (M) and threatened species (T) (Table 4.15). Some species such as Eastern Curlew are both migratory and threatened and so sites with these species will have additional weighting. The weighted overall rank (R) will give the relative risk of impacts and consequences for shorebird populations in the BMRG region from Tannum Sands to Pt Vernon.

The calculation of the overall rank (R) can be expressed as:

$$R = T(M((l_{lh} * c_{lh}) + (l_d * c_d) + (l_p * c_p))) \quad (1)$$

where $T = 3$ and $M = 2$. Thus, if a roost is unlikely to have unsustainable loss of habitat, disturbance or predation in the next year, each will score a 1. If the roost is small, then these unlikely events should have negligible consequence for the local and regional populations of shorebirds and each will score a 1 as well. If the roost supports both migratory and threatened species of shorebird, the sum of the multiplied scores $(1*1) + (1*1) + (1*1)$ is multiplied by the weightings $(3*2)$ to produce an overall rank $(R) = (1+1+1)*3*2 = 18$. This is the lowest rank possible for a roost with both migratory and threatened species. By corollary the lowest rank for roosts with only migratory species is $(1+1+1)*2 = 6$ and only threatened species is $(1+1+1)*3 = 9$. Higher overall rank does imply some greater significance to the regional populations of shorebirds. The differences in rank will also be influenced quite strongly by the relative weighting given to the two groups of species of greater concern (threatened and migratory species). Should a roost have only non-migratory (resident) shorebirds and none that were considered under threat, then the overall rank $(R) = 3$.

4.3.3 Estimated overall risk at each roost and priorities for management

The overall ranks of each roost varied from 6 for roosts with only migratory species with little risk of habitat loss, disturbance and predation to 84 at Dr May's Is in the Elliot R mouth. Many roosts, such as those in Pancake and Middle Ck with internationally significant populations of one or more species were at much lower risk than smaller roosts further south. This was largely due to their locations that are currently remote from substantial human impacts. The roosts that were assessed to be at most risk were roosts in close proximity to people or had uncertain tenure. Four roosts ranked significantly higher than other roosts by two or more in the initial likelihood and consequence scores ($R \geq 60$). The ranks of other roosts, with a higher than average rank (> 19.6) (Table 4.16), with both migratory and threatened species graded from 48 to 18. We will discuss these four roosts that separated out as being at highest risk in detail and make management recommendations that can help reduce the risk of adverse impacts on their ability to support important shorebird populations.

Table 4.15 — The shorebird species in the BMRG region from Tannum Sands to Pt Vernon and their listing on either the JAMBA/CAMBA Migratory bird Agreements or considered threatened or rare under current Queensland or federal legislation (June 2007). Scientific names follow those listed in the JAMBA/CAMBA agreements and are not necessarily the same as recognised in the current taxonomic literature.

Common name	Scientific name	JAMBA/CAMB A	Threatened
Bar-tailed Godwit	<i>Limosa lapponica</i>	✓	—
Beach Stone Curlew	<i>Escacus magnirostris</i>	—	✓
Black-tailed Godwit	<i>Limosa limosa</i>	✓	—
Bush Stone Curlew	<i>Burhinus gallarius</i>	—	✓
Common Sandpiper	<i>Tringa hypoleucos</i>	✓	—
Curlew Sandpiper	<i>Calidris ferruginea</i>	✓	—
Eastern Curlew	<i>Numenius madagascariensis</i>	✓	✓
Great Knot	<i>Calidris tenuirostris</i>	✓	—
Greater Sand Plover	<i>Charadrius leschenaultii</i>	✓	—
Greenshank	<i>Tringa nebularia</i>	✓	—
Grey Plover	<i>Pluvialis squatarola</i>	✓	—
Grey-tailed Tattler	<i>Tringa brevipes</i>	✓	—
Japanese Snipe	<i>Gallinago hardwickii</i>	✓	—
Lesser Sand Plover	<i>Charadrius mongolus</i>	✓	—
Marsh Sandpiper	<i>Tringa stagnatilis</i>	✓	—
Pacific Golden Plover	<i>Pluvialis dominica</i>	✓	—
Red Knot	<i>Calidris canutus</i>	✓	—
Red-necked Stint	<i>Calidris ruficollis</i>	✓	—
Ruddy Turnstone	<i>Arenaria interpres</i>	✓	—
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	✓	—
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>	—	✓
Terek Sandpiper	<i>Xenus cinereus</i>	✓	—

Common name	Scientific name	JAMBA/CAMB A	Threatened
Wandering Tattler	<i>Tringa incana</i>	✓	—
Whimbrel	<i>Numenius phaeopus</i>	✓	—
Wood Sandpiper	<i>Tringa glareola</i>	✓	—
TOTAL		21 spp	4 spp

Dr Mays Is, Elliot River mouth (ERMI)

This roost ranked as most under threat because it supported locally significant populations of migratory shorebirds, breeding, globally threatened Beach Stone Curlew, had a high probability that this breeding attempt would be disturbed sufficient to cause nest abandonment and was highly likely that pet dogs would destroy the nest and even kill the adult birds. The regional significance of the roost is also supported by the breeding of Pied Oystercatcher on the island. This species was only found to be breeding at two other sites outside the Great Sandy Strait.

The location of Dr Mays Is in close proximity of a popular holiday village with a boat ramp directly opposite, means the island receives a regular daily stream of visitors who take their pets in their boats. During short observation periods on the survey, QWSG members saw multiple landings of people and their unrestrained pets. The breeding by both the Beach Stone Curlew and the Pied Oystercatcher was recorded in October and would be predicted to last for about a month until the juvenile birds fledged (Tomkovich and Weston, 2007). Thus, the greatest impact of people disturbing the shorebirds or their pets predated the eggs or chicks only happens during a short window each year. At other times, roosting shorebirds that are disturbed have a choice of several other roosts within 1 -2 km. Any disturbance at these times is unlikely to have substantial consequences for the population.

The annual timing of breeding by resident shorebirds such as Beach Stone Curlew and Pied Oystercatcher is unpredictable. This is believed to be due the unpredictability and variability in our climate and its effect on food supply (Tomkovich and Weston 2007). Breeding can occur from August to December on the southern Queensland coast for both species (QWSG database). Individuals of both species may not breed each year and there is little information on the faithfulness of species like Beach Stone Curlew to particular nesting sites. Thus, it makes it difficult to implement management actions that restrict access to the island during fixed periods when the shorebirds are expected to breed. As an alternative, a combination of public education on the presence of threatened shorebirds on the island and their nesting requirements could be coupled with regular surveys by local QPWS staff to monitor shorebird activity. Appropriate signs at the boat ramp and on the island could also be erected. Enclosures around active nests have also been used elsewhere to enhance the breeding success of the threatened Hooded Plover in southern Australia (Tomkovich and Weston 2007).

Gables Point Rocks (GAPR) and Pt Vernon (PVER)

The two large roosts at Pt Vernon on the edge of the Hervey Bay urban area (GAPR and PVER) are the most important roosts in that region for several species of shorebird. Both roosts support large numbers of migratory shorebirds, have threatened Beach Stone Curlews resident and are highly disturbed. This disturbance may be sufficient to potentially impact on bird fitness for migration. These sites currently are public open space but their tenure is not secure and the consequences of the Hervey Bay City Council developing the site would be significant in a regional context as there are few alternative roosts within 5 km that provide a similar mix of roosting habitats. Signs providing information on the shorebirds that use the sites do not appear to be effective at influencing the behaviour of people that knowingly disturb the shorebirds. Unleashed dogs are often encouraged to chase the birds as part of their exercise routine. Regular and prolonged disturbance by dogs and people during the high tides when the shorebirds are congregated can affect their ability to gain weight before migration. Studies in the UK have shown that disturbances of less than twice per hour can use sufficient energy to impair the potential for shorebirds to migrate (Goss-Custard et al. 2006).

Management of the interactions between people and shorebirds in the Gables Point Rocks and Pt Vernon area needs to be undertaken by Hervey Bay City. There is state legislation that prohibits wilful disturbance of shorebirds with an on the spot fine of \$250. An active campaign by council and EPA officers to increase public awareness of the value of the area to shorebirds and the negative impacts disturbance is having on the potential for shorebirds to migrate. Improvements to the layout of existing signs and increased coverage with additional signs could also have a positive effect on increasing public awareness. Council also may need to consider issuing fines for deliberate disturbance of shorebirds by people who are aware of laws.

Bundaberg Port swamp (BPSW)

The threats to the viability of the Bundaberg Port Corporations' dredge spoil ponds as a major regional shorebird roost are different from those faced by the other roosts identified to be at greater risk. This roost is artificial and the use by shorebirds is strongly influenced by the quality and quantity of different habitats within the pond system. The mix of habitats and their quality are affected by the frequency and extent of flushing by fresh and salt water. In order for the pond system to remain attractive to a large number of shorebird species, the Bundaberg Port Corporation will need to agree to become actively involved in management. The Port will need to regulate the height and quality of the water in the ponds by increasing the exchange frequency between the ponds and the adjacent river. Lunar or semi-lunar flushing through changing water levels with a series of adjustable height intake pipes would maintain the water quality in the ponds. This in turn will promote benthic and aquatic invertebrate production that attracts shorebirds. The effect of any changes in the height of the intake water will need to be monitored to ensure it does not adversely impact on the established salt marsh vegetation along the stormwater channels. This habitat is favoured by Sharp-tailed Sandpipers and Red-necked Stint and is the largest area of this habitat within the shire.

