

Field and Priorities Study



Lands End
Photographed by Ron Sandercock



Normanville Dunes Coastal Vegetation
Photographed by Mary Crawford



Newland Head
Photographed by Alison Eaton

5 RESULTS OF FIELD AND PRIORITIES STUDY

5.1 Descriptions of Coastal Cells

This project has defined 27 coastal cells comprising the Southern Fleurieu coast. Assembled datasets relating to conservation values and threatening processes valued these data and placed these values on GIS maps, in detail to the raster point level, (25m x 25m). This analysis has contributed to the cell descriptions detailed in this section.

In addition conservation values and threatening processes have been summed and averaged and the results of this shown on the following two pages. For the map 'Mean Conservation Values', conservation values for each raster point have been averaged: points have been defined 'high', 'medium', or 'least' value according to breaks in the distribution of values. A similar process was carried out for the following map, threat layers means.

A comparison of the summed results of these two analyses shows that a number of areas have high conservation values and a high threat level:

- a) The beaches and lower slopes of Fishery Beach, Lands End, Cape Jervis and Morgans Beach;
- b) The cliffs and cliff tops from Newland Head to the Bluff
- c) Normanville Dunes;

This result is seen as significant for priority decisions for management actions, and this is picked up in relevant local actions (within the cell descriptions following) and within the regional actions.

Southern Fleurieu Coastal Conservation Analysis Combined Detailed Coastal Conservation Priority

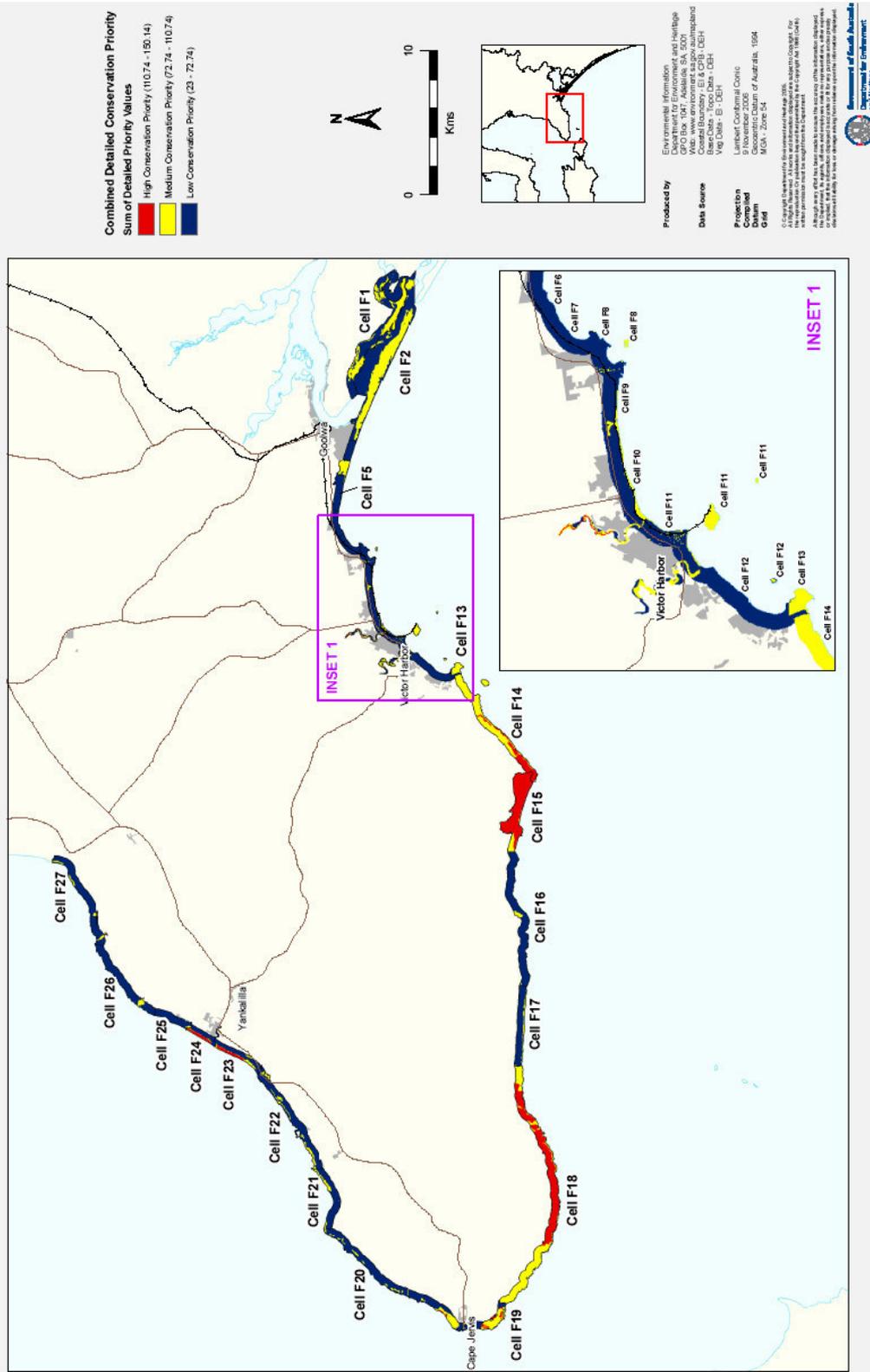


Figure 24. Combined detailed conservation priority scores

Southern Fleurieu Coastal Conservation Analysis Combined Detailed Threatening Processes

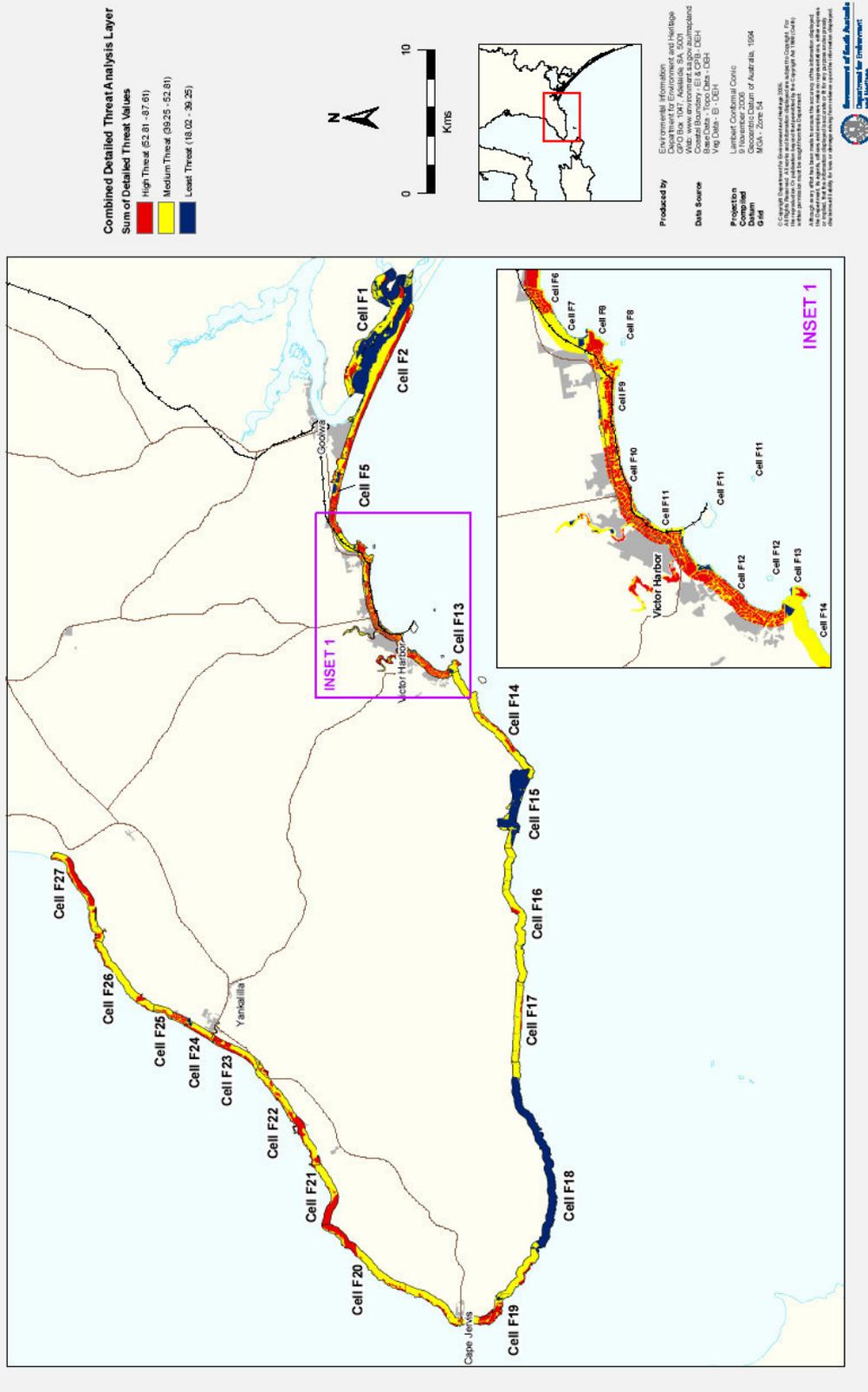


Figure 25. Combined detailed threatening processes scores

5.1.1 The Cell Description Template

The detailed cell descriptions within section 5.1 have been constructed as follows:

Table 12. The cell description template

Paragraph in Coastal Cell description	Source of information
Landforms Biota/ Benthic Habitat Land Use/ Ownership	The DEH internal GIS system – ‘Coastmaps’. Reference materials
Values Threats Opportunities	Field appraisal by consultant. Interviews with community members working on coastal projects in the area
Conservation Analysis (GIS) Threats Analysis (GIS)	Analysis of state databases; ranking of conservation and threat data. Spatial summation and analysis by EI GIS branch.
Climate Change Projections	Analysis by study team of the IPCC and CSIRO projections for South Australia and interpretation of possible changes in biophysical systems as a result.
Actions	Derived from information above
Priority assigned to actions.	Categorisation of priority was decided by the project steering committee: priority depended on (i) GIS Analysis; (ii) Key players within the locality; (iii) Potential hazard to life and property. This is further detailed below.

5.1.2 Deciding on Priority of Actions

Within the Cell Descriptions (section 5.1) and the Action Summary Table (1.3.1) a priority has been indicated against each of the proposed actions. The project steering committee and the author of this section adopted a scheme of priority assessment based on the processes within this project and the duties and aims of the major players. The general reasons for these priorities are given below.

