

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

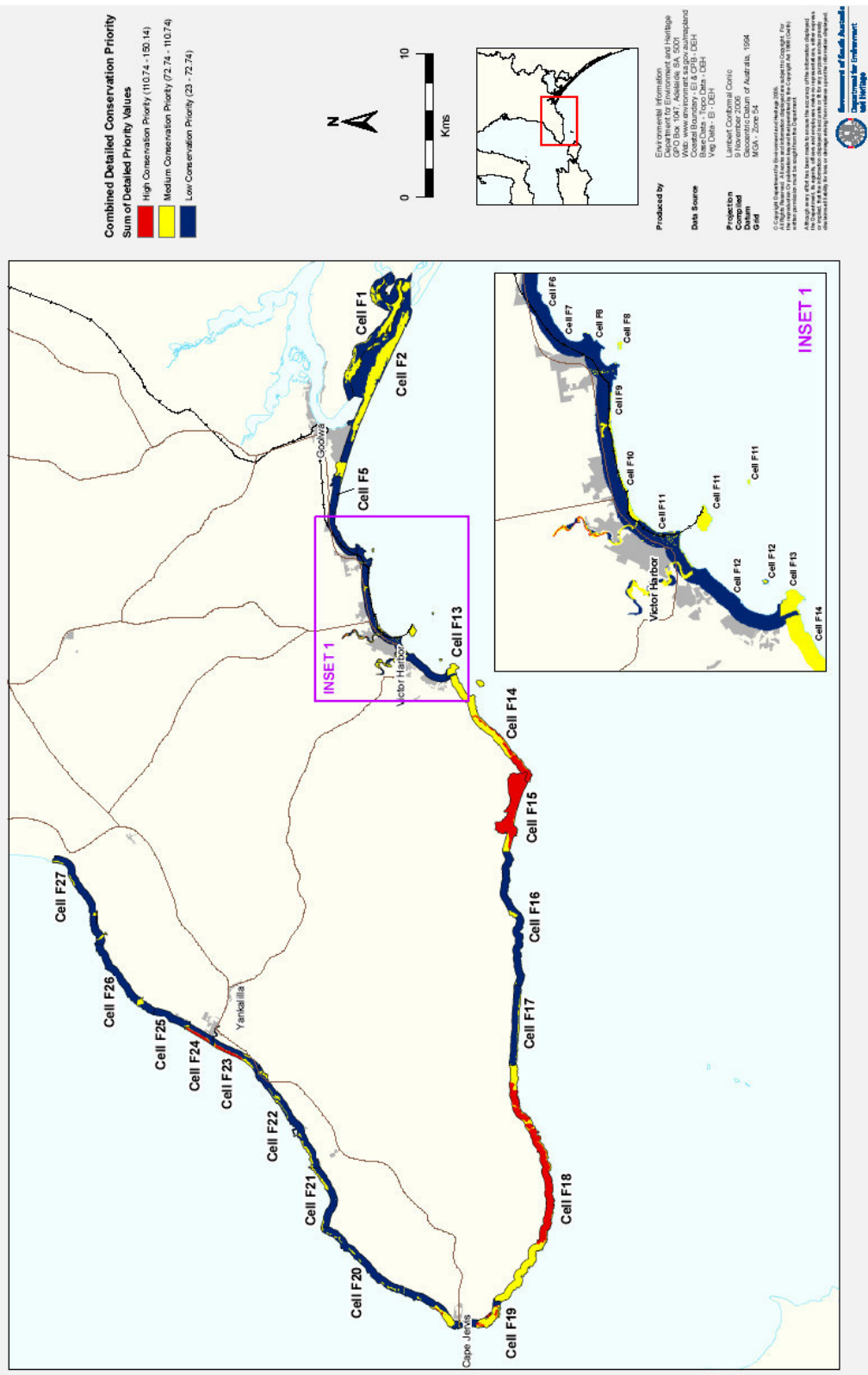


Figure 24. Combined detailed conservation priority scores

Southern Fleurieu Coastal Conservation Analysis Combined Detailed Threatening Processes