There are two artificial roosts in Brisbane with systems for water exchange that have been set up by the Port of Brisbane Corporation. The Bundaberg Port Corporation could contact the environmental manager at the Port of Brisbane. The environmental manager, Brad Kitchener would be happy to provide advice or possibly provide assistance in developing a similar water exchange system to that in use at the artificial roost at the mouth of the Brisbane River. At this

artificial roost, two viewing hides has been built with display material on shorebirds. These hides have enhanced the enjoyment of visitors to the Port of Brisbane area and generated much positive publicity for the Port of Brisbane Corporation. If designed well in the beginning, a system for the Bundaberg port Corporation's dredge spoil pond similar to that at the Port of Brisbane will require minimal maintenance. The should also be able to be continued to be used as a site for drying the dredge spoil from the mouth of the river and thus keeping the costs of any modifications to a minimum.

4.3.4 Summary of priorities for managing coastal shorebird roosts between Tannum Sands and Pt Vernon

A total of 126 high tide roosts for migratory and resident shorebirds were identified and mapped during the three field surveys (Feb 2006, Oct 2006 and Mar 2007). This enabled most roosts to be counted twice. An additional 15 roosts from previous surveys since January 1994 could not be relocated during the current project. This brings the overall total number of roosts to 141 in the area surveyed. This is a large number of roosts for a section of coast of this length. It indicates that the shorebirds have several options for suitable roosts in most areas and that habitat loss to development has been minimal to date.

Given the large number of roosts, we have developed a simple approach to add some objectivity to any process to prioritise the roosts that might need active management. The assessment process we developed has been modified from similar approaches developed elsewhere to prioritise actions in complex situations. The terminology has also been borrowed from more formal risk assessment approaches where the likelihood of an adverse action or event is considered separately from the consequence of that action or event.

Applying this approach to the 141 roosts has identified four roosts where the shorebirds appear to be under greater threat than at other roosts. These four roosts were: Dr Mays Is in the mouth of the Elliot R (ERMI), Gables Point Rocks (GAPR) and Pt Vernon (PVER) in Hervey Bay and the dredge spoil ponds at the Bundaberg Port (BPSW). The threats to shorebirds at each of these roosts are discussed and some management options to help reduce the threats to shorebirds are suggested. The issues that are threatening the shorebirds vary between each roost. Disturbance by people is important at three of the roosts (ERMI, GAPR and PVER). The issue at the Bundaberg Port roost is related to water quality and its impacts on the mix of habitats within the roost site.

Table 4.16 — The list of shorebird roosts in the QWSG database (including those counted since 1994), their maximum count of shorebirds, presence of migratory or threatened species, land management agency responsible and an assessment of their relative risks (known by QWSG) to habitat loss from human modification, disturbance by people or predation by feral animals (cats, dogs, foxes). Each risk category are assessed for its likelihood of occurring within the next year and the consequence for shorebird populations within the BMRG study region from Tannum Sands to Pt Vernon. Roosts with high overall rank are highlighted in **bold**. (**Note:** Land management agencies in this table can differ from those implied in previous tables as the previous tables summarise the status of each roost within the boundaries of each local government and not whether the local authority is responsible for the management of each roost).

Site	QWSG Site	Max. count	JAMBA/ CAMBA (Wt=2)	Threatened (wt=3)	Management Agency	Loss of habitat		Disturbance		Predation		Overall rank
						LH	Con	LH	Con	LH	Con	
Lady Musgrave Is	LMIS	116	✓	✓	Qld	1	2	2	1	1	1	30
Wild Cattle Is, Tannum Sands	WCIS	50	✓	✓	Qld	1	1	2	1	2	1	30
Tannum Ck, Tannum Sands	TANC	13	✓	✓	Qld	1	1	1	1	1	1	18
Tiber Point	NR07	1	✓	✓	MV	1	1	1	1	1	1	18
Morris Ck claypan Rodds Pen	MOCC	26	✓	✓	Qld	1	1	1	1	1	1	18
Hummock Hill Is Beach 1	HIB1	2	✓	✓	MV	1	1	1	1	1	1	18
Hummock Hill Is Beach 2	HIB2	2	✓	✓	MV	1	1	1	1	1	1	18
Hummock Hill Is Rocks	HHIR	24	✓	✓	MV	1	1	1	1	1	1	18
Rodds Peninsula W side	RPWS	48	✓	✓	Qld	1	1	1	1	1	1	18
Spit End	NR09	1076	✓	✓	Qld	1	3	1	2	1	1	36
Rodd's Harbour inside Morris Creek	MOCK	44	✓	✓	Qld	1	1	1	1	1	1	18
Hummock Hill Is SW side	HHIW	35	✓	✓	MV	1	1	1	1	2	1	24
Morris Creek mouth	NR08	324	✓	✓	MV	1	2	1	2	2	1	36
Rodds Peninsula sth east	RPSE	1496	✓	✓	Qld	1	3	1	2	1	1	36
Hummock Hill Is S side	HHIS	119	✓	✓	MV	1	1	1	1	2	1	24
Rodd's Harbour Bird Island Rock	BIRK	4	✓	✓	Qld	1	1	1	1	1	2	24
Colosseum Inlet lagoon	CILA	138	✓	✓	Ca	1	1	1	1	1	1	18
Colosseum Inlet sandy beach	CISB	51	✓	✓	Ca	1	1	1	1	1	1	18

Site	QWSG Site	Max. count	JAMBA/ CAMBA (Wt=2)	Threatened (wt=3)	Management Agency	Loss of habitat		Disturbance		Predation		Overall rank
						LH	Con	LH	Con	LH	Con	
Colosseum Inlet saltmarsh	CISM	112	✓	✓	Ca	1	1	1	1	1	1	18
Jenny Lind Creek	JLCK	676	✓	✓	MV	1	2	2	1	1	2	36
Mundoolin Rocks opp.	NR10	1205	✓	✓	MV	2	1	1	2	1	1	30
Chinaman Ck-Jenny Lind Junction	CHJL	62	✓	✓	MV	1	1	1	1	1	1	18
Pancake Creek inner north	NR12	816	✓	✓	MV	1	2	1	1	1	1	24
Jenny Lind Ck sandhill	JLCS	235	✓	—	MV	1	1	2	1	1	1	8
Pancake Ck mangroves	PCMA	532	✓	✓	MV	1	1	1	1	1	1	18
Boyne Ck causeway, Mundoolin Pen	CIBC	49	✓	✓	MV	2	1	2	1	1	1	30
Twelve Mile Ck 1	TMC1	101	✓	✓	Ca	1	1	1	1	1	1	18
Mangrove Bay	NR11	771	✓	✓	MV	2	2	1	2	1	1	42
Mundoolin Rocks North	NS10	66	✓	✓	Qld	1	1	1	1	1	1	18
Rodds peninsula south	RPSS	158	✓	✓	Qld	1	1	1	1	1	1	18
Mundoolin Rocks W side	MRWS	724	✓	✓	MV	1	2	1	1	1	2	30
Mundoolin Rocks South	NS27	4	✓	✓	Qld	1	1	1	1	1	1	18
Twelve Mile Ck 2	TMC2	49	✓	✓	Ca	1	1	1	1	1	1	18
Colosseum Inlet mangrove Ck mouth	CIMM	13	✓	—	MV	1	1	1	1	1	1	6
Pancake Ck upper samphire	PCUS	50	✓	—	MV	1	1	1	1	1	1	6
Causeway Ck Rodds Peninsula	CCK	5	✓	✓	MV	1	1	1	1	1	1	18
Rodd's Harbour sand island	RDSA	105	✓	✓	Qld	1	1	1	1	1	1	18
E side Colosseum Inlet	CIEM	11	✓	—	MV	1	1	1	1	1	1	6
Colosseum Inlet mangrove Ck 1	CIM1	1	✓	—	MV	1	1	1	1	1	1	6
Mundoolin Rocks S beach	MURS	735	✓	✓	MV	1	2	1	2	1	1	30
Colosseum Inlet	COIN	5	✓	✓	MV	1	1	1	1	1	1	18