Table 13. Criteria for priority of proposed actions

Designation	Description
High (Cons/Threat)	Relates to a matter or area which has a high conservation priority score within the region and is under very significant immediate threat.
High (Hazard)	This action relates to an actual or potential flooding or erosion hazard, water quality or a cliff instability issue where human safety may be involved.
High (Soc/Econ)	Relates to an issue or place which has a high social or economic significance.
Medium (KP cell)	Relates to an area or issue which has been identified by key players as being important within this cell.
Medium (KP region)	Relates to an area or issue which has been identified by key players as being important within the region.
Medium (Threat)	This action relates to a significant threat, within the GIS threat analysis, i.e. a threat to conservation values.
Medium (Cons)	Relates to an area or matter which has a high to medium total conservation priority scores within the region.
Medium (Soc/Econ)	Relates to an area or matter which has moderate social or economic significance.
Low (Cons)	Relates to an issue or place of moderate conservation priority.
Low (Hazard)	Relates to a flooding, erosion, water quality or cliff hazard of long term potential, but low immediate concern.

Cell F1 Murray Mouth, southern shore of Hindmarsh Island



Landforms

“The geomorphology of the Murray Mouth and associated sand peninsulas; the flow regime; the significant freshwater and sediment input to the coastal area; and associated variety of freshwater, estuarine and saltwater habitats, make the Murray Mouth estuary a major physical and biological influence in the region.” (Baker, 2004, p.302). Low rolling aeolianite plain of Hindmarsh Island, with brackish swampy swales.

Benthic Habitat/ Biota

Sand and silt fine estuarine sediments. Dune, saltmarsh and mangrove habitats; swamp paperbark; samphire in swales; pasture grasses.

Land Use/ Land Ownership

Pasture. Small wetlands and creeks. Homes and holiday homes adjacent coastal reserve. Waters, foreshore and coastal reserves under care and control of NPWS (Coorong National Park).

Values

Tourism – walking, fishing, birdwatching. The community has invested great effort in re-planting brackish swales and saltmarsh areas, previously cleared by grazing.

The estuary and its shores are a wetland of international significance - a “Ramsar” site. This wetland is considered to be a region of outstanding national and international conservation value, particularly for its variety of wetland habitats and significance for waterbirds and other coastal birds.



Southern coast of Hindmarsh Island and the Murray Mouth

(Coast Protection Board, May 2003)

Threats (Field and Local)

Regional threat posed by drought and lack of environmental flows to the lakes and spilled beyond the barrages affects river mouth closure, significant wading bird sites, fish habitat, as well as local ground waters. Movement of sand into the Murray Mouth leads to sand smothering of tidal mudflats, reducing feeding areas for waders; also, constriction of the mouth reduces the tidal prism and hence the area of tidal flats and wader habitat. Factors affecting River Murray flows to this area are decided nationally and are subject to extremely limited local influence.

Agreements over fencing of small brackish wetlands (see example in foreground above) as part of Landcare activity, have allowed insufficient edge spaces for effective re-planting of the slopes bordering the wetlands.

Modification of coastline of the island (see above) by a plethora of private jetties, and illegal land reclamation: beyond local changes the effects of these changes are unstudied.

Opportunities

Commitment at all levels of government to invest effort in the Murray Mouth for its symbolic value and as a Ramsar site.

Considerable local volunteer effort and expertise in revegetation improving terrestrial habitat: currently being advanced in a number of ways, including a plant nursery. The presence of a seed farm able to supply native plant seeds for revegetation projects.

Conservation Analysis (GIS)

The total of conservation means gives a moderate score. The distribution of summarised conservation values show medium to low values over the entire cell, with no areas of high conservation value. The medium values follow the distribution of remnant vegetation blocks.

The major contributors to the conservation total are high scores for bird and butterfly habitat, remnant vegetation block size, shape and connectivity, numbers of threatened species and species richness. 30 threatened plant species and 62 threatened fauna species have been recorded in this cell; a total of 311 of all flora and fauna have been recorded. Supratidal saltmarsh and swamp paperbark habitats found within this cell are rare within South Australia.

Priority of habitat based on the significance of bird species recorded gave a high value for this cell. The state endangered *Haliaeetus leucogaster* (White bellied Sea-Eagle), the state vulnerable *Coturnix ypsilophora* (Brown Quail), *Rallus pectoralis* (Lewin's Rail), *Numenius madagascariensis* (Eastern Curlew), *Cladorhynchus leucocephalus* (Banded Stilt), *Thinornis rubricollis* (Hooded Plover), *Sterna nereis* (Fairy Tern) and 26 state rare bird species have been recorded in this cell.

This cell includes Aboriginal sites of significance; more broadly, all the lands and waters are of importance to the Ngarrindjeri people and are subject to a Native Title claim.

Threat Analysis (GIS)

The threat summary results showed a moderate threat total for this cell. The main threats within the analysis are areas of acid sulfate soil potential, land use and land ownership, numbers of exotic plants and the distribution of aggressive weeds. Vegetation patch size, shape and isolation showed comparatively high threat scores. The fragmented pattern of remnant vegetation and revegetation areas raises connectivity issues. Detailed raster analysis shows that within the cell combined threat rating varies from high threat values at the inner (landward) edge of the cell, to low values over the rest of the cell.

The following red alert weeds have been found within this cell:

Ehrharta villosa var. *maxima*, *Gazania linearis*, *Lycium ferocissimum*, *Acacia cyclops*, *Chrysanthemoides monilifera* ssp. *monilifera*, *Leptospermum laevigatum*, *Acacia saligna*, *Euphorbia paralias*, *Euphorbia terracina*, *Oxalis pes-caprae*, *Marrubium vulgare*.

[However, it is clear that the dominating threat for all features of this coastline is the flow of the Murray and the management of the barrages].

Potential Climate Change Threats

Climate change issues pose a long term threat for this cell in 2 major respects:

1. Increasing aridity within the Murray Darling catchment will further increase the challenges to increasing environmental flows to the lower Murray.
2. Rising sea level may well be above mean IPCC projections, assuming continuation of tectonic sinking in this locality.

Intertidal mudflat, mangrove and saltmarsh are closely dependent on tide heights, and will need to migrate upslope to survive. Supratidal samphire and swamp paperbark stands will be similarly affected. In response, high resolution topographic land survey is needed to detail this threat. Following this, a review of development plans will be necessary to define buffer zones for habitat migration and to review procedures for the development approval of flood levee bank construction. The same process will allow more close specification of the flooding hazard threat to shacks and homes near the Murray Mouth (see photograph above).

Management Comments

The management of this cell is set within an international, national and regional context, and many significant issues are decided in Albury and Canberra.

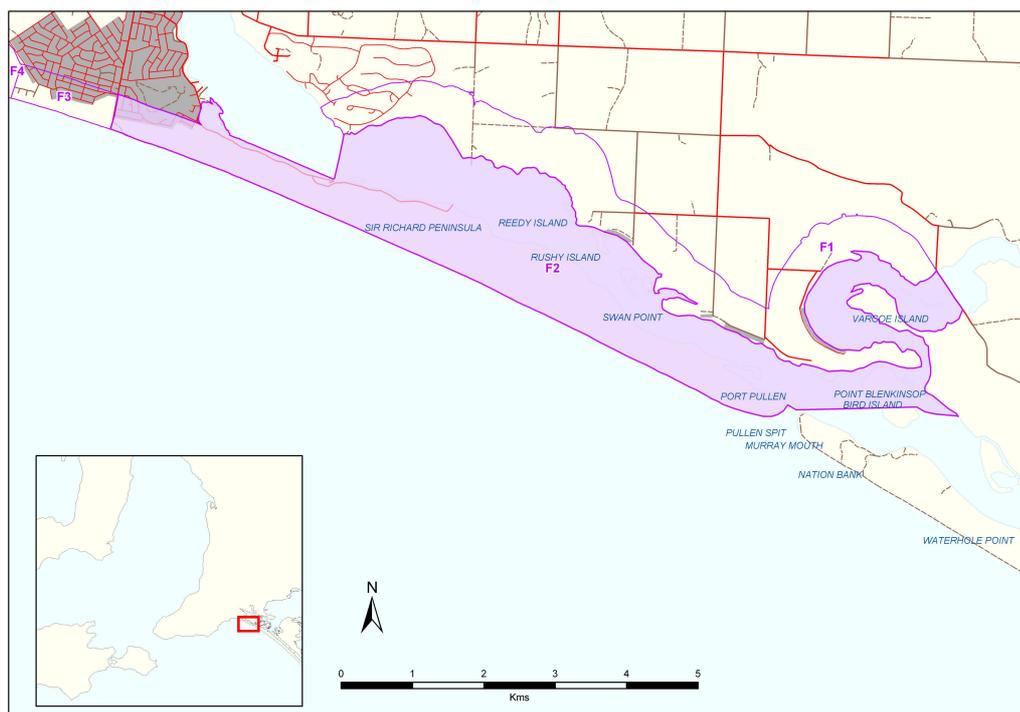
The estuary and its shores are a wetland of international significance, a "Ramsar" site: considered to be a region of outstanding national and international conservation value, particularly for its variety of wetland habitats and significance for waterbirds and other coastal birds. Other relevant international agreements include the China-Australia Migratory Birds Agreement (CAMBA) and the Japan-Australia Migratory Birds Agreement (JAMBA). Nationally, the Murray Mouth has been designated part of the Terminal Lakes and Coorong "Significant Ecological Asset" by the Murray Darling Basin Commission, (MDBC).

The cell, or parts of the cell, is subject to a number of management plans: *The Coorong National Park Management Plan, 1990*, (NPWS SA); the *Coorong Lakes Albert and Alexandrina, Murray Mouth Ramsar Management Plan, 2000* (NPWS SA), (a revised draft of this plan is currently in progress); the *Lower Lakes, Coorong and Murray Mouth Asset Environmental Management Plan 2005* (MDBC). There are also fisheries and tourism management plans for the area. To date these plans do not appear to have considered the local implications of climate change.

The following comments are made based on the local issues within the cell description above. Habitat issues are currently the subject of detailed research as part of the revision of the RAMSAR site management plan.

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY	KEY PLAYERS
Intertidal and supratidal saltmarsh communities	These tide dependent habitats are threatened by climate change induced accelerated sea level rise. Some of the communities are rare in South Australia.	F1.1 Detailed high resolution mapping of topography of low lying land.	High (Cons / Threat)	Commonwealth Natural Disasters Mitigation Program. SA DEH
		F1.2 Review of buffer zone provisions to allow for species migration within the Development Plan. Also review of flood hazard issues for shacks.	High (Cons / Threat)	Council DEH. Landcare volunteers
Marshy swales	Stock exclusion and revegetation of numerous small remnant wetlands on the island.	F1.3 Continue priority support for ongoing restoration program of wetlands.	High (Cons / threat)	Council NRM, Landcare DEH
		F1.4 Review of agreements on positioning of fences around wetlands	High (Cons / Threat)	PIRSA, Landcare Council
	Improvements in vegetation block connectivity could enhance resilience.	F1.5 Explore opportunities to establish vegetation corridors linking remnant vegetation blocks.	Medium (Cons.)	NRM, Landcare
Whole cell	Presence of a significant number of red alert weeds. Development of private jetties and illegal land reclamation.	F1.6 Targeted control of priority weed species. Pursue educational opportunities to reduce incidences of the use of invasive garden species.	Medium (Threat)	NRM. Council. Landcare volunteers
		F1.7 Agency enforcement with regard to jetties and land reclamation.	Medium (Soc / Econ)	DEH. Council

Cell F2 Goolwa (Beach Road) to the Murray Mouth: the Sir Richard Peninsula



Landforms

These include a sand barrier, 11 km long and up to 30m high and a 500m wide high energy dissipative surf zone, usually with straight inner and outer bar systems. The position of the Murray Mouth is naturally unstable due to the variations in littoral drift, tidal flow and river flow. In historical times the position of the mouth has moved in both directions, over 1,000m. For the last 30 years the mouth has been moving towards the west, shortening the Sir Richard Peninsula by 50m per year. "The geomorphology of the Murray Mouth and associated sand peninsulas; the flow regime; the significant freshwater and sediment input to the coastal area; and associated variety of freshwater, estuarine and saltwater habitats, make the Murray Mouth estuary a major physical and biological influence in the region." (Baker, 2004, p.302)

Biota & Benthic Habitat

90% of this cell is remnant vegetation which consists of extensive dune grassland, with sparse shrubs and trees and many exotic grass species. The nearshore seafloor is clear sand; with sparse seagrasses.