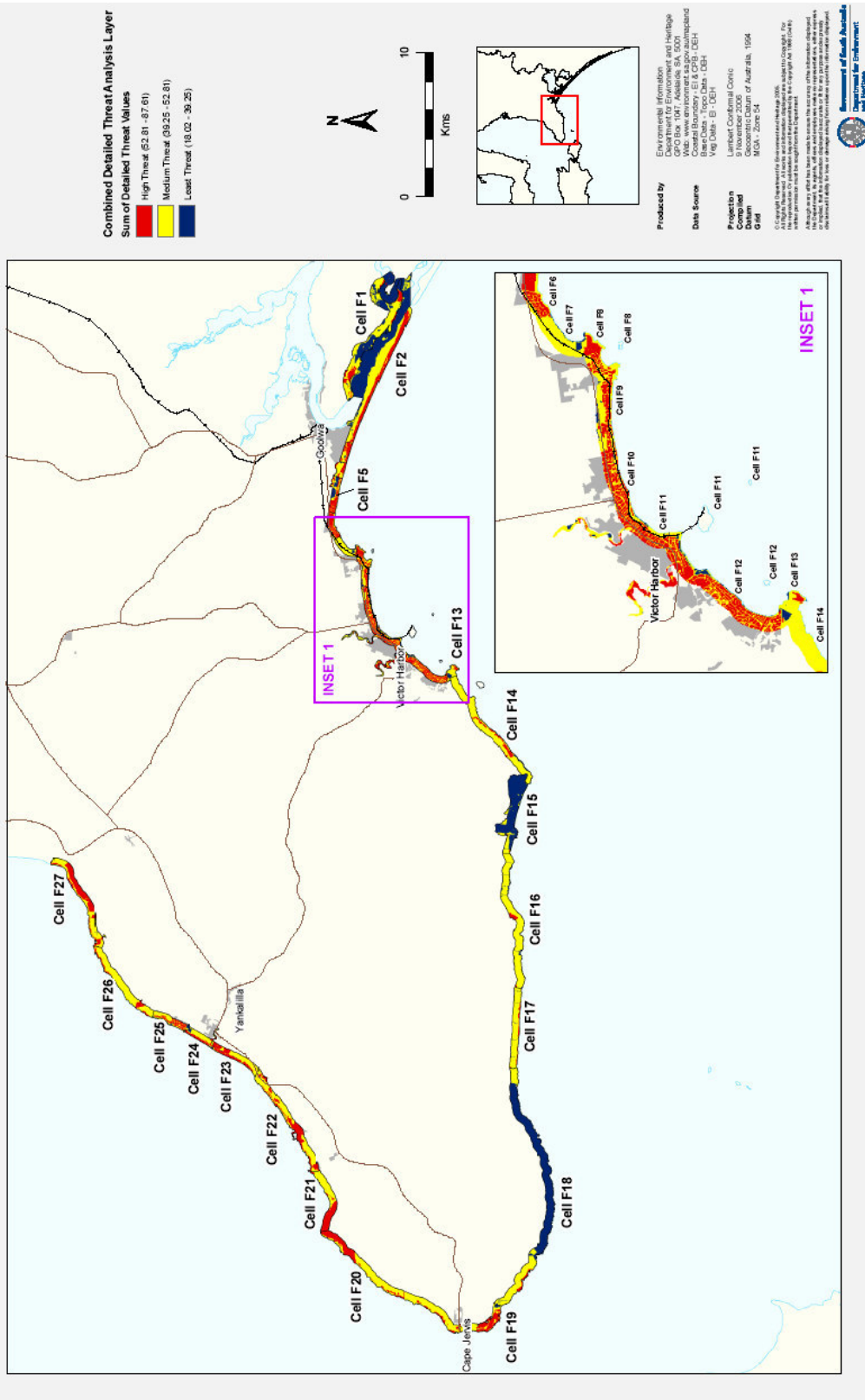


Figure 25. Combined detailed threatening processes scores

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.