Site	QWSG Site	Max. count	JAMBA/ CAMBA (Wt=2)	Threatened (wt=3)	Management Agency	Loss of habitat		Disturbance		Predation		Overall rank
						LH	Con	LH	Con	LH	Con	
Colosseum Inlet mangrove Ck 2	CIM2	56	✓	—	MV	1	1	1	1	1	1	6
Colosseum Inlet E claypan	CIEC	260	✓	✓	MV	1	1	1	1	1	1	18
Turkey Beach sand island	TUR1	143	✓	✓	Qld	1	1	1	1	1	1	18
Colosseum Inlet mangrove Ck saltpan	CIMS	253	✓	✓	MV	1	1	1	1	1	1	18
Middle Is eastern beach	MIBE	609	—	✓	MV	1	1	2	1	1	1	12
Pancake Ck upper claypan	PCUC	109	✓	✓	MV	1	1	1	1	1	1	18
Turkey Beach town foreshore	TUR3	31	✓	—	MV	1	1	2	1	1	1	8
Awoonga Dam Pelican Bay	ADPB	60	✓	—	Ca	1	1	1	1	1	1	6
Thorton Creek, Rodds Harbour	THCK	54	✓	✓	Qld	1	1	1	1	1	1	18
Turkey Beach mangrove island	NS30	4	✓	✓	MV	1	1	1	1	1	1	18
Upper Thornton Ck, Rodds Harbour	THUC	25	✓	✓	MV	1	1	1	1	1	1	18
Turkey Beach A	NS28	13	✓	—	Qld	1	1	1	1	1	1	6
7 ml Ck mangroves	SMCM	40	✓	—	Qld	1	1	1	1	1	1	6
Middle/Pancake Ck claypan	MIPC	69	✓	✓	MV	1	1	1	1	1	1	18
Middle/Pancake Creek connection	MIPN	49	✓	✓	MV	1	1	1	1	1	1	18
Oaky Ck Turkey Beach	OCTB	123	✓	✓	MV	1	1	1	1	1	1	18
Worthington Ck W bank	WCWB	111	✓	—	MV	1	1	1	1	1	1	6
Upper 7 ml Ck Inlet SE	SMCS	34	✓	✓	MV	1	1	1	1	1	1	18
Middle Ck mangroves	MIMA	47	✓	—	MV	1	1	1	1	1	1	6
Lady Elliot Is	LEIS	1140	✓	✓	Qld	1	2	2	2	1	1	42
Upper 7 ml Ck Inlet mangrove Is	SMCI	30	✓	—	Qld	1	1	1	1	1	1	6
Middle Ck sandflat	MISF	59	✓	✓	MV	1	1	1	1	1	1	18

Site	QWSG Site	Max. count	JAMBA/ CAMBA (Wt=2)	Threatened (wt=3)	Management Agency	Loss of habitat		Disturbance		Predation		Overall rank
						LH	Con	LH	Con	LH	Con	
Upper 7 ml Ck Inlet W bank	SMCW	12	✓	✓	MV	1	1	1	1		1	12
Middle Creek A7	NR13	118	✓	✓	MV	1	1	1	1	1	1	18
Middle Ck mouth island	MCMI	20	✓	✓	Qld	1	1	1	1	1	2	24
Middle Ck N bank claypan	MINC	18	✓	✓	MV	1	1	1	1	1	1	18
Middle Ck S bank claypan	MISC	11	✓	—	MV	1	1	1	1	1	1	6
Bustard Bay sandbank	BBSB	327	✓	✓	Qld	1	2	2	2	1	1	42
opp boat ramp - 1770 A5	NS35	1	✓	✓	Qld	1	1	1	1	1	1	18
Eurimbula Ck W bank	EUWB	37	✓	✓	Qld	1	1	1	1	1	1	18
Bustard Bay beach	BUBA	7	—	✓	Qld	1	1	1	1	1	1	9
Eurimbula Creek	EUCK	23	✓	✓	Qld	1	1	1	1	1	1	18
Upper Toms Ck N bank	UTNB	24	✓	✓	MV	1	1	1	1	1	1	18
Roundhill Ck mangroves	RHCM	106	✓	—	Qld	1	1	1	1	1	1	6
Upper Toms Ck claypan	UTCC	117	✓	✓	MV	1	1	1	1	1	1	18
Roundhill Ck upper mangroves	RHUM	47	✓	—	Qld	1	1	1	1	1	1	6
Roundhill Ck mangrove Is	RHMI	72	✓	—	Qld	1	1	1	1	1	1	6
Roundhill Ck W bank	RHWB	16	✓	—	Qld	1	1	1	1	1	1	6
Mitchell Ck mangroves	MCMA	8	✓	—	Qld	1	1	1	1	1	1	6
Mitchell Ck foredune	MCFD	20	✓	—	MV	1	1	1	1	1	1	6
Mitchell Ck sandbank	MCSB	40	✓	✓	Qld	1	1	2	1	1	1	24
Mitchell Ck sandspit	MCSS	15	✓	—	MV	1	1	2	1	1	2	10
Baffle Creek mouth S side	NS07	95	✓	✓	MV	1	1	2	1	1	1	24
Baffle Ck S mangrove bank	BCMB	67	✓	✓	MV	1	1	1	1	1	1	18
Littabella Ck north bank	LCNB	70	✓	✓	MV	1	1	1	1	1	1	18

Site	QWSG Site	Max. count	JAMBA/ CAMBA (Wt=2)	Threatened (wt=3)	Managemen t Agency	Loss of habitat		Disturbance		Predation		Overall rank
						LH	Con	LH	Con	LH	Con	
Kolan River Ck mangroves	KRCM	36	✓	✓	MV	1	1	1	1	1	1	18
Kolan River S bank sandspit	KRSS	252	✓	✓	Bu	1	2	2	2	1	2	48
Kolan R upper mangroves	KRUM	108	✓	✓	Bu	1	1	1	1	1	1	18
Croome Ck, Moore Pk Bundaberg	CCMP	71	✓	✓	Bu	1	1	1	1	1	1	18
Burnett R Fairymead Ramp	FAMR	76	✓	✓	Bu	1	1	1	1	1	1	18
Skyring estuary mouth east bank	SEME	209	✓	✓	Qld	1	1	2	1	1	1	24
Skyring estuary coast mangroves	SECM	94	✓	—	Qld	1	1	1	1	1	1	6
Skyring estuary island	SEIS	113	✓	✓	Qld	1	1	1	1	1	1	18
Skyring Estuary Bundaberg	SKYE	231	✓	✓	Qld	1	1	1	1	1	1	18
Bundaberg Lake North Head	LANH	73	✓	✓	Bu	1	1	1	1	1	1	18
Burnett R Port Breakwater	PBRK	52	✓	—	Bu	1	1	2	1	1	1	8
Burnett R Rockwall Beach	RKWB	24	✓	✓	Bu	1	1	2	1	1	1	24
Burnett R Rockwall North	RKWN	287	✓	✓	Qld	1	1	1	1	1	1	18
Burnett River Boat Harbour	BOHA	186	✓	✓	Bu	1	1	2	1	1	1	24
Burnett R Rockwall South	RKWS	51	✓	—	Bu	1	1	2	1	1	1	8
Groyne Gorham Park, Bundaberg Port	GGPB	51	✓	—	Bu	1	1	2	1	1	1	8
Oaks Beach, Burnett R	OBBR	35	✓	—	Bu	1	1	1	1	1	1	6
Buss St Burnett R	BUSS	141	✓	—	Bu	2	2	1	1	1	1	12
Hermans Rd Burnett R	HERM	44	✓	—	Bu	1	1	1	1	1	1	6
Bundaberg Port swamp	BPSW	2495	✓	✓	Qld	2	3	1	3	1	1	60
Burnett R Mill Ferry	MIFE	3	✓	—	Bu	1	1	1	1	1	1	6
McGills Rd Burnett R	GILL	16	✓	✓	Bu	1	1	1	1	1	1	18

Site	QWSG Site	Max. count	JAMBA/ CAMBA (Wt=2)	Threatened (wt=3)	Managemen t Agency	Loss of habitat		Disturbance		Predation		Overall rank
						LH	Con	LH	Con	LH	Con	
Mary Kinross Park, Bagara	MKPB	53	✓	—	Bu	1	1	2	1	1	1	8
Town Reach Bundaberg	TORE	44	✓	✓	Bun	1	1	2	1	1	1	24
Burnett R Barrage	BARR	109	✓	—	Bun	1	1	2	1	1	1	8
Elliot R north bank claypan	ERNC	29	✓	✓	Bu	1	1	1	1	1	1	18
Elliot River estuary	ELRI	166	✓	✓	Bu	1	1	2	1	1	1	24
Crescent Point Bundaberg	CRPT	1	✓	—	Bun	1	1	1	1	1	1	6
Elliot R south bank sandbar	ERSS	34	✓	✓	Bu	1	1	1	1	1	1	18
Elliot R mouth island	ERMI	193	✓	✓	Qld	1	2	2	3	2	3	84
Elliot R south bank claypan	ERSC	121	✓	✓	Bu	2	1	2	1	1	1	30
Coonarr Ck mouth sandbanks	CCMS	37	✓	✓	Qld	1	1	1	1	1	1	18
Coonarr Ck upstream mangroves	CCUM	26	✓	✓	Bu	1	1	2	1	1	1	24
Theodolite Ck mouth northside	TCMN	379	✓	—	Bu	1	1	2	1	1	1	8
Theodolite Ck north bank mangroves	TCNM	259	✓	✓	Bu	1	1	1	1	1	1	18
Theodolite Ck up reaches claypan	TCUC	65	✓	✓	Is	1	1	1	1	1	1	18
Theodolite Ck south bank spit	TCSS	92	✓	—	Is	1	1	2	1	1	1	8
Theodolite Ck sandbar	TCSB	549	✓	✓	Qld	1	1	2	2	1	1	36
Theodolite Ck south bank tributary	TCST	64	✓	✓	Qld	1	1	2	1	1	1	24
Theodolite Ck, Woodgate	TECK	389	✓	✓	Is	1	1	2	1	1	1	24
Theodolite Ck Frizzells Rd claypan	TCFC	51	✓	✓	Is	1	1	1	1	1	1	18
Woodgate Swamp	WOGS	47	✓	—	Is	2	1	2	1	1	1	10
Burrum R mouth north bank	BRMN	87	✓	✓	Is	1	1	1	1	1	1	18
Noakes Pt Burrum River	NPBR	179	✓	✓	HB	1	1	1	1	1	1	18
Gregory Is, Burrum River	GIBR	7	✓	—	Qld	1	1	1	1	1	1	6