Land Use/ Ownership

Since the construction of the Goolwa Barrage in 1938, the management of the peninsula has been in the hands of the former E&WS department, now SA Water (Sir Richard Peninsula Committee). There has been a long term concern, by the water utility, with the stability of the dunes, especially immediately west of the barrage, which formerly led to extensive planting of marram.

Draft Marine Park Zoning

General Use Zone and Habitat Protection Zone HP3 (Murray Mouth)

http://www.environment.sa.gov.au/coasts/pdfs/encounter_marine_park_zp_tech.pdf



Sir Richard Peninsula, the Goolwa Barrage, Murray estuary and Hindmarsh Island (Coast Protection Board, May 2003)

Values / Uses (Field visits and local reports)

The estuary and its shores are “considered to be a region of outstanding national and international conservation value, particularly for its variety of wetland habitats and significance for waterbirds and other coastal birds”, (Baker, 2004, p.301). Open space. Tourism – walking, 4WD on beach. Fishing and cockle gathering, (the Goolwa Cockle, *Donax (Plebidonax) deltoides* is found in the intertidal zone).

Threats (Field visits and local reports)

These include damage by 4WD and foot traffic in the dunes and storm damage to the foredune. The coastal zone of the development plan is a narrow foreshore strip; the Peninsula itself is a conservation zone and raises the issue of re-zoning, since the peninsula is largely unstable or potentially unstable sand dunes. 4WD and uncontrolled dogs on the beach threaten plovers and their eggs in spring. Sea Wheat Grass is well established in the foredunes of the peninsula; to the extent that Hilton & Harvey (2002) suggest that foredunes could become over-stabilised, and sand movement to the hind dunes greatly slowed. Most of the dunes on the northern side of the peninsula are infested with Pyp Grass.

Conservation Analysis (GIS)

The total of conservation means gives Sir Richard Peninsula an average to high score. Median values are found widely across the whole sand barrier and estuarine wetland areas; the beaches, degraded foredunes, and the fringe of the Goolwa residential areas show low values. The distribution of values amongst the conservation variables is unique. The extensive areas of native vegetation, although weed infested, provide habitat for birds, reptiles and butterfly larvae; there is also a relatively high value for total number of threatened species. The high values for reptiles, is based on species dependent on coastal habitat. Remnant vegetation shape, size, and connectivity values are high, as are habitat; values for endemic vegetation associations of which a high proportion are found only in this vegetation block (layer 2C) are also high; however, values for European Heritage are low to average. This cell includes Aboriginal sites of significance.

The state endangered *Haliaeetus leucogaster* (White bellied Sea-Eagle), *Neophema chrysogaster* (Orange-bellied Parrot); the state vulnerable *Coturnix ypsilophora* (Brown Quail), *Numenius madagascariensis* (Eastern Curlew), *Cladorhynchus leucocephalus* (Banded Stilt), *Thinornis rubricollis* (Hooded Plover), *Sterna nereis* (Fairy Tern) and 30 state rare bird species have been recorded in this cell. Many of the rare species are waders which seasonally reside in the sheltered saltmarsh areas on the estuary side of the peninsula or shorebirds feeding, and in some cases nesting, on the beach. Nesting opportunities for the Hooded Plover

appear to have been restricted by vehicle and foot traffic along the beach and foredune, to the extent that no nests have been reported in spring 2006.

Threats Analysis (GIS)

The combined threat rating gives a low score for cell 2. Weed distribution and numbers of exotic species are an alert for concern in these areas. There are distinctive issues relating to acid sulfate soil potential in the saltmarsh on the estuarine side of the peninsula. Informal camping near the Murray Mouth and dune instability are also significant threats.

The following red alert weeds have been found within this cell: *Asparagus asparagoides*, *Ehrharta villosa* var. *maxima*, *Gazania linearis*, *Lycium ferocissimum*, *Euphorbia paralias*, *Oxalis pes-caprae*, *Euphorbia terracina*, *Olea europaea* ssp. *Europaea*, *Carpobrotus edulis*, *Coprosma repens*, *Juncus acutus*.

The combined threat of *Ehrharta villosa* (Pyp Grass) plus *Thinopyrum junceiforme* (Sea Wheat Grass), i.e. low vegetation regeneration ability and potential long term geomorphological change (Hilton and Harvey, 2002).

Potential Climate Change Threats

Climate change issues pose a long term threat for this cell in 3 major respects:

1. Increasing aridity within the Murray Darling catchment will further increase the challenges to increasing environmental flows to the lower Murray. Aridity will slow the natural recovery of dune vegetation to damage.
2. Rising sea level affecting the estuarine shore may well be above average, assuming continuation of tectonic sinking in this area.
3. Rising sea level will lead to recession of the ocean beach and barrier dune areas; this could be of an order of 5 to 30 metres, though this range would be affected by littoral drift factors. Likely increases in the low period swell component of wave climate and a possible increase in the magnitude of peak storm events increase the uncertainty in seasonal changes of beach state.

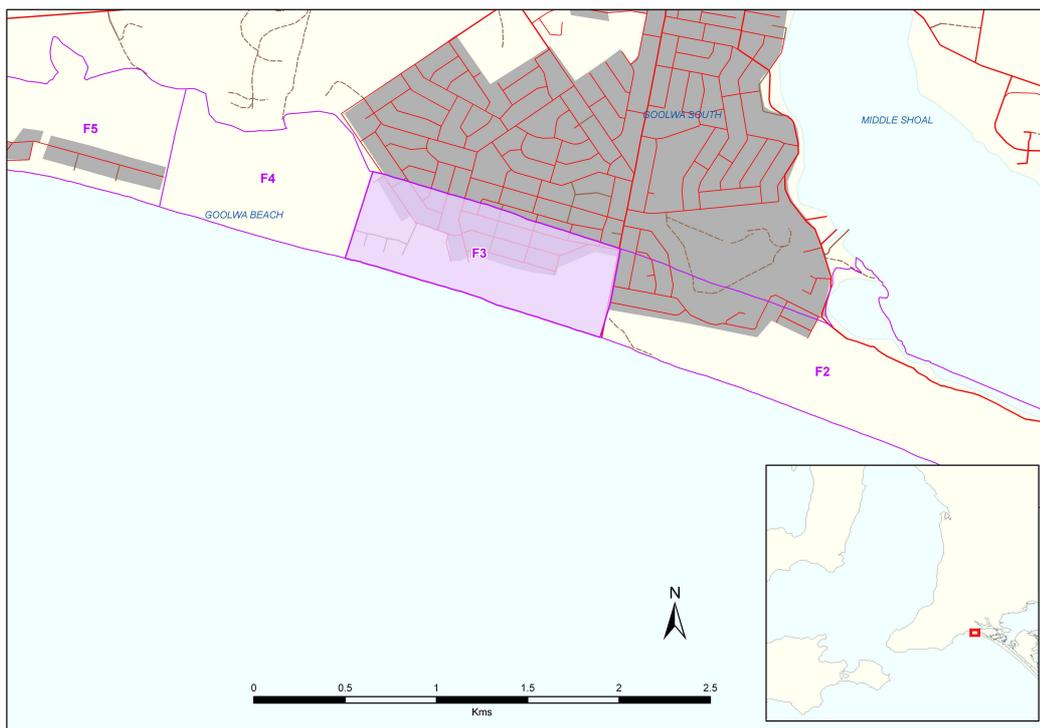
Intertidal mudflat, mangrove and saltmarsh are closely dependent on tide heights, and will need to migrate upslope to survive; supratidal samphire and swamp paperbark stands will be similarly affected. In response, high resolution topographic land survey is needed to detail this threat. It will be necessary to review opportunities for recession of tide-dependent species on the landward side of the peninsula.

The Coast Protection Board has established 2 beach profile line surveys on the peninsula to monitor changes on the ocean beach and foredunes. These are located at approximately 3km and 7km from beach road.

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
NEARSHORE WATERS	Raised silt, algae and bacterial levels following releases from the barrages. Raised turbidity levels affecting water users.	F2.1 Record incidents of water quality affecting users of nearshore waters	Low (hazard)	SLSC Council
BEACH	Used as a beach recreation area for people and as a road for off road vehicles (ORV) Possible conflict of vehicles and people on peak use days.	F2.2 Record incidents relating to conflict of beach use and vehicles	Low (hazard)	SLSC, Sir Richard Peninsula Committee, Council.
	Habitat for shorebirds: conflict between ORV and plover nests in spring.	F2.3 Signage to keep vehicles below spring tide mark OR F2.4 Consider a ban on vehicles on the beach (note: the Hooded Plover is EPBC listed).	High (Cons/ threat)	Sir Richard Peninsula Committee Council
	Informal camping on the beach near the Murray Mouth and in the dunes (issue is linked to the use of vehicles on the beach and in the dunes, as well as lack of facilities).	F2.5 Review the practice of informal camping near the Murray Mouth.	Medium (threat)	Sir Richard Peninsula Committee, Council.
	Likely beach and dune recession consequent on climate change effects.	F2.6 Continuation of monitoring of nearshore and beach sand levels through the Coast Protection Board beach profiles.	Low (Hazard)	Coast Protection Board, Council.