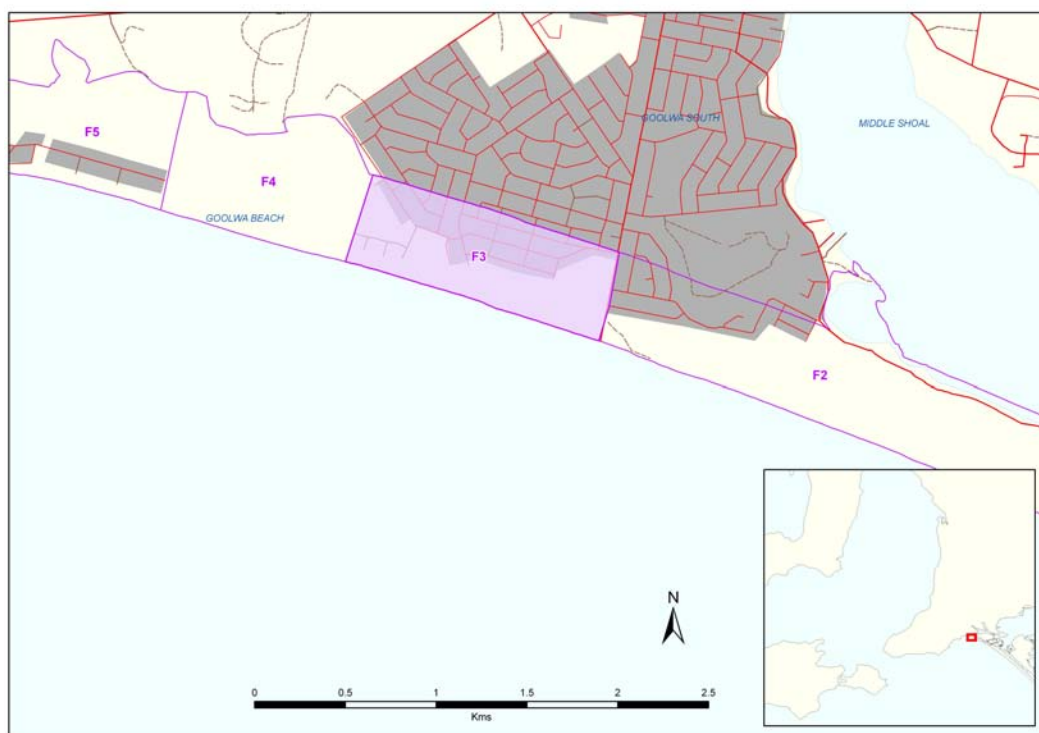
Intertidal mudflat, mangrove and saltmarsh are closely dependent on tide heights, and will need to migrate upslope to survive; supratidal samphire and swamp paperbark stands will be similarly affected. In response, high resolution topographic land survey is needed to detail this threat. It will be necessary 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*.