Shorebirds of the Burnett Coast: surveys of critical high tide roosts

Site	QWSG Site	Max. count	JAMBA/ CAMBA (Wt=2)	Threatened (wt=3)	Managemen t Agency	Loss of habitat		Disturbance		Predation		Overall rank
						LH	Con	LH	Con	LH	Con	
Burrum R south bank claypan	BRSC	84	✓	✓	HB	1	1	1	1	1	1	18
Toogoom Ck northside claypan	TONC	173	✓	✓	HB	1	1	1	1	1	1	18
Toogoom Ck mouth northside	TOMN	52	✓	✓	HB	1	1	2	1	1	1	24
Toogoom Ck coast claypan	TOCC	616	✓	✓	HB	1	1	1	1	1	1	18
Gables Point Rocks Hervey Bay	GAPR	1664	✓	✓	HB	1	3	2	3	1	2	66
Point Vernon	PVER	2085	✓	✓	HB	1	3	2	3	1	2	66
Eli Ck mouth, Hervey Bay	ELCM	205	✓	✓	HB	1	1	2	1	1	1	24
O'Reagans Ck, Hervey Bay W side	ORCW	731	✓	✓	HB	1	2	2	2	1	1	42
O'Reagans Ck, Hervey Bay E side	ORCE	454	✓	✓	HB	1	2	2	2	1	1	42
Eli Ck claypan, Hervey Bay	ELIC	430	✓	✓	Qld	2	2	1	2	1	1	42
Overall average						1.06	1.18	1.27	1.14	1.04	1.07	19.6

5. SURVEY OF BREEDING RESIDENT SHOREBIRDS

5.1 Introduction

While most shorebirds only visit Australia during their non-breeding period, the resident shorebirds that do breed in Australia have special habitat requirements. To locate the likely breeding sites including nests requires a survey during the breeding season. This was undertaken in the Great Sandy Strait during September 2006 by a small team with QPWS assistance. The high tide mapping survey of the full region in October 2006 also recorded nests of breeding resident shorebirds.

5.2 Islands in Great Sandy Strait

A survey was conducted to investigate the western coastline of Fraser Island from Moon Point to Coolooloi Ck and the islands within the Great Sandy Strait from Big Woody in the north through to the Carlo complex in Tin Can Bay. Local knowledge (Bradleys) suggested that this area would be a likely area for breeding shorebirds. The team comprised 5 QWSG people, 2 QPWS staff and two boats “Yerandunah” and “Tern Loose”. Some early reconnaissance was undertaken by the local members of the team. Foreshores were scanned for birds from the boats and important sites were walked at high tide.

All resident shorebird sightings were recorded using GPS co-ordinates in decimal degrees for each location. Breeding pairs were defined as those exhibiting nesting or breeding behaviour, such as agitation or distraction display when they are approached, whether or not nests/chicks were located. Nests weren't easy to find.

The islands with breeding birds were Little Woody Island, Picnic Island, Duck Island, Big Woody Island and Stewart Island. Breeding behavior in Beach Stone-curlew was recorded on the western side of Fraser Island south of Wathumba Ck. The ideal habitat for nesting Pied Oystercatcher was rock or pebbles in the open on a small island. Some nests were also on sand and under trees or shrubs. Sooty Oystercatcher preferred rock under trees or shrubs on a small island. Big Woody Island where most nests were found has wide tidal flats. It had 15 nesting pairs of Pied Oystercatcher (6 nests located) and 6 pairs of Beach Stone-curlew exhibiting nesting behaviour. The location of Beach Stone-curlews suggested their preferred nesting habitat to be on an island with sand, pebbles and rock habitat and in proximity to grass and trees or shrubs. While island habitat may not be identified as important roost habitat it has been found to be critical as shorebird breeding habitat.

The islands out from Maaroom, ie, Thomas, Roundbush, New, and Slain, weren't surveyed because the channels, even at high tide, were inaccessible for the “Yerandunah” and the Bradleys were unfamiliar with the waterways here. Professional crabbers and fishers work extensively in this area, but it is felt that disturbance to birds here (if any) from this group would be minimal (D. Bradley pers. comment). The Bradleys put into the southeast tip of the western half of Turkey Island but found no birds and considered it prudent not to continue into unfamiliar water around the rest of the island. Turkey Island is used by students on school trips

and there may be some areas that could be checked out using someone with a boat and local knowledge.

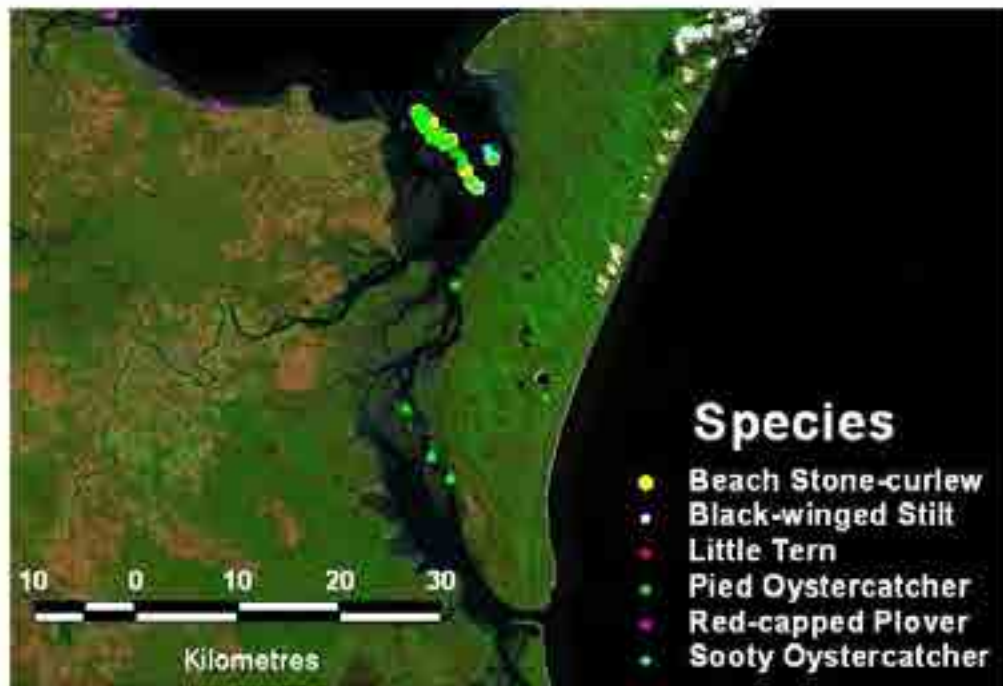


Figure 5.1 — Map of nesting resident shorebirds or observations of breeding behaviour during an extensive survey of islands in the Great Sandy Strait during September 2006.

A total of 30 confirmed breeding pairs were recorded during the survey, including 9 pairs of Beach Stone-curlew, 18 pairs of Pied Oystercatchers and 3 pairs of Sooty Oystercatchers, two pair on Little Woody and one on Duck Island. The Bradleys located two of the nests of the Sooty Oystercatchers. Each nest contained two eggs. A total of only 23 Red-capped Plovers was observed and there was no evidence of any breeding activity amongst these birds in this area.

All sightings of resident waders were recorded and it could be expected that with the Pied Oystercatchers' inclination to territoriality that breeding areas might well be in the vicinity of those areas where each pair was sighted. A map of the location of these resident wader sightings is shown in Figure 5.1.

Highlight of the exercise for the team was a Pied Oystercatcher nest with newly hatched chick waiting right where the team stepped ashore on Big Woody Island. The significance of Big Woody Island is that it is only minutes from Hervey Bay, but a very important breeding habitat area which has little impact because of its rocky shores, which are pretty rugged in comparison with Fraser Island's sandy beaches. This makes it less attractive to day visitors from Hervey Bay.