DUNE	Serious foredune erosion and vehicle track damage. Control of ORV, entering dune where fencing inadequate.	F2.7 Restore fence at foredune. Monitor incursions into the foredune. Explore options for restoration of the dune, (Cut brush; jute matting; re-vegetation)	High (Cons / threat)	Sir Richard Peninsula Committee, NRM.
	Between Barrage Road and the beachfront. There are several foot paths which need management and monitoring.	F2.8 Monitor and manage foot traffic.	Medium (threat)	Sir Richard Committee, NRM.
	Weed control and re-vegetation	F2.9 Targeted control of weed species. Pursue educational opportunities to reduce incidences of the use of invasive garden species.	Medium (threat)	
ESTUARINE SHORE	Bird habitat of international significance, Ramsar site Management of the whole of the estuary.	F2.10 Local input as necessary to the current management process.	Medium (Cons)	Community groups, Council.
	These tide dependent habitats are threatened by climate change induced accelerated sea level rise.	F2.11 Detailed high resolution mapping of topography to define potential sea level rise hazard.	Low (hazard)	Commonwealth Natural Disasters Mitigation Program, SA DEH.
WHOLE CELL	Cell has good conservation values, is adjacent to Ramsar site and a high profile at the Murray Mouth; management is currently inactive.	F2.12 Review the inclusion of the whole peninsula in Coorong Conservation Park and Ramsar site	High (Cons / threat)	SA DEH – NPWS, Commonwealth DEH

Cell F3 Goolwa: Beach Road to Treleaven Avenue



Landforms

“This entire beach is composed of fine sand and exposed to waves averaging over 2m. These break across a 500m wide double bar surf zone, characterized by numerous spilling breakers and substantial wave set-up and set-down at the shoreline and, during lower wave conditions, widely spaced rips.” (Short, 2001, p.98). Barrier dunes (c. 100m wide); undulating coastal plain, appears as a former aeolianite surface.

Biota and Benthic Habitat

Bare sand to 4km offshore. Dune shrubs and grasses.

Land Use

Suburban residential development is found over the coastal plain and into the rear of the dunes. Some degraded remnant dune vegetation areas remain.

Values (field visits and local reports)

A coastal reserve, with a sizeable sand dune complex, still retaining some vestiges of dune biodiversity values. There is a heavily used recreation beach and extensive car parking (levelled dune surface, now bitumised), kiosk, and toilet. Activities can include swimming, beach walking, fishing, cockle gathering.

Draft Marine Park Zoning

General Use Zone (http://www.environment.sa.gov.au/coasts/pdfs/encounter_marine_park_zp_tech.pdf)



Goolwa, immediately west of Beach Road

(Coast Protection Board, May 2003)

Threats (Field visits and local reports)

Foot damage to the dunes, shown by multiple tracks and weed distribution. Incursion of residential development into dune in Eastern corner of the cell. Uncontrolled dogs on the beach threaten plovers and their eggs in spring, as do vehicles on the beach, to the SE of Beach Road.

Opportunities

Community education, at the large Beach Road carpark, aimed at reducing human impact on dunes in this area. Redevelopment of the carpark and facilities, could include significant interpretation.

Conservation Analysis (GIS)

This cell has the lowest total of conservation means within the region. Low conservation values are found across the entire cell, although it has some remnant dune areas, biodiversity and heritage values are low to non-existent. There are some values for rarity of dune vegetation assemblage within South Australia, and also some moderate values for bird habitat. The state vulnerable *Thinornis rubricollis* (Hooded Plover) has considerable potential for breeding within this cell, but reduced by vehicles and dogs on the beach and in the dunes. The state rare *Haematopus longirostris* (Pied Oystercatcher) and *Neophema elegans* (Elegant Parrot) have been recorded in this cell.

Threats Analysis (GIS)

The combined threat rating for cell 3 is high: notably the threat values for dune instability and distribution of rated weeds are the highest in the region. Informal camping, development zoning, land ownership and use, vegetation block size, shape and isolation, and proportion of exotic plant species all contribute to the combined rating. Part of the inner edge of the dunes on the western part of the cell is zoned residential; houses have been built within the dunes, with destabilising impact.

The following red alert weeds have been found within this cell: *Ehrharta villosa* var. *maxima*, *Gazania linearis*, *Lycium ferocissimum*, *Chrysanthemoides monilifera* ssp. *Monilifera*, *Leptospermum laevigatum*, *Euphorbia paralias*, *Euphorbia terracina*, *Olea europaea* ssp. *Europaea*, *Oxalis pes-caprae*.

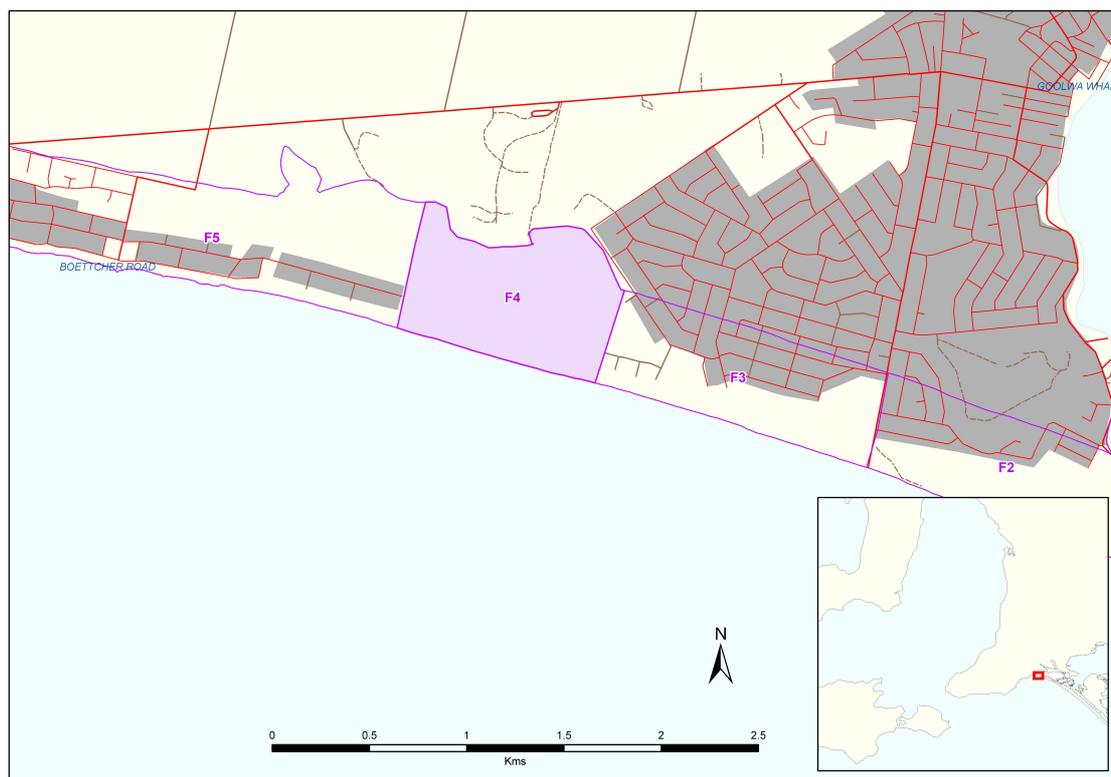
Possible Climate Change Threats

Over time increasing aridity will slow natural recovery from damage to dune vegetation. Rising sea levels will see increased storm damage to foredunes; Bruun Rule calculations of beach recession could be compromised by active littoral drift values here, however, recession of the order 10 – 20m over 50 years could be likely, given current IPCC forecasts. Likely increases in the low period swell component of wave climate and a possible increase in the magnitude of peak storm events increase the uncertainty in seasonal changes of beach state.

(Long term monitoring of dune, beach and nearshore sand levels is carried out at this cell by Coast Protection Board profile line)

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Beach	Seasonal threat to nesting plovers and eggs.	F3.1 Interpretive sign on nesting hooded plovers and dogs. Fencing of nests.	High (Cons / threat)	DEH HP Recovery Project, Council
	4WD on beaches east of Beach Rd has led to foredune damage along the peninsula	F3.2 Review the need to allow 4WD beach access.	Medium (threat)	Council
Beach and Dune	Impact of foot traffic and dogs challenges the stability of the dunes at both E and W of Beach Road, (see photo above).	F3.3 Explore opportunities to better manage foot traffic impacts in dunes and rehabilitate damaged areas as required.	Medium (threat)	Council, Community Goolwa -> W LAP.
		F3.4 Pursue opportunities for community education to reduce the impacts on the Beach Road dunes.	Medium (threat)	
	Weed control and rehabilitation.	F3.5 Targeted control of weed species. Pursue educational opportunities to reduce incidences of the use of invasive garden species.	Medium (threat)	Council, Community, Goolwa-> W LAP.
	Likely beach and dune recession consequent on climate change effects.	F3.6 Continuation of monitoring of nearshore and beach sand levels through the Coast Protection Board beach profile established at Beach Road.	Low (Hazard)	Coast Protection Board, Council.

Cell F4 Tokuremoar Reserve



Landforms

"This entire beach is composed of fine sand and exposed to waves averaging over 2m. These break across a 500m wide double bar surf zone, characterized by numerous spilling breakers and substantial wave set-up and set-down at the shoreline and, during lower wave conditions, widely spaced rips." (Short, 2001, p.98). Low dune barrier, backed by brackish coastal swamp within an aeolianite swale and rise at inner edge of cell.

Biota and Benthic Habitat

Clear sand to 4km offshore. Dune grasses and shrubs. Brackish coastal swamp vegetation in swale, with samphire and Swamp Paperbark.

Land Use/ Land Ownership

This cell is listed as a Crown Lands Act Reserve, including the foreshore (the development plan includes the foredune only as a coastal zone).

Values and Uses (field visits and local reports)

This small area provides an invaluable glimpse of the varied habitats of the south coast of the Fleurieu before development. The reserve is known to be of significance to the local Aboriginal people; however, it is not registered as a significant site on the state heritage register (and hence was not assigned a value for Aboriginal heritage in the GIS analysis).

Draft Marine Park Zoning

General Use Zone (http://www.environment.sa.gov.au/coasts/pdfs/encounter_marine_park_zp_tech.pdf)



Tokuremoar Reserve, formerly the Goolwa Conservation Park
(Cycle track and Goolwa dump immediately landward)

(Coast Protection Board, May 2003)

Threats (Field visits and local reports)

High numbers of introduced plant species. Tokuremoar, and the adjacent low lying land immediately to the west, are subject to land based flooding; however, flooding regimes are dependent on land and water management within the catchment, which is based on agricultural needs and wetland management. Locally, there is potential for groundwater contamination from the adjacent dump, which is immediately upslope on a pervious limestone slope. The dump also remains a fire hazard to the Tokuremoar reserve. There is currently no monitoring of flooding, groundwater levels and groundwater quality, although the values of this rare area depend upon its hydrology. The bulk of this cell is outside the Coastal Zone of the development plan, in General Farming, and hence is not subject to the coastal hazard zone provisions of the development plan or the protections given swamp and sand dune areas in many other coastal areas. Uncontrolled dogs on the beach threaten plovers and their eggs in spring and summer.

Opportunities

Public ownership of this rare coastal swamp gives the opportunity for government / community partnerships to actively manage the area. (Currently the Alexandrina council annually removes Victorian tea tree from this reserve).

Conservation Analysis (GIS)

The total of conservation means shows this to be one of the relatively high conservation value locations within the region; there is little variation in averaged totals across the cell. All plant and animal conservation layers score medium to high means for this cell, though no heritage values have been located here. The highest value means are for vegetation shape size and connectivity, for butterfly larvae habitat, for reptile habitat, and priority of vegetation assemblage based on rarity within South Australia.