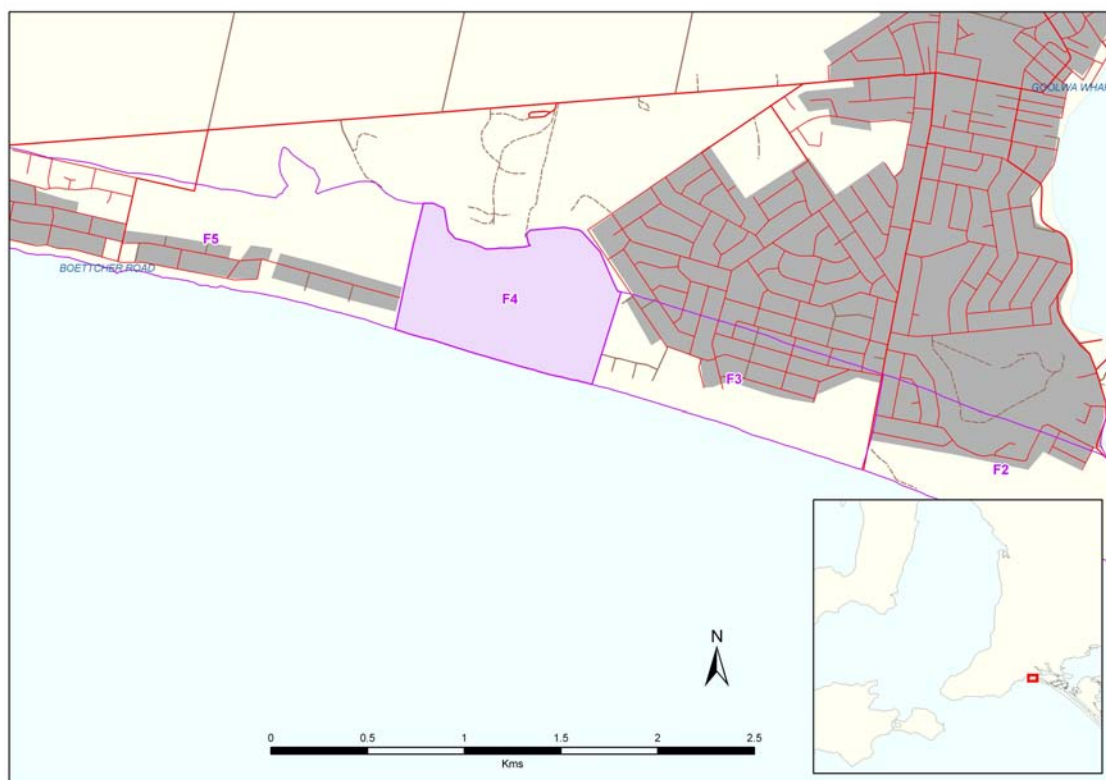
Possible Climate Change Threats

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.

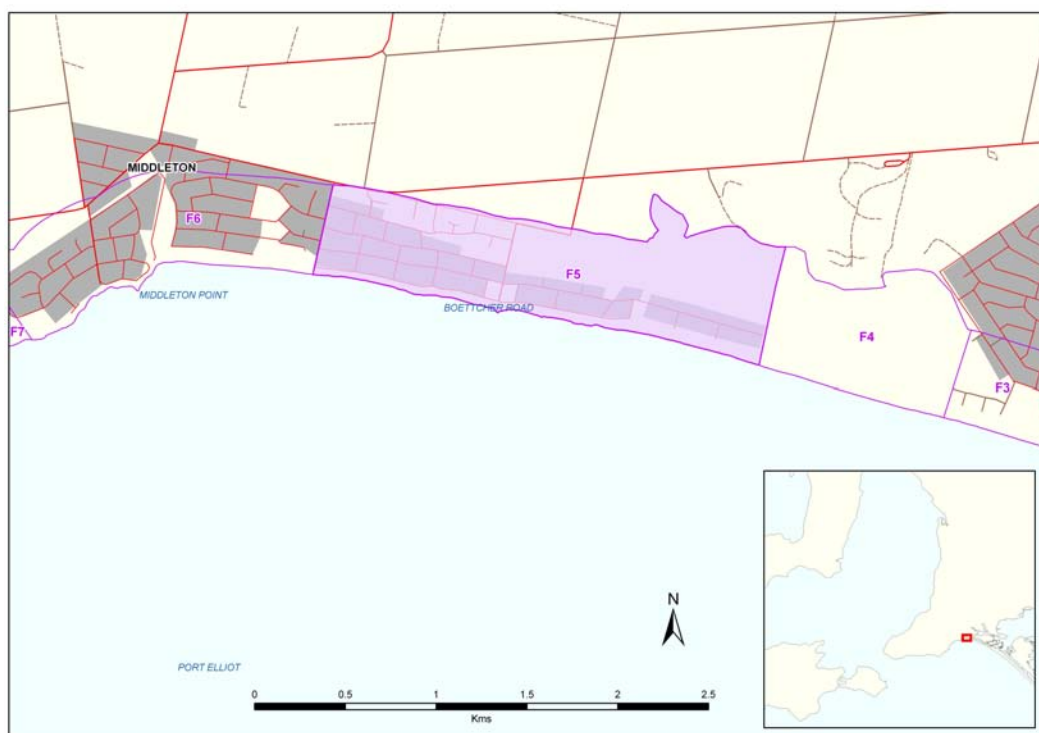
The following red alert weeds have been found in this cell: *Asparagus asparagoides*, *Ehrharta villosa* var. *maxima*, *Lycium ferocissimum*, *Acacia cyclops*, *Euphorbia terracina*, *Acacia saligna*, *Euphorbia paralias*, *Olea europaea* ssp. *europaea*, *Carpobrotus edulis*, *Marrubium vulgare*, *Pinus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