5.3 Coast from Tannum Sands to Pt Vernon

Quite remote areas of the coast were visited in the October 2006 and March 2007 high tide roost surveys. Significantly some of these areas were being used by breeding resident shorebirds. The sites were mostly visited by small boats that allowed access to sand spits in the mouth of rivers or creeks. QWSG members and contacts in the area provided the teams of participants. The breeding sites were recorded as part of the mapping and counting of the roost site. In March 2007 juvenile of Red-capped Plover were recorded Colosseum Inlet and in Twelve Mile Creek and also in the clay pan on the upper reaches of Morris Creek on Rodd's Peninsula. A Pied Oystercatcher nest with two eggs on the beach on Rodd's Peninsula opposite the island at mouth of Morris Creek was recorded in October 2006. The Morris Creek mouth island roost is also considered a potential Pied Oystercatcher breeding site (Figure 5.2). During the March 2007 survey several immature Red-capped Plovers were present at Mangrove Bay high tide roost suggesting nesting on the beach dune.



Figure 5.2 — Map of the breeding records of resident shorebird species in the northern Burnett Coast from Tannum Sands to Rodd's Peninsula.

The presence of long established resident pairs of Beach Stone-curlew on the beach at Eurimbulah National Park and the mouth of Jenny Lind Creek on Middle Island strongly suggest that these birds breed in these areas. Both pairs are in regions remote from regular human disturbance. Most disturbances at Jenny Lind Creek would occur during the regular visits of the LARC amphibious vehicle and the tourists on board. However, these visitors do not roam widely and are not likely to have a significant impact on the breeding success of this pair. The main threat would be from feral predators such as foxes and cats.

Breeding shorebirds were found on the October 2006 survey at sites between the Kolan River and Burnett River. A Little Tern chick was located on the long sand spit on the southern side of Baffle Ck. At the Kolan River the long narrow sand spit accessed from the Kolan Conservation Park held a Pied Oystercatcher chick and a Red-capped Plover nest with 2 eggs. Also at Littabella Ck north bank was a nest of the Pied Oystercatcher with one egg in the middle of the sand spit, 2 Red-capped Plover chicks and one Little Tern chick, still with downy feathers and one juvenile Little Tern, just flying. Small numbers of Little Tern nest on Barubbra Is in the Skyring Estuary in Burnett River (Figure 5.3).



Figure 5.3 — Map of the breeding records of resident shorebirds and Little Tern along the coast between Town of 1770 and the mouth of the Burnett River.

In October 2006, two shorebird nests were found on Dr Mays Island in the mouth of the Elliot River. A pair of Beach Stone-curlew with the previous season's juvenile were recorded and also a nest with a single egg located on sand under a small *Casuarina*. A Pied Oystercatcher nest with 2 eggs was also located. Both nests were at the base of vegetated low dunes on the mainland side of the island. This area is the access point for boaties landing on the island. A specific case of disturbance to the birds on Dr Mays Island was noted several days after the nests were discovered. A small boat with four adults, one child and a small terrier type dog landed on the island close to where the eggs were located. Not long afterwards, about 400 terns lifted from an area immediately behind where the Beach Stone-curlews were nesting. It seems obvious that the dog disturbed them. The Bundaberg Port dredge spoil pond supports breeding Black-winged Stilt recorded in December 2005. A Red-capped Plover nest with 2 eggs was recorded on a beach within the estuary of Coonar Ck in October 2006 (Figure 5.4).



Figure 5.4 — Map of the breeding records of resident shorebirds in the southern Burnett Coast from the Burnett to Burrum Rivers.



Figure 5.5 — Location of breeding resident shorebird nests in the southern Burnett Coast from Burrum R to Pt Vernon.

In the October 2006 survey, nests of Red-capped Plover, both with 2 eggs were recorded. One nest was at Burrum River mouth north roost which is a sand beach on the edge of Woodgate National Park and one at the mouth of O'Reagans Ck at Hervey Bay (Figure 5.5).

5.4 Management recommendations for breeding resident species

5.4.1 Beach Stone-curlew

The Australian population of Beach Stone-curlew is estimated to be about 5000 birds (2500 pairs) (Geering et al 2007). The species is listed as Vulnerable in Queensland and nationally. The surveys have confirmed breeding at 10 locations for Beach Stone-curlew; nine sites were on islands in the Great Sandy Straits and one on Dr Mays Island at the mouth of the Elliot River (Figure 5.6). There were also a further 15 pairs identified in the region. This means that the Burnett Coast and Great Sandy Strait hold at least 1% of the estimated Australian population. Most of the pairs seen during the surveys would be expected to breed at the appropriate time.

The confirmed breeding records are mostly in National Parks so will have greatest security from habitat loss. Birds were seen on mouths of creeks and estuaries including Baffle, Middle, Kolan, Pancake, Colosseum, Eli and Morris Creeks. They were also recorded at Spit End and Mundoolin Rocks. Many of these sites are readily accessible and thus heavily disturbed by people on the coast. Protected status provided by National Parks with appropriate controls on people accessing the breeding sites should be implemented.

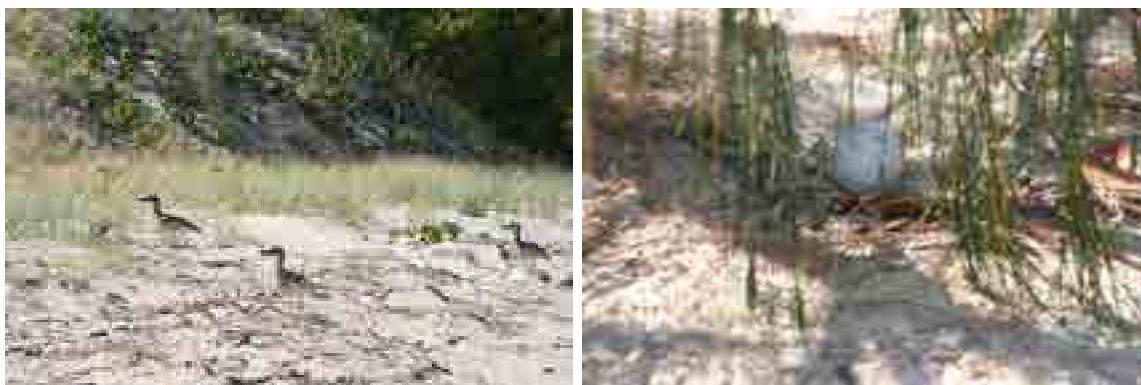


Figure 5.6 — Photograph of adult Beach Stone Curlew (left) and their nest on Dr May's Is in the mouth of the Elliot River in October 2006 (Photographs: Ivell Whyte)

5.4.2 Pied Oystercatcher

Breeding Pied Oystercatchers were found in both the Great Sandy Strait (18 nests) and on the Burnett coast, with 4 nests located (Rodd's Peninsula, Kolan River, Littabella Ck and Dr Mays Island). Where there is suitable habitat with protection from predators such as on small islands and on sand spits, breeding has occurred (Figure 5.7). This is important given that much of the range of the Pied Oystercatcher in Australia has been heavily impacted by development. This has reduced breeding success with the much of population being represented by older birds (Geering et al. 2007). It is important that the dunes remain free from vehicle traffic, stock and pet dogs. Where there are key habitats such as small islands and sand spits in the mouths of estuaries these should be restricted from peoples gaining access via boats and 4WDs during the breeding season (August – December).



Figure 5.7 — Pied Oystercatcher chick in nest on Big Woody Is in the Great Sandy Strait in September 2006 (Photograph: Lesley Bradley)

5.4.3 Sooty Oystercatcher

Sooty Oystercatcher nests were found in the Great Sandy Strait, on Little Woody and Duck Island (Figure 5.8). There would be other nesting sites in the region, where there is suitable habitat, namely rocky ocean shores. This specialist habitat requirement restricts their distribution and their nests would not be as likely to occur at the same sites as the high tide roosts surveyed. This lessens the chance of finding breeding birds during regular surveys. Rocky coastlines on the mainland and on islands should be surveyed at the appropriate season for further nests. Very little published information is available on Sooty Oystercatcher breeding. The finds of the nests on the islands in the GSS was a major addition to the available information on this species.



Figure 5.8 — Photographs of Sooty Oystercatcher nesting habitat (left) where the nest is located behind the rock in centre right of the photograph. Photograph on the right shows the simple nest scrape with two eggs taken during the September 2006 survey of islands in the Great Sandy Strait (Photographs: Lesley Bradley and Ivell Whyte).

5.4.4 Red-capped Plover

Four nests and one chick of the Red-capped Plover were found during the October 2006 survey (Figures 5.9 and 5.10). There were also several sightings of juvenile birds. These sightings and the widespread occurrence of Red-capped Plover across the entire Burnett Coast suggest that they nest in dispersed areas throughout the region. Limited published information is available on their breeding behaviour and recording nesting and juvenile birds would be important information to collect. The locations of the nests suggest the importance of protecting sand spits and sandy beaches throughout the Burnett Coast from disturbance by people, vehicles and boats.