Grund (1997) notes that the area is in "Poor condition, but highly significant as breeding habitat for *Anisynta cynone cynone*", the Blue Cynone butterfly, which is found here; the rating for butterfly larvae habitat was the highest in the region. Reptile habitat is notable, providing refuge for species which are dependent on habitats only found in coastal areas.

The state vulnerable *Coturnix ypsilophora* (Brown Quail), *Cladorhynchus leucocephalus* (Banded Stilt), *Thinornis rubricollis* (Hooded Plover); the state rare *Cereopsis novaehollandiae* (Cape Barren Goose), *Anas*

rhyncotis (Australasian Shoveller), *Plegadis falcinellus* (Glossy Ibis), *Gallinago hardwickii* (Latham's Snipe), and *Neophema elegans* (Elegant Parrot) have been recorded in this cell.

Threats Analysis (GIS)

Combined threat ratings give a moderate score for this cell. Numbers of exotic species and rated weeds are comparatively high. The adjacent Goolwa dump, viewscape, and some dune instability add to threat scores.

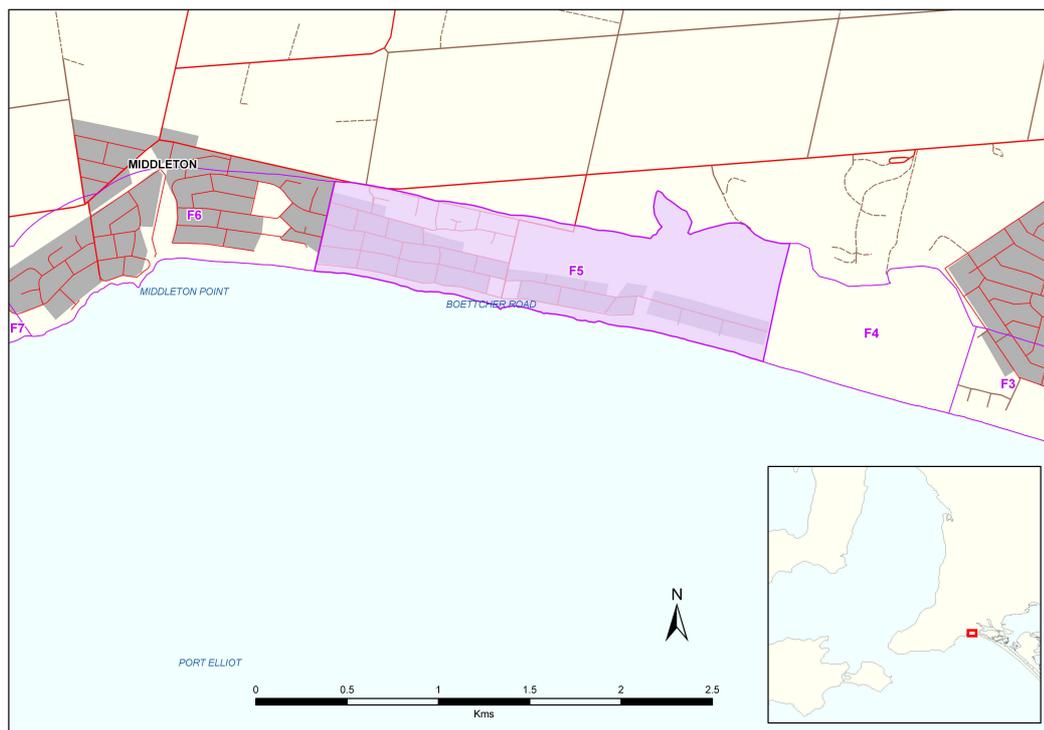
The following red alert weeds have been found in this cell: *Asparagus asparagoides*, *Ehrharta villosa* var. *maxima*, *Lycium ferocissimum*, *Acacia cyclops*, *Euphorbia terracina*, *Acacia saligna*, *Euphorbia paralias*, *Olea europaea* ssp. *europaea*, *Carpobrotus edulis*, *Marrubium vulgare*, *Pinus radiata*, *Solanum linnaeanum*.

Possible Climate Change Threats

Over time increasing aridity will slow natural recovery from damage to dune vegetation and compounds the pressure of lack of floodwaters on the paperbark swamp. Rising sea levels will see increased storm damage to foredunes; Bruun Rule calculations of beach recession could be compromised by active littoral drift values here, however, recession of the order 10 – 20m over 50 years are likely, given current IPCC forecasts. Probable increases in the low period swell component of wave climate and a projected increase in the magnitude of peak storm events increase the uncertainty in seasonal changes of beach state.

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Whole Crown Land Reserve	Continued lack of active management in a reserve with high conservation and Aboriginal heritage value, which is facing increased population pressure from adjacent areas.	F4.1 Review by DEH Land Administration Branch, Coast Protection and NPWS, in light of conservation values and increasing threats.	High (Cons / threat)	DEH, SA Dept of Aboriginal Affairs and Reconciliation.
Whole Crown Land Reserve	Earlier draft management plan completed for the Ngarrindjeri people did not take into account the conservation values outlined in this study.	F4.2 Review and updating of the management plan by a group including NRM, CP Branch, local residents and Aboriginal people.	High (Cons / threat)	Local LAP, Council, CP Branch DEH, NRM Board, Ngarrindjeri people.
	Development plan zoning does not fully recognise dynamic coastal habitats.	F.4.3 Review of Development plan.	Medium (threat)	Council.
	Threats to habitat of the Blue Cynone butterfly larvae.	F4.4 Development of strategy to manage indigenous fauna habitat.	High (Cons / threat)	Local LAP, NRM, Volunteers.
	The reserve is of conservation value, but is under growing population and weed pressure.	F4.5 Targeted control of weed species. Pursue educational opportunities to reduce incidences of the use of invasive garden species. Immediate review of access control issues.	High (Cons / threat)	Local LAP. NRM. Volunteers.
Melaleuca swamp	Pressures on groundwater and flooding regime.	F4.6 Review opportunities to establish a monitoring regime of flooding regime, groundwater levels and groundwater quality.	Medium (threat)	NRM, Community volunteers.
Beach	Pressures on Hooded Plover from walkers and dogs.	F4.7 Notices to inform dog owners about nesting seasons and Hooded Plover; erection of warning fences at nests.	High (Cons / threat)	Volunteers. Council.

Cell F5 Surfers Beach, Middleton



Landforms

"This entire beach is composed of fine sand and exposed to waves averaging over 2m. These break across a 500m wide double bar surf zone, characterized by numerous spilling breakers and substantial wave set-up and set-down at the shoreline and, during lower wave conditions, widely spaced rips." (Short, 2001, p.98). 200m dune barrier in E. of cell, grading to a 10m aeolianite bluff. Further west a discontinuous low foredune at base of low (<10m high) aeolianite bluff; aeolianite coastal plain.

Biota and Benthic Habitat

Bare sand offshore to 4km. Low coastal heath on narrow cliff-top coastal reserve.

Land Use/ Land Ownership

Residential land. Small area of grazing land. Narrow coastal reserve.

Draft Encounter Marine Park Zoning

Sanctuary zone S-9 begins 200m offshore; Habitat Protection Zone HP-2 inshore

(http://www.environment.sa.gov.au/coasts/pdfs/encounter_marine_park_zp_tech.pdf)



Surfers: high energy beach, dunes, low aeolianite cliffs, suburban coastal sprawl, grazing land.
(Coast Protection Board, May 2003)

Values (Field visits and local reports)

Recreational beach used primarily for walking, surfing and fishing. Remaining dunes constitute a valuable buffer against coastal erosion.

Threats (Field visits and local reports)

Dumping of garden wastes in small reserves compounds the weed problem. The large number of holiday homes in the area brings heavy seasonal use, unbalanced by any knowledge of the local environment. Uncontrolled dogs on the beach threaten plovers and their eggs in spring. Dunes show multiple foot traffic impact. Erosion of aeolianite cliffs periodically leads to undercutting with threatened cliff collapse.

Opportunities

The small area of cliff top coastal reserve and dunes (continuing to cell 4), allows the opportunity to make a concentrated effort of weed control and revegetation.

Public education of the value of the coastal reserves.

Conservation Values (GIS Analysis)

The entire cell shows low conservation values, including small vegetation blocks at the northern and eastern fringes of the cell.

The state vulnerable *Thinornis rubricollis* (Hooded Plover); the state rare *Haematopus longirostris* (Pied Oystercatcher), *Haematopus fuliginosus* (Sooty Oystercatcher) and *Neophema elegans* (Elegant Parrot) have been recorded in this cell.

Threats (GIS Analysis)

Combined threat values give a moderate total for this cell. This is made up of high scores for proportion of exotic species and distribution of rated weeds. Moderate scores include development zoning, dune instability, cliff instability, land ownership, land use and viewscape values.

The following red alert weeds were found in this cell: *Gazania linearis*, *Acacia Cyclops*, *Lycium ferocissimum*, *Leptospermum laevigatum*, *Acacia saligna*, *Euphorbia paralias*, *Euphorbia terracina*, *Oxalis pes-caprae*, *Arctotis stoechadifolia*, *Carpobrotus edulis*, *Coprosma repens*.

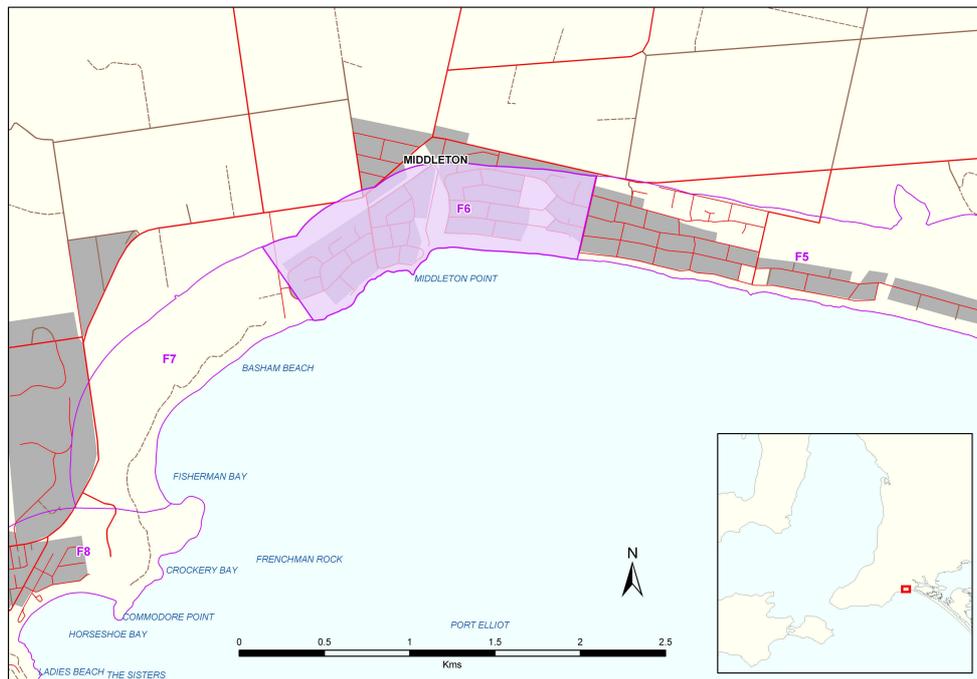
Possible Climate Change Threats

Over time increasing aridity will slow natural recovery from damage to dune vegetation. Rising sea levels will see increased storm damage to foredunes; Bruun Rule calculations of beach recession could be compromised by active littoral drift values here, however, recession of the order 10 – 20m over 50 years could be likely, given current IPCC forecasts. Changes in wave climate which increased the long period swell component would increase the likelihood of foredune damage. Where dunes are eroded in front of aeolianite cliffs, these will be undermined at varied rates, depending on their local composition.