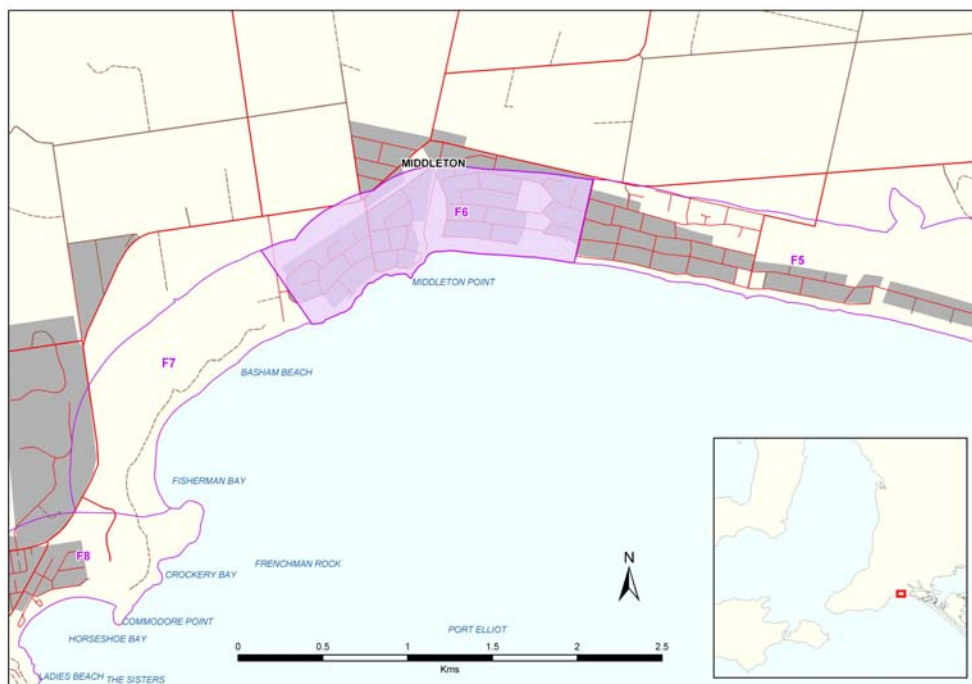
Possible Climate Change Threats

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*.