5.4.5 Little Tern

Little Tern was found breeding at Baffle and Littabella Cks and are known to breed on the western sand spit of Barubbra Island in the Burnett R mouth. There are few breeding locations of Little Tern in Queensland and therefore their significance warrants a high level of effort to protect these sites. These sites should be monitored for their use as breeding sites and where disturbance occurs at these sites from people in boats and in vehicles this should also be monitored. Opportunities to control predators (especially on Barubbra Is) should be a priority and restricted access should be achieved and enforced.



Figure 5.9 — Adult male (left) and female Red-capped Plover protecting their small chick on sand spit at Littabella Creek in October 2006 (Photograph: Lesley Bradley).



Figure 5.10 — Adult female Red-capped Plover showing distraction display to lead counters away from her nest on the western side of the Kolan River mouth in October 2006 (Photograph: Lesley Bradley).

6. INNER REEF ISLAND SURVEYS

6.1 Lady Elliot Island

Lady Elliot and Lady Musgrave Islands were surveyed for shorebirds and all roosts mapped during visits by QWSG members. Lady Elliot Is was surveyed between 22 – 24 December 2006 and Lady Musgrave on 23 January 2007. On Lady Elliot Is, two counters surveyed the entire perimeter and open central sections of the island (including the resort) at both high and low tide each day between 22 – 24 December 2006. This provided a total of 6 separate surveys of the shorebirds and terns on the island. The same route was taken for all surveys, but the sequence and direction of movements varied among surveys. All flocks of roosting shorebirds were mapped at high tide.

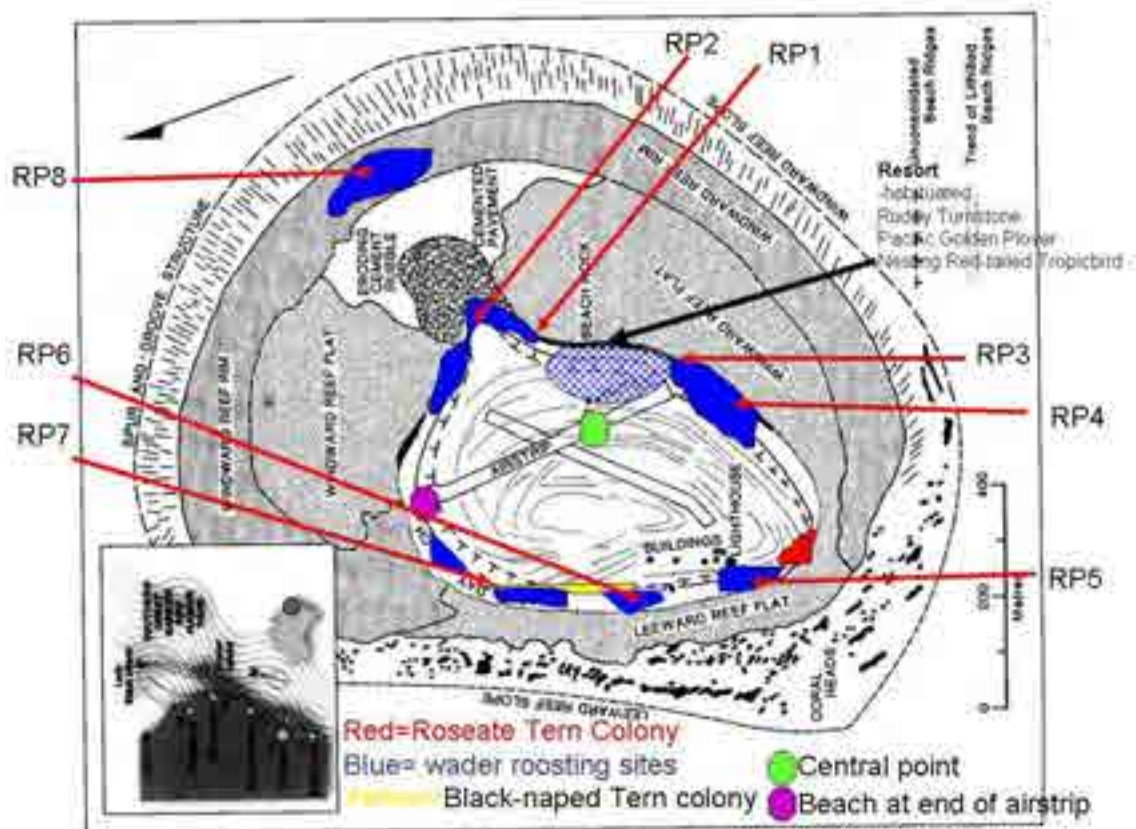


Figure 6.1 — Map of Lady Elliot Is showing the locations of the key shorebird roosting points mapped (RP in blue) and breeding colonies of Roseate (red) and Black-naped Terns (yellow). Blue hatched area approximates the extent of buildings for the Lady Elliot Is Resort.

Both islands receive large numbers of visitors that either camp (Lady Musgrave Is) or stay in a small resort (Lady Elliot Is). As a consequence, the shorebirds on these islands have adapted to the high levels of human interaction. Two species of shorebirds have habituated to living around the resort on Lady Elliot Is and wander among the buildings. The most confiding

species was Ruddy Turnstone and this is common around the buildings, even during low tide when most other shorebirds are out feeding on the extensive coral reef flats around the island (Figures 6.1 and 6.2).



Figure 6.2 — Photograph of Lady Elliot Is showing the resort on left of airstrip (left) and a immature Pacific Golden Plover foraging among the buildings in the resort.

The coral reef habitats are all coarse and so not utilised by shorebird species that probe in the substrate for their food. As a result, the island supported a different shorebird species composition to that found in adjacent coastal habitats. Differences seen included the largest number of Ruddy Turnstones along the Burnett Coast (240) and 5 Wandering Tattlers. Lady Elliot and Lady Musgrave Is were the only roosts where this species was seen during the surveys (Table 6.1). The large count of Ruddy Turnstone represents about 1.2% of the estimated Australian population and almost 0.7% of the Flyway population (Geering et al. 2007). This would make Lady Elliot Is nationally-significant for this species. It is one of the few roosts in Queensland where substantial numbers of Ruddy Turnstone occur. All sites of national and international significance for Ruddy Turnstone occur in southern or western Australia (Geering et al. 2007).



Figure 6.3 —Pacific Golden Plover, Bar-tailed Godwit (left) and Ruddy Turnstone (left and right) roosting among *Casuarina* forest on south-western side of Lady Elliot Is.

Table 6.1 — The maximum number of each species of shorebird and other waterbird counted on Lady Elliot Is during high tide surveys between 22 – 24 December 2006

<i>Species</i>	<i>Max. count</i>
Bar-tailed Godwit	7
Black-naped Tern	18
Crested Tern	136
Eastern Reef Heron	1
Greater Sand Plover	2
Grey-tailed Tattler	5
Lesser Sand Plover	11
Pacific Golden Plover	49
Pied Oystercatcher	2
Red-necked Stint	6
Roseate Tern	165
Ruddy Turnstone	240
Silver Gull	14
Sooty Oystercatcher	1
Wandering Tattler	5
Whimbrel	2
White-faced Heron	1
TOTAL	367

Shorebirds do not appear to be excessively threatened by predators or human disturbance on Lady Elliot Is. Tourists do disturb some shorebirds throughout the tidal cycle each day, particularly at high tide when the birds roost on the upper beach. Typical examples of disturbance include Ruddy Turnstones roosting on the beach near the departure point for glass bottom boats. Other species, less conditioned to disturbance roost in *Casuarina* forest on the south side of the island (around RP4: Figures 6.1 and 6.3) in an area off limits to the public.

Of greatest concern are the regular daily disturbances of the less tolerant, beach nesting terns such as Roseate and Black-naped Tern. These species are known to abandon nests after even one or two disturbances at critical stages of their breeding cycle (Skerrett and Rocamora 2007). In order to ensure successful breeding by both Roseate and Black-naped Terns on Lady Elliot Is, the EPA needs to gain the cooperation of the resort owners to better inform their guests of the sensitive nature of these ground-nesting terns during the nesting season (November – January). Most guests will respect the nesting areas of the terns if they are better informed of the impacts that these kinds of disturbances will have on their breeding. Some signage is located on different sections of the beach informing tourists that there are seabirds nesting in the

area. However, the signs have become obscured by vegetation over time and were not located in the vicinity of the Roseate and Black-naped Tern nesting colonies (Figure 6.4).



Figure 6.4 — Roost of Ruddy Turnstone and Roseate Terns (blue: RP5 on Fig 6.1) (left) and Roseate Tern nesting colony (red on left) and in photograph at right. **Note** in aerial photograph on left, the track to beach that is heavily used each day by guests from the resort to reach glass-bottom boats that leave for coral reef viewing.