(Long term monitoring of dune, beach and nearshore sand levels is carried out at this cell by Coast Protection Board profile line).

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Beach	Destruction of plover eggs in spring and summer.	F5.1 Notices informing public on plovers and requesting restraint on dogs in spring and summer.	High (Cons / threat)	Council
Cliff top Reserves	Weed infestation.	F5.2 Weed control and revegetation program. Signs to discourage garden waste dumping.	Medium (threat)	Council and community partnership
	Instability of aeolianite (calacarenite) cliffs with collapse hazard.	F5.3 Warning signs of cliff instability.	High (hazard)	Council
Dunes (east end of cell)	Foot traffic impact.	F5.4 Signage and access control of foot traffic on dunes.	Medium (threat)	Council and community partnership
Beach and dune	Seasonal visitor impacts on dunes.	F5.5 Development of educational materials for seasonal visitors / holiday homes to reduce impact on dune and beach.	Medium (threat)	Council and community partnership
	Long term adjustment to climate change induced conditions.	F5.4 Continued monitoring of sand levels through CPB profile.	Low (hazard)	Coast Protection Board

Cell F6 Middleton



Landforms

“This entire beach is composed of fine sand and exposed to waves averaging over 2m. These break across a 500m wide double bar surf zone, characterized by numerous spilling breakers and substantial wave set-up and set-down at the shoreline and, during lower wave conditions, widely spaced rips. At Middleton a strong permanent rip runs out against the rocks.” (Short, 2001, p.98). The beach is backed by a low marl bluff; and fronted by a small foredune (c. 10m wide). Bourman (1974) records erosion c.200m of this bluff and the dunes which were here, over a period of 100 years, to 1970. Recently, recession continues through slumping at times of saturation and wave removal of slumped material, but has slowed considerably, and may well have been reversed. Settlement is established on a gently sloping low platform of clay marl. The lower Middleton Creek is incised into this platform.

Benthic Habitat/ Biota

Offshore is clear sand. Foredune is weed dominated by sea wheat, sea spurge, gazania and sea rocket; however some spinifex, saltbush and pigface remain. Exotic grasses on clay plateau. Middleton Creek banks and slopes dominated by weeds – tamarisk, gazania, kikuyu and couch grass.

Draft Encounter Marine Park Zoning

Sanctuary zone S-9 begins 200m offshore; Habitat Protection Zone HP-2 inshore.

(http://www.environment.sa.gov.au/coasts/pdfs/encounter_marine_park_zp_tech.pdf)



Middleton and the mouth of Middleton Creek

(Coast Protection Board)

(photo taken 1997, subsequently a small dune has formed in front of low cliff)

Land Use/ Land Ownership

Residential coastal plain with coastal and creek line Council reserves. . The wide coastal reserve immediately East of Middleton Creek (creek to Chapman Av) is invaluable as a buffer to erosion here, and should be defended against development pressure. Farm and urban stormwater run-off to the Middleton Creek. Erosion episodes of the marl cliffs and creek banks contribute to turbidity in the nearshore zone.

Values (Field visits and local reports)

Recreational beach used for walking, surfing and fishing. The remaining narrow reserves provide an invaluable buffer zone.

Threats (Field visits and local reports)

Storm water is a factor in local erosion points within the creek slopes and marl bluffs. Uncontrolled dogs on the beach threaten plovers and their eggs in spring.

Opportunities

The small areas of coastal reserves give opportunity for a relatively small number of man hours to achieve very considerable change.

Conservation Values (GIS Analysis)

The sum of conservation means shows this cell to have one of the lowest totals within the region. All parts of this cell show summarised conservation values as low. However, there are some biodiversity values, as 53 threatened plant and animal species have been recorded within the cell. Values for priority of vegetation species based on status of the community, on the rarity of the community and the status of the flora are above average for the region; there are also values for percentage of endemic species and species richness. The cell contains a geologic monument.

Threat Analysis (GIS Analysis)

Development potential through zoning, high viewshed and viewscape scores, give this cell a high threat score, the fourth highest in the region. A high threat value for ownership reflects the low area of publicly owned land: coastal reserves have been much reduced by erosion, subdivision, road and carpark construction. As a result, reserves remain as narrow clifftop strips, a riparian reserve, a single line of dunes and talus slopes below some cliffs. These small areas currently suffer from weed infestation.

The following red alert weeds have been found within this cell: *Gazania linearis*, *Acacia cyclops*, *Lycium ferocissimum*, *Chrysanthemoides monilifera* spp. *monilifera*, *Leptospermum laevigatum*, *Acacia saligna*, *Euphorbia paralias*, *Euphorbia terracina*, *Olea europaea* ssp. *europaea*, *Oxalis pes-caprae*, *Carpobrotus edulis*, *Coprosma repens*, *Marrubium vulgare*, *Pinus halepensis*.

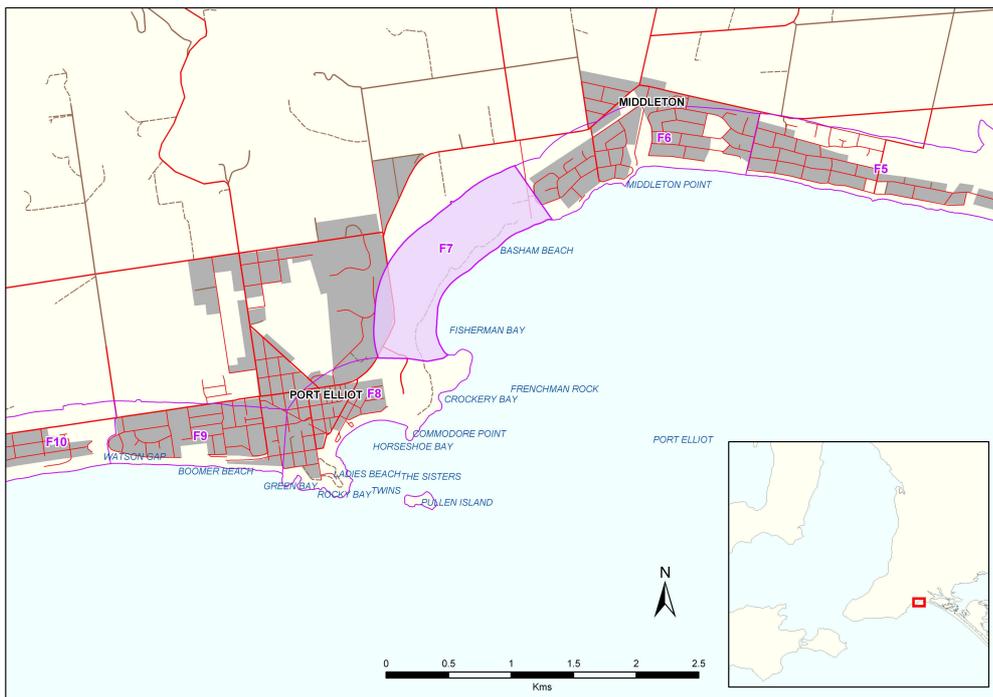
Possible Climate Change Threats

Over time increasing aridity will slow natural recovery from damage to dune vegetation. Rising sea levels will see increased storm damage to foredunes; Bruun Rule calculations of beach recession could be compromised by active littoral drift values here, however, recession of the order 10 – 20m over 50 years could be likely, given current IPCC forecasts. Changes in wave climate which accentuate the long period swell component would increase the likelihood of foredune damage. Cliffs will be eroded at varied rates, depending on their local composition: the ancient metamorphics of the Middleton headland will be little affected; however, the marl bluff between the Middleton Creek and Chapman Road is vulnerable to tidal sapping at its base.

(Long term change of the beach and near shore sea floor is monitored by the Coast Protection Board profile at the eastern end of the cell. Monitoring of the cliff erosion is also carried out by the CPB).

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Coastal and riparian reserves	Weed infestation, including many invasive species.	F6.1 Weed control and revegetation program within riparian reserve.	Medium (threat)	Council and community partnership.
	Dumping of garden waste and soils in reserves.	F6.2 Signs to discourage garden waste dumping.	Medium (threat)	
Beach, dune and low cliff	Long term adjustment to climate change induced conditions.	F6.3 Continued monitoring of sand levels through CPB profile and cliff top pegs.	Medium (threat)	Coast Protection Board.
		F6.4 Ensure the buffer zone protection offered by coastal reserves is not encroached upon.	High (hazard)	Council.
Stormwater outlets to creek and foreshore	Localised erosion, conduit for weeds and sediments.	F6.5 Review impact on foreshore and creek of current stormwater arrangements.	Medium (threat)	Council.

Cell F7 Bashams Regional Park



Landforms

A curving 1.8km, low energy beach, facing ESE, is sheltered by Commodore Point (foreground below) and nearshore reefs, (with change in orientation at Middleton Point, to face SE, at cells 6 and 5). The narrow beach is of fine sand and shellgrit. There is accumulation of seagrass detritus, especially at low energy, highly protected western corner, called Fisherman's Bay.

There is a narrow continuous inshore bar, and a number of inshore reefs. The beach is connected to a low narrow irregular single line of dunes: local anecdotal reports suggest these dunes have been much reduced by sand removal for fill on the boggy lower slopes immediately landward, and for other purposes. The Coast Protection Board long term profile monitoring near Middleton Rocks shows this end of the beach is stable; however, there is current recession of c.1 - 2m per year at the centre of the embayment.

The low sloping coastal plain landward of the dunes collects drainage from a large area of agricultural land, roads and suburbs.

Draft Marine Park Zoning

Sanctuary Zone 9 (http://www.environment.sa.gov.au/coasts/pdfs/encounter_marine_park_zp_tech.pdf)



Crockery Beach, Frenchmans Rocks and Bashams Beach (May 2003)

Benthic Habitat/ Biota

Inshore limestone reef, with bare sand offshore. Fore-dune grasses and dune shrubs. (Revegetation of coastal slopes (formerly pasture), with open woodland, tall and low shrub canopy, as well as sedge and native grasses).

Land Use/ Land Ownership

The cell was formerly (<c.1980) grazed and cultivated, including the dunes. Now an open space state park (Bashams Regional Park), including the caravan park and the slopes SE of the railway, are Crown land (Min Env & PI). The dunes and foreshore are Crown land both under the care and control of Alexandrina council. Land parcels NW of rail are privately owned: they are farmed and include 2 dwellings.