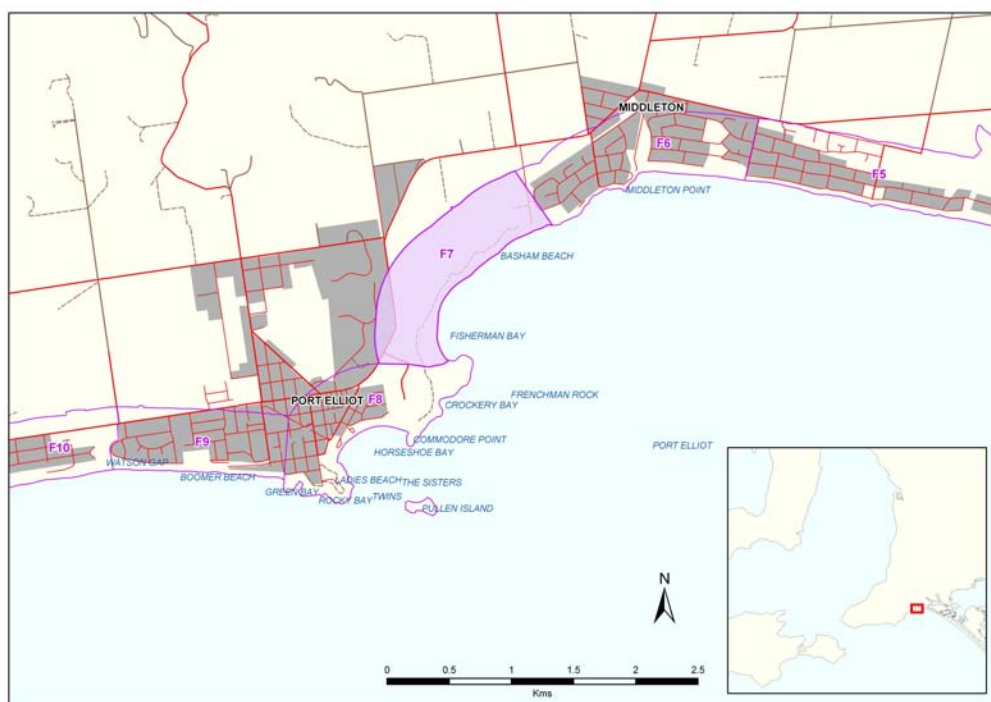
Possible Climate Change Threats

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. Foredune 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*

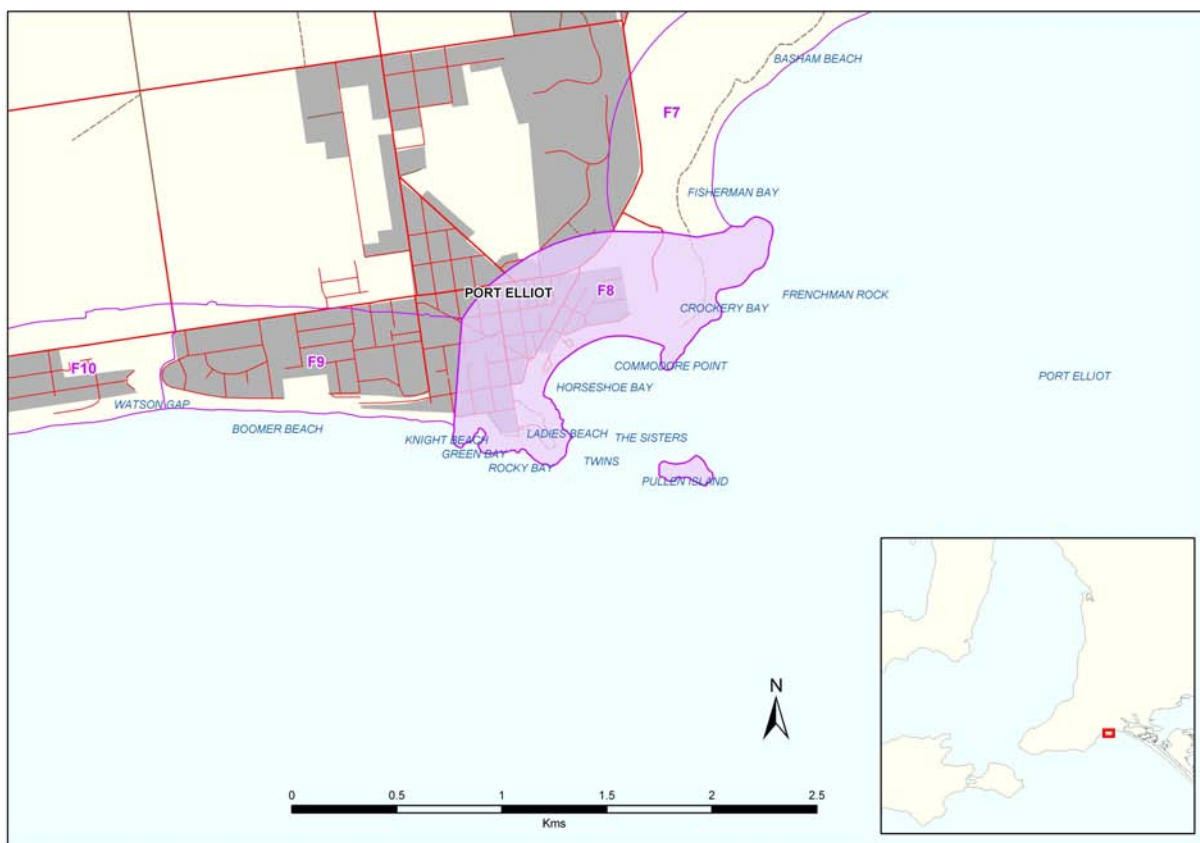
Small areas of potentially unstable dune (central and eastern end of Bashams Regional Park) are inappropriately zoned, since they lie inland of the coastal zone on the Alexandrina Development Plan.