6.2 Lady Musgrave Is

Lady Musgrave Island is smaller than Lady Elliot Is and is mostly covered with native vegetation (Figure 6.2). The area of exposed coral reef flat may also be much smaller than on Lady Elliot Is. As a consequence, the island supports much fewer shorebirds (80 vs 367). The species composition of the shorebirds on Lady Musgrave Is was similar to that found on nearby Lady Elliot Is. The exceptions were the less common species on the larger island such as Greater Sand Plover and Red-necked Stint (Table 6.2).

The major issue for shorebirds on Lady Musgrave Island is the lack of roost sites that are free from disturbance by tourists. This is most obvious during the summer non-breeding season when the numbers of shorebirds and tourists are highest. There are no rangers stationed on the island to monitor or manage human activities and the regular tourist boats that bring large numbers of people to the island daily. These visitors are not well-informed about the shorebirds as they are not seen as an important component of the reef ecology that is the focus of most visits. Our visit to the island for this survey was short (2 days) and thus may not be representative of the levels of disturbance regularly experienced by shorebirds on Lady Musgrave Is. However, the intensity of the disturbance suggests that it may be affecting the ability of these birds to build up body fat for migration in March-April. Evidence from recent studies in the UK have shown that disturbances of more than 1-2 times/hr during roosting can affect the survival of shorebirds in regions where food is scarce during their non-breeding season (Goss-Custard et al. 2006). These studies were undertaken in southern England where the temperatures are much harsher than at Lady Musgrave Is. However, we have no data on foraging rates and feeding success of shorebirds from Lady Musgrave Is to know if the shorebirds can sustain the levels of disturbance that will occur during daytime high tides in summer. As an interim measure until more quantitative data can be obtained on disturbance, we recommend that the EPA monitor the situation and provide information to the tourist boat

operators and their guides on the adverse impacts of disturbance to roosting shorebirds. Campers can also be given material informing them about shorebirds and encourage them to minimise their use of the south-western beach during high tide. This information could be distributed with other materials when applying for permits.



Figure 6.5 — Map of Lady Musgrave Is with the main beach used by shorebirds for roosting at high tide shown in red along with the main camping ground shown in yellow

Table 6.2 — The maximum number of each species of shorebird during two counts on Lady Musgrave Is on 23 January 2007.

Species	Max. count
Bar-tailed Godwit	4
Eastern Reef Heron	9
Grey-tailed Tattler	9
Lesser Sand Plover	2
Pacific Golden Plover	10
Pied Oystercatcher	2
Ruddy Turnstone	52
Wandering Tattler	1
TOTAL	80

6.3 General conclusions and recommendations

The shorebird populations on Lady Elliot and Lady Musgrave Islands are small compared to populations on the adjacent mainland. The highest count on Lady Elliot Is was 367 birds and this was dominated by Ruddy Turnstone (65%). This population of Ruddy Turnstone on Lady Elliot Is is regionally and nationally-significant, representing over 1.2% of the estimated Australian population. Ruddy Turnstone and Pacific Golden Plover have habituated to high levels of human disturbance on Lady Elliot Is and many of these species now forage in the grounds of the tourist resort. Other species that are more prone to disturbance roost in *Casuarina* forest, an extremely atypical habitat for these birds. However, this habitat is off-limits to tourists and ensures little disturbance. In contrast, shorebirds on Lady Musgrave Is have fewer choices for roosting habitats because of the vegetation structure on the foredune and so are more heavily disturbed. The total population on Lady Musgrave Is was much lower than on Lady Elliot Is (80 birds), but had a similar species composition.

Disturbance of beach-nesting terns such as the threatened Roseate Tern and the Black-naped Tern is a major issue on Lady Elliot and probably also on Lady Musgrave Is (we have no direct evidence). These species are extremely vulnerable to nest abandonment during the early stages of nesting. Disturbance at this time could halt an entire breeding event on that island. Tourists have direct access to nesting habitats and the current signage on Lady Elliot Is is obscured by vegetation or not located in areas currently used by these species.

We recommend that EPA take a more active role in promoting public awareness of shorebirds and beach nesting seabirds on these islands. Information on the adverse impacts of disturbance on these species needs to be provided to the tourist operators and their guides. They should be actively encouraged to include shorebirds on their public education program to both day and overnight visitors to these islands. Minimum approach distances could be calculated for each species group and the operators advised. We recommend tourists be advised to avoid using beaches beyond direct access points during the 2 hours either side of the daily daytime high

tide. Any compliance will have a positive impact on the health of the shorebirds and will help maintain the viability of the ground nesting seabird colonies on these islands.

7. PLAN FOR MONITORING SHOREBIRD ON THE BURNETT COAST

7.1 Constraints

Monitoring of shorebird populations is usually undertaken in order to detect trends in shorebird abundance within an acceptable timeframe that enables possible interventions to be effective (Rogers et al 2007). Counts at high tide roosts have been the widely used approach in shorebird monitoring in Australia. It is the most practical method available to cover the large areas of coastline inhabited by shorebirds. In order to monitor population trends, monitoring must account for a wide range of factors that influence the accuracy and precision of the counts. The large variability in counts at high tide roosts mean that many counts are required to have statistical confidence in any trends detected (Atkinson et al 2006).

A comprehensive shorebird monitoring program will not be feasible for the Burnett Coast as the number of volunteers and the large distances involved make this impractical. Instead, the BMRG may consider a less ambitious plan to monitor all shorebird roosts on the coast between Tannum Sands and Pt Vernon once each two years. The goals of this plan will be to obtain an index of shorebird abundance that can be compared the new approach trialled in NW Australia by The Australasian Wader Study Group (AWSG) (Rogers et al. 2007). This approach uses the variability of components of a count at a site to obtain an estimate of the variability in the numbers present. It has enabled the AWSG to compare single summer counts of the large Eighty Mile Beach system made in successive years. Changes in abundance between successive surveys of as little as 12% could be detected by this approach. It is also being considered as one of the methods to be used nationally by the new National Shorebird Population Monitoring Project being started by Birds Australia later in 2007.

7.2 Proposed monitoring program

QWSG proposes that a monitoring program for the BMRG region of responsibility should include all the shorebirds in the Great Sandy Strait as well as the coast north of Pt Vernon. The smaller Great Sandy Strait region (~ 80 km N to S) has about the same number of shorebirds as the entire 250 km of coast surveyed in the current project. The 52 roosts identified in this region (Harding et al 2005) could be surveyed in conjunction with those in the southern part of the Burnett Coast (to the Burnett R mouth). In alternate years, the coast north of the Burnett R could be surveyed. This would provide an estimate of shorebird abundance every two years and these estimates can be compared statistically to detect significant changes. Any significant declines could be assessed further to identify if the possible causes were local effects or caused by factors outside the region that were leading to a broader population decline. Data from such surveys would also help to inform local and state government agencies of the status of shorebird populations in their area. It will highlight areas where more active site management may be required. A report card on threats and changes to the integrity of each roost could be developed as a means to inform the local governments of roosts with changes that might threaten their viability (Figure 7.1).



Figure 7.1 — Proposed plan for shorebird monitoring in the BMRG region showing the areas surveyed each year, the seasonal timing of each survey and the applications of the results.

7.3 Indicative budget

The costs of the surveys will be reduced if they are undertaken by QWSG volunteers and local residents. The indicative budget would be approximately \$20,000 for each two year cycle (Table 7.1). Costs include fuel and accommodation for volunteers, boat charter and reporting. The eight local governments with jurisdiction in the region surveyed and the regional office of the EPA will each receive a short report card each two years detailing the status of each roost in terms of shorebird diversity and abundance, changes to the likelihood or consequences to any identified threats at each roost and comments on the quality of the habitats and any changes noted.

Table 7.1 — Indicative budget for shorebird monitoring by QWSG in the BMRG region for each two-year survey cycle.

Item	Timing	Indicative cost
Survey Great Sandy Strait roosts	December Year 1	\$5,000
Survey roosts Pt Vernon to Burnett R	December Year 1	\$3,000
Breeding resident survey	Sept/Oct Year 2	\$2,000
Survey roosts Tannum Sands to Burnett R	Dec/Jan Year 2	\$7,000
Reporting	End of Year 2	\$3,000
TOTAL		\$20,000

8. ACKNOWLEDGEMENTS

Such a large survey of over 250 km of coast cannot occur without the considerable support of a large number of people. During the October 2006 survey, over 60 people were in the field. This level of activity requires close coordination. We thank Kirsty Balmer for her excellent efforts in organising, and coordinating the three surveys. Kirsty ensured that we not only had the most appropriate people for the field conditions at each roost, but that they were well resourced with the correct information about what they had to do and how to get there. Some participants during the surveys deserve particular praise. We especially thank Don and Lesley Bradley for their great contribution to the project by undertaking additional reconnaissance of remote areas, participation in the breeding shorebird surveys, providing their boats for use in all surveys and taking on extra surveys at late notice when others unexpectedly hurt themselves just before the March 2007 survey. Without this help, several aspects of the project would not have been completed to the level of thoroughness that was possible. Ivell and Jim Whyte also participated in all the coastal surveys and Ivell joined the QPWS staff on their boat during the survey of breeding resident shorebirds. We thank them both for their large contribution to the success of the project. Ray Woodburgess from Turkey Beach also deserved special thanks for his kind participation in the October 2006 and March 2007 surveys. Ray took people he did not know out into remote areas in his own boat on several days just because he believed in the aims of the work. He was unfailingly helpful and welcoming into the community and we appreciate all his efforts for the project.