Draft Encounter Marine Park Zoning

Habitat Protection Zone HP-2 inshore, to hwm.

Values (Field visits and local reports)

Bashams Park is a heritage site, a recreational site, and a site where habitats for native plants and animals are being re-established.

There are numbers of midden sites at the headlands and within the dunes, two Aboriginal burial sites within the cell, as well as male and female sites of significance to local Aboriginal people.

Bashams Regional Park is a valuable open space break in the urbanised coastal plain which extends from Victor Harbor to Goolwa. A variety of recreational activities, including walking, cycling and orienteering are popular here. The headlands at each end of the cell provide prime whale watching sites in winter, when the mammals often remain close to the shore within the sheltered bay.

The Bashams Regional Park is currently under landscape change, through withdrawal of grazing, weed control and extensive revegetation. Construction of an amphitheatre is taking place, as well as repair and preservation of farm buildings, the construction of a small wetland to reduce the pollution potential of regional

surface stormwater flow, and the creation of a bird habitat. Shorebirds feed in the sheltered inter-tidal and upper beach environments, apparently on the results of beachcast seagrass detritus decay. Reefs also provide opportunities for shorebirds, waders and divers.

Threats (Field visits and local reports)

Heavy pressure of recreational uses is increasing due to regional rapid population growth and threatens attempts to stabilise and revegetate the dunes, the headlands and the lower slopes, as well as threatening the degradation of Aboriginal sites. The slopes of Commodore Headland provide a challenge to mountain bikers, with damaging results. Dunes currently house many weeds species (see lists below), including well established, old olive plantings. Uncontrolled dogs on the beach threaten plovers and their eggs in spring.

Opportunities

The obvious value of this rare area of open space within the urbanised south of the region, is the result of the actions, over three decades, of the community and governments to establish, maintain and improve it as public open space. The ongoing implementation and development of the Bashams Park Plan (Rust PPK, 1992) is undertaken by the Bashams Park Trust, Alexandrina Council and various state agencies. Heavy pressure of recreational use creates the need to continue and extend the work energetically. The established amphitheatre and improvements to the former dairy sheds give current scope for meetings and educational activities, which could build on the recent involvement of schools, TAFE and Aboriginal groups in planting and land management. Signed educational trails, booklets and web-based information also could build awareness of the values of the area. Accommodation at the Caravan Park, road access and parking, and land give the possibility of construction of an interpretation centre at the western end of the park.

Current work on protection and extension of native grass areas may offer the long term opportunity to establish butterfly larval food sites in tussock grasses.

Conservation Analysis (GIS)

Summarised conservation means show relatively low to medium values across the cell. Values accrue from priority of vegetation species based on the status of the community, on the rarity of vegetation communities within the state (less than 20 records within South Australia), on the priority of sites with threatened flora, (14 threatened plant species are found in this cell). There are also values for species richness; 102 plant and animal species have been recorded in this cell. Heritage values include a geological monument and Aboriginal sites of significance.

The state vulnerable *Thinornis rubricollis* (Hooded Plover); the state rare *Actitis hypoleucos* (Common Sandpiper), and *Haematopus fuliginosus* (Sooty Oystercatcher) have been recorded in this cell.

Threat Analysis (GIS)

Threat values give a low to moderate total for this cell. However, high viewscape and viewshed values, a large proportion of recorded exotic species, and some dune instability flag important threat potential for the area. Recorded weed lists (see below) show that aggressive and invasive weeds are found here and the average value for significant weeds for the whole cell is relatively high; mapping shows the whole cell can be classified as suffering a high weed threat.

Red Alert Species for Coastal Cell 7 - Bashams Beach

Lycium ferocissimum, *Euphorbia paralias*, *Euphorbia terracina*, *Olea europaea ssp. Europaea*, *Oxalis pes-caprae*, *Ehrharta calycina*

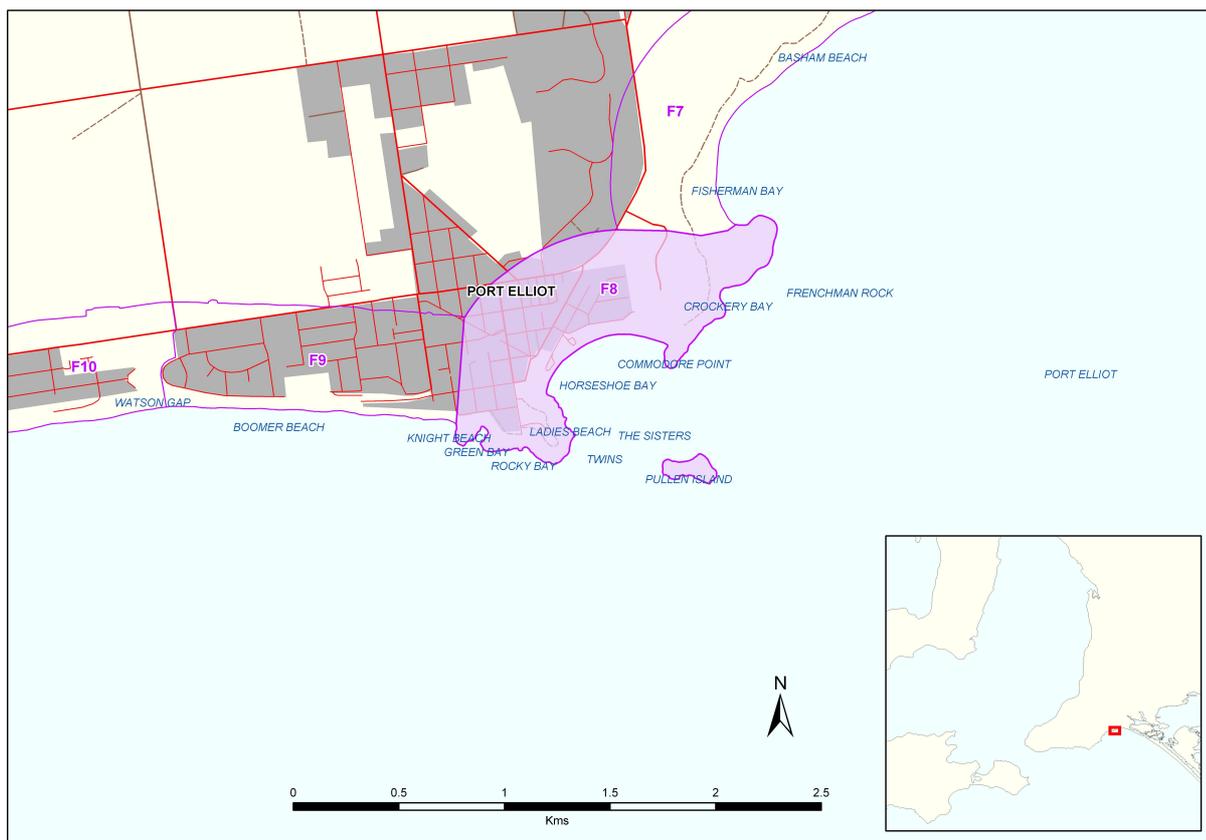
Small areas of potentially unstable dune (central and eastern end of Bashams Regional Park) are inappropriately zoned, since they lie inland of the coastal zone on the Alexandrina Development Plan.

Possible Climate Change Threats

Over time increasing aridity will slow natural recovery from damage to dune vegetation. Rising sea levels will see increased storm damage to foredunes; Bruun Rule calculations suggest beach and dune recession of the order 5 – 30m over 50 years could be likely, given current IPCC forecasts. Changes in wave climate to increase the long period swell component would increase the likelihood of foredune damage; also, long period waves will change the focus of erosion due to inshore wave refraction effects.

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Headlands	Management of recreational use.	F7.1 Continue access control through plantings, utilising indigenous coastal plants, and signage.	Medium (Cons)	Council, Bashams Trust
	Weed invasion.	F7.2 Respond to high numbers of weed species through increased effort.	Medium (threat)	Bashams Trust
	Protection of heritage sites.	F7.3 Continue access control through plantings and signs	Medium (Cons)	Council, Bashams Trust
Beach	Management of recreational use to reduce impact on dunes.	F7.4 Support access control by signage.	Medium (threat)	Council, Bashams Trust
	Management of dog walkers on beach to reduce impact on Hooded Plovers in nesting season.	F7.5 Signage on Hooded Plover. Community monitoring in nesting season.	High (Cons / threat)	Bashams Trust, DEH HP Recovery Program.
	Localised beach erosion.	F7.6 Beach pole monitoring.	Low (hazard)	Coast Protection Board, Council, Bashams Trust
	Long term beach change (at the eastern end of the embayment).	Continuation of monitoring at CPB profile.		Coast Protection Board
Dunes	Weed invasion.	F7.7 Respond to high numbers of weed species through increased effort, targeting red alert species.	Medium (threat)	Bashams Trust
	Foredune storm damage; localized erosive trend.	F7.8 Use of wind drift fencing, where appropriate.	Medium (threat)	Bashams Trust
	Foot damage.	F7.9 Support access control by signage.	Medium (threat)	Council, Bashams Trust
	Inappropriate Development Plan Zoning.	F7.10 Revise zoning to include dunes in coastal zone.	Low (Cons)	Council, State Planning. DEH (CPB)
Coastal Slopes	Re-establishment of areas of indigenous vegetation & weed control.	F7.11 Continue effort to implement Bashams Park plan.	Medium (Cons)	Bashams Trust
	Management of recreational use.	F7.12 Management of use of park by clubs, including appropriate information-giving.	Medium (Soc / Econ)	Council, Bashams Trust
(Whole cell)	Education re regional and local coastal and marine environment	F7.13 Amphitheatre, caravan park, former dairy farm buildings (needing further improvement) provide the basis of the physical infrastructure for an interpretation / education centre within Bashams Park.	Medium (KP region)	Council, Bashams Trust, State Agencies

Cell F8 Commodore Point, Horseshoe Bay and Freemans Knob



Landforms

Horseshoe Bay is a small, semicircular, southeast facing bay, wedged in between the prominent 30m high granite headland of Commodore Point and Freeman Knob (pictured above). The Bay is protected by Pullen Island, granite reefs and a stone groyne at its western end (below). Once a major port with a working jetty, the bay is now a prime recreation beach. Semicircular sand beach of Horseshoe Bay, facing SW, protected by large composite granite headlands of Commodore Point and Freeman's Knob.

Benthic Habitat/ Biota

Inshore limestone reef, grading to low profile reef offshore (several sites surveyed for monitoring potential).

Land Use / Land Ownership

Privately owned residential land. Extensive Council owned caravan park. The coastal reserves at the two large headlands are visually dominating.

Draft Encounter Marine Park Zoning

Commodore Headland and Pullen Island: Sanctuary Zone S-9 inshore, to HWM. Rest of cell is Habitat Protection Zone HP-2.

(http://www.environment.sa.gov.au/coasts/pdfs/encounter_marine_park_zp_tech.pdf)



Horseshoe Bay, Freemans Nob and Green Bay (showing foot traffic impacts) (Coast Protection Board, 2003)

Values (Field visits and local reports)

European heritage and scenic amenity. Heavily used safe swimming beach and grassed reserve at Horseshoe Bay. Fishing, snorkelling, walking.

Threats (Field visits and local reports)

Development pressure is very high in this area, (and neighbouring cells), leading to urban infill and expansion, and placing pressure on all coastal resources, including public land. Mountain bike, walker and whale watching pressure on Commodore Headland. Has visible impact on native vegetation and Aboriginal midden sites.

Conservation Analysis (GIS)

The total of conservation means is moderate to high; much of this cell shows low conservation values, apart from a number of small areas within the Port Elliot residential area and small coastal reserves.

There are values for vegetation communities, including threatened communities and flora, rarity within South Australia, and endemic plant communities (more than 50% of such communities found in the Southern Fleurieu region). Priority based on species richness and on habitat for significant bird species. Heritage values are high, including Aboriginal sites of significance and a geological monument; European heritage values rate highly, through shipwrecks and a variety of buildings and remains linked to former uses of the area, which have maritime connections. Pullen Island provides a refuge and breeding site for the Little Penguin and the Silver Gull.

The state vulnerable *Sterna nereis* (Fairy Tern); the state rare *Egretta sacra* (Eastern Reef Egret), *Actitis hypoleucos* (Common Sandpiper), *Larus dominicanus* (Kelp Gull) and *Haematopus fuliginosus* (Sooty Oystercatcher) have been recorded in this cell.

Threat Analysis (GIS)

This cell has a relatively large total score due to the high proportion of privately owned urban land. While a coastal reserve has been retained, it is relatively narrow and as a result development pressure value is high. To this is added high viewscape and viewshed, and proportion of exotic plant species; moderate scores accrue for cliff instability and official camp sites.

The following red alert weeds are found within this cell: *Asparagus asparagoides*, *Gazania linearis*, *Lycium ferocissimum*, *Chrysanthemoides monilifera ssp. Monilifera*, *Leptospermum laevigatum*, *Rhamnus alaternus*, *Acacia saligna*, *Euphorbia paralias*, *Euphorbia terracina*, *Oxalis pes-caprae*, *Argyranthemum frutescens ssp.*, *Coprosma repens*, *Ehrharta calycina*, *Pinus sp.*.

Possible Climate Change Threats

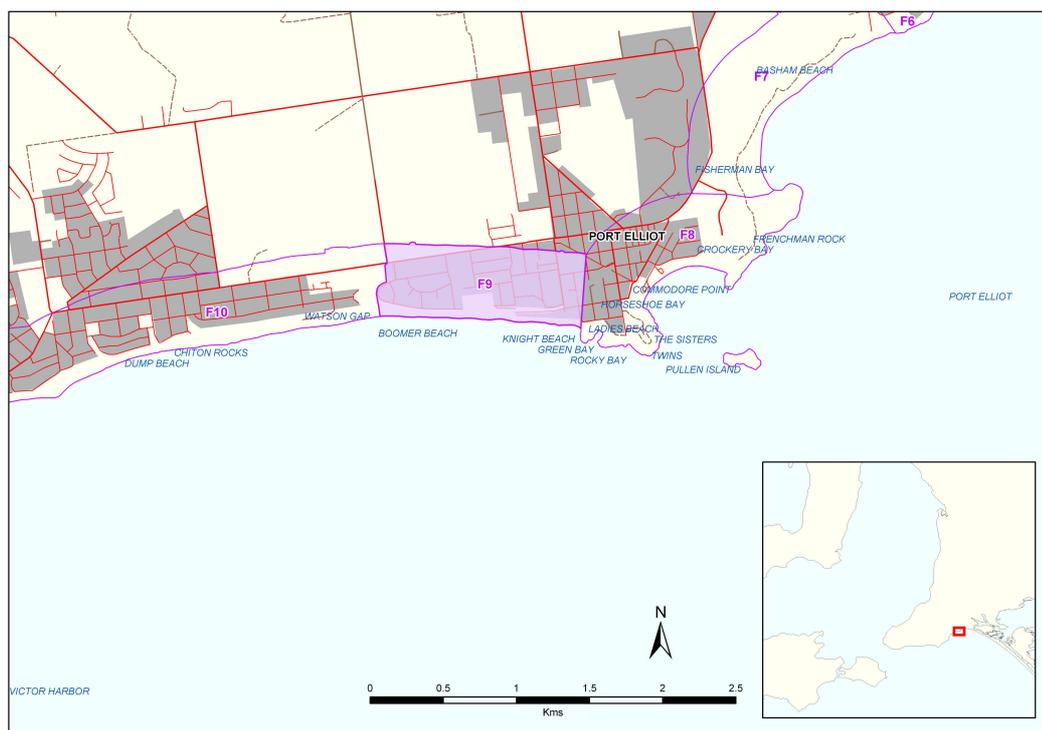
Over time increasing aridity will slow natural recovery from damage to the small areas of dune vegetation. Rising sea levels will see increased storm damage to beaches and foredunes; Bruun Rule calculations of beach recession suggest an order 5 – 30m over 50 years could be likely, given current IPCC forecasts. Changes in wave climate which increased the long period swell component would increase the likelihood of foredune damage.

This cell is resilient to projected changes due to the massive headlands and lack of floodable land; however, the lack of a buffer zone allowing the recession of Horseshoe Bay beach creates a potential long term threat of beach loss.

(Long term change at the dune, beach and nearshore sea floor is monitored by the CPB profile line at mid Horseshoe Bay).

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Reserves on former dune behind beach	Maintenance of reserve as a visual feature and buffer against beach change.	F8.1 Minimise increase in structures which reduce future flexibility through development plan provisions.	Low (Hazard)	Council
Beach and dune	Maintenance of high value recreational beach.	F8.2 Minimise / or seek alternatives to hard structures at rear of beach.	High (Soc / Econ)	Council
	Stability of dune at eastern end of bay. Conservation of sediment within the beach/ dune system.	F8.3 Use of sand drift fences. Access control.	Medium (threat)	Council & Community
	Beach change in Horseshoe Bay is significant because of the lack of a buffer zone for infrastructure.	F8.4 Continue beach profile monitoring.	Low (hazard)	Coast Protection Board
Pullen Island	Value as a bird nesting site.	F8.5 Monitoring of bird populations.	Low (Cons)	NPW

Cell F9 Knights Beach and Boomer Beach



Landforms

Boomer Beach begins at Freeman Knob, where dumping waves break at a low terrace reflecting beach. Low foredunes have in part been driven up a 10m bluff at the rear of the beach. Medium energy sand beach; narrow dune driven up low bluff. Coastal plain of outwash materials and aeolianite.

Benthic Habitat/ Biota

Heavy platform reef, with large inshore patches of sand and seagrass

Land Use/ Land Ownership

Residential area covering the coastal plain. Railway reserve and narrow steep dune corridor. Coastal reserve and private ownership.

Values (Field visits and local reports)

Recreational beach with swimming and surfing. Dune has a significant buffer function for railway and other developments.

Draft Encounter Marine Park Zoning

Habitat Protection Zone HP-2.

(http://www.environment.sa.gov.au/coasts/pdfs/encounter_marine_park_zp_tech.pdf)



Knights Beach

(Coast Protection Board, May 2003)

Threats (Field visits and local reports)

Increased visitation and recreational use due to increased local population and tourist promotion and the popularity of whale watching are placing increased pressure on the dunes.

Garden prunings, soil and lawn clippings containing seed banks of weed species from adjacent properties are placed on the low bluff and within the dunes. The existence of many weeds within nearby gardens means they are readily spread by people and birds. Taylor (2003) notes problems associated with the railway reserve, which contains many woody weeds; cuttings of these weeds are disposed of in the dunes during track maintenance.

Opportunities

Detailed local analysis of weed control and re-planting strategy is available in Taylor (2003).

Conservation Analysis (GIS)

The total of conservation means is ranked 19th of 27 cells in the region; foredunes and dune slopes show medium values, while the coastal plain sums to low values.

High values are found here for threatened bird habitat and also species richness: a total of 203 plant and animal species have been recorded in this cell. Conservation means are relatively high for vegetation associations, including those rare (<20) in SA associations including threatened plant species and associations found only in Southern Fleurieu. The cell includes a geological monument.

The state vulnerable *Thinornis rubricollis* (Hooded Plover) and the state rare *Haematopus fuliginosus* (Sooty Oystercatcher) have been recorded in this cell.

Threats Analysis (GIS)

Combined threat ratings give a moderate to high total. High values for rated weeds and proportion of exotic plants, for development zoning, land use and private land ownership are the basis of this rating. Other values accrue for viewscape and dune stability.

The following red alert weeds were found within this cell: *Asparagus asparagoides*, *Gazania linearis*, *Acacia cyclops*, *Lycium ferocissimum*, *Chrysanthemoides monilifera ssp. monilifera*, *Dipogon lignosus*, *Leptospermum laevigatum*, *Acacia saligna*, *Euphorbia paralias*, *Euphorbia terracina*, *Olea europaea ssp. europaea*, *Arctotis stoechadifolia*, *Argyranthemum frutescens ssp.*, *Carpobrotus edulis*, *Coprosma repens*, *Pinus halepensis*.

Possible Climate Change Threats

Over time increasing aridity will slow natural recovery from damage to dune vegetation. Rising sea levels will see increased storm damage to foredunes; Bruun Rule calculations of beach recession could be compromised by active littoral drift values here, however, recession of the order 5 – 15m over 50 years could be likely, given current IPCC sea level forecasts. Changes in wave climate which increased the long period swell component would increase the likelihood of foredune damage, as well as changing mean littoral drift speeds and possibly direction. For beaches such as this, where refraction of long period swell will be important, change in wave climate will greatly increase unpredictability in beach response.

Community beach pole monitoring at Chiton Rocks is collated by the CPB.

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Beach	The narrow beach and foredune is subject to frequent change, with community concern over potential erosional loss of dunes.	F9.1 Continuation of community beach pole monitoring.	Medium (Soc / Econ)	Community, CPB
Dune	Ongoing problems in weed control. Revegetation with indigenous species.	F9.2 Target residences with educational materials in regard to weed dumping.	High (Soc / Econ)	Coastcare group and Council
	Protection of significant flora and fauna.	F9.3 Implementation of management plan by Taylor (2003).	High (Soc / Econ)	Council and Coastcare group
	Damage and de-stabilisation by foot traffic.	F9.4 Improvement of signage at path entrances and by railway reserve. Strategic use of sand drift fencing.	High (Soc / Econ)	Council and Coastcare group
	Planning for continued increase in impact by visitation.	F9.5 Adequate access infrastructure, signage.	High (Soc / Econ)	Council and Coastcare group
Bluff	Stormwater erosional damage.	F9.6 Erosion control at outlets. Review of stormwater catchments, to slow peak runoff.	Medium (threat)	Council