The following people are thanked for their participation in one or more of the surveys of the Burnett Coast and inner reef islands (in alphabetical order by first names): Allan Briggs, Andrew and Margaret Geering, Barbara Dickson, Bob and June Gleeson, Chris Barnes, Claire Parker, David Edwards, David Milton, Dawn Beck, Dennis and Lorna Johnson, Dez Wells, Don and Lesley Bradley, Floss Wainwright, Heather Smith, Ivell and Jim Whyte, Jason Kas, Jill Denning, Jimmy Liolios, John Bell, John and Cathy Gatley, John Knight, Joyce Harding, Judy Caughley, Judy Coles, Ken Cowell, Leeann Evans, Linda Cross, Liz Tanner, Margaret Bullock, Michele Burford, Natalie McGrath, Paula Ryan, Peter Fraser, Peter Pearson, Peter Rothlisberg, Peter Royal, Ray Woodburgess, Rob Kernot, Rod Whiting, Sandra Harding, Sawn Norman, Terry Kelly, Tim Thornton, Tim Siggs. We apologise to anyone we have inadvertently left off by mistake.

The project would not have been possible without the support of Sue Sargent, Coastal Coordinator BMRG and the federal government Natural Heritage Trust. We also thank Kirsten Wortel from the Qld EPA Southern Region office in Maryborough for providing the funding for the initial coastal aerial reconnaissance and all aerial photographs that were used to map the 126 roosts identified during the project.

9. REFERENCES

- Atkinson, P.W., Austin, G.E., Rehfisch, M.M., Baker, H., Cranswick, P., Kershaw, M., Robinson, J., Langston, R.H.W., Stroud, D.A., van Turnhout, C. and Maclean, I.M.D. (2006). Identifying declines in waterbirds: the effects of missing data, population variability and count period on the interpretation of long-term survey data. *Biological Conservation* **130**: 549 – 559.
- Burnett Mary Regional Group (BMRG) (2005). *Memorandum of Understanding: between Queensland Wader Study Group (QWSG) & Burnett Mary Regional Group for Natural Resource Management Incorporated (BMRG)*. Activity Code A0027, December 2005.
- Geering, A., Agnew, L. and Harding, S. (eds.) (2007). *Shorebirds of Australia*. CSIRO Publishing, Melbourne. 242pp.
- Goss-Custard, J.D., Triplet, P., Suer, F., West, A.D. (2006). Critical thresholds of disturbance by people and raptors in foraging wading birds. *Biological Conservation* **127**: 88 – 97.
- Harding, S., Milton, D and Cross, L (2005). *Great Sandy Strait shorebird roost mapping project: final report*. Queensland Wader Study Group.
- Rogers, D.I., Roger, K.G., Gosbell, K.B. and Hassell, C.J. (2007). Causes of variation in population monitoring surveys: insights from non-breeding counts in North-western Australia 2004-2005. *Stilt* **50**: 176 – 193.
- Skerrett, A. and Rocamora, G. (2007). New breeding records of Roseate Tern *Sterna dougallii* in the Seychelles. *Bulletin of the African Bird Club* **14**: 62 – 67.
- Tomkovich, P.S. and Weston, M.A. (2007). Breeding ecology. Pp. 9 – 33. *In*: Geering, A., Agnew, L. and Harding, S. (eds.). *Shorebirds of Australia*. CSIRO Publishing, Melbourne.

APPENDIX A – LOCAL GOVERNMENT SHOREBIRD FACTSHEET

Local government shorebird factsheet and guidelines for planners (use with shorebird GIS)

What are shorebirds ?

Shorebirds or waders are a diverse group of birds from the taxonomic order Charadriiformes and include plovers, sandpipers, stints, curlews, knots, snipes, godwits, avocets, stilts, oystercatchers, pratincoles, lapwings and several other odd species. They range in shape and size from the tiny Red-necked Stint (25 g) to the largest shorebird species, Eastern Curlew, at 1.3 kg. Their bills vary greatly in length and shape among the species groups, depending on their prey and habitats they use.



Terek Sandpipers roosting on a typical type 3 roost
(Photo: Ian Sutton)

Shorebirds can be classified into two main groups – migratory or resident. The migratory species make spectacularly long annual flights to reach their breeding grounds in northern Russia, Alaska, Mongolia and China. Because migratory waders are shared between a number of countries, there are international agreements that identify and promote the protection of these birds.

Where do they live ?

In the Great Sandy Strait, the majority of shorebirds, and all migratory species, live on the coast and feed in the intertidal area. Their lives are governed by the tides not by the sun and so when the tides are low, they will be feeding, both day and night. At high tide, the feeding habitats are covered; they need to rest to digest their food and sleep. In order to do this, they need a suitable “roosting” site – near their feeding ground, safe from predators (disturbance) and of a habitat that enables them to maintain their preferred body temperatures.

These roost sites are usually open areas above high tide (claypans, saltmarshes, sandbars, spits) where they can see predators easily. Tides vary during the lunar cycle and seasonally and so shorebirds take advantage of this to use different roost sites depending on the tide height.

There are three main types of roost site:

Type 1 – ground sites that cater for most species on most tides (saltmarshes, claypans or high level sandpits). Most common type of roost used by shorebirds (especially at spring tides)

Type 2 – sites that serve as roosts on lower high tides or function as a staging roost during incoming and outgoing tides as they move on and off the feeding grounds.

Type 3 – tree roosts used by a selection of species that move into trees (mostly old mangroves) behind a type 2 roost as the tide rises. These roosts are often close to larger type 1 ground roosts of other shorebird species.

Migratory shorebirds are predominantly in the GSS in the summer months and its where they spend the non-breeding season (September-April).

At the end of the non-breeding season (March/April), as they prepare to migrate to the Arctic, shorebirds feed continuously to build up fat reserves that they use during the long flights. Disturbance to shorebirds at this time can have a significant adverse effect on their ability to complete this flight and breed.

Major management issues and suggested guidelines

Shorebirds roosts are often in estuaries where there are already many important reasons why they should be kept free of development. Maintaining viable shorebird roosts needs to be seen as part of the overall protection of a wetland system (with both tidal and fresh water components). A viable roost should not be disturbed by human activity. Therefore the roost needs to be managed in the context of the surrounding wetlands. The buffer distances required for the roost will vary with the land use in the buffer. For example, people can walk within 50m of roosting birds without disturbing them. However, this will only occur when its in a managed way – such as only along a set path clearly separated from the roost, (which may be fenced or separated by water).

When new residential subdivisions are being considered in the vicinity of shorebird roosts, the intent should be to allow the shorebirds flexibility in how and when they use the roost. For instance the birds will have different areal requirements in different seasons, tides and weather conditions. Therefore it is important to maintain a variety of habitats in a wetland. A recommended buffer is to ensure that assessable development is 200m from the highest astronomical tide.



Example of 200m buffer (blue line) around boundary of a wetland containing high tide shorebird roost (red line) at Toolara.

Such residential subdivisions should only be considered after establishing options to secure existing roost sites. To obtain approval for the development, developers need to make tradeoffs that provide protection of wetlands, including the shorebird roosts.

The other important area for shorebirds beside their roost sites is the intertidal areas where they feed when the tide is out. While shorebirds do concentrate their feeding in productive mudflats in the mouths of estuaries, these areas are most often subject to water pollution from storm water runoff and sewerage outlets. In areas of dense development, retention basins are needed to reduce high flows to marine areas.

Other threats in the GSS include damage of freshwater wetlands by feral pigs, changes to roosts from increased mangrove growth, invasion of wetlands by weeds such as groundsel. Feral foxes and cats prey on breeding shorebirds and migratory species at high tide roosts.

If the known shorebird roosts (identified in the GIS) are kept viable and free from disturbance, they should ensure that shorebirds have sufficient area to maintain their populations in the GSS.

The on-going management of roosts will often require cooperation between agencies. These agencies may include the QPWS and/or the Department of Natural Resources and Mines, depending on the tenure of the area. By taking a cooperative approach, the most effective management option can be identified for each roost. This approach will usually be on a case-by-case basis.

Further information

Qld EPA (2004) Moreton Bay shorebird management strategy

Qld EPA (2005) Draft Great Sandy Marine Park Northern Section Management Plan

Ramsar site description for Great Sandy Strait (including Great Sandy Strait, Tin Can Bay and Tin Can Inlet) (www.ramsar.org/gss)

Department of Environment and Heritage directory of important wetlands (www.deh.gov.au/water/wetlands)

Shorebird brochure (Shorebird Conservation in Australia) insert to Wingspan 12 (4) December 2002.

Qld EPA (2004) Draft SEQ Regional Coastal Management Plan.