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

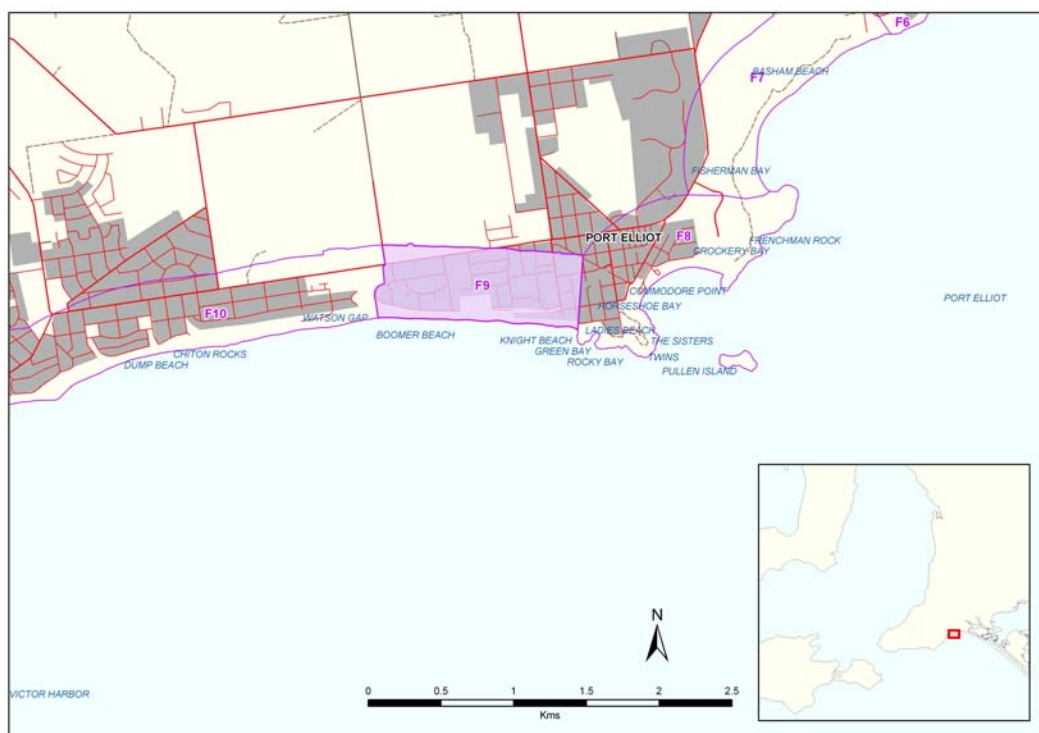
Over time increasing aridity will slow natural recovery from damage to the small areas of dune vegetation. Rising sea levels will see increased storm damage to beaches and foredunes; Bruun Rule calculations of beach recession suggest an order 5 – 30m over 50 years could be likely, given current IPCC 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*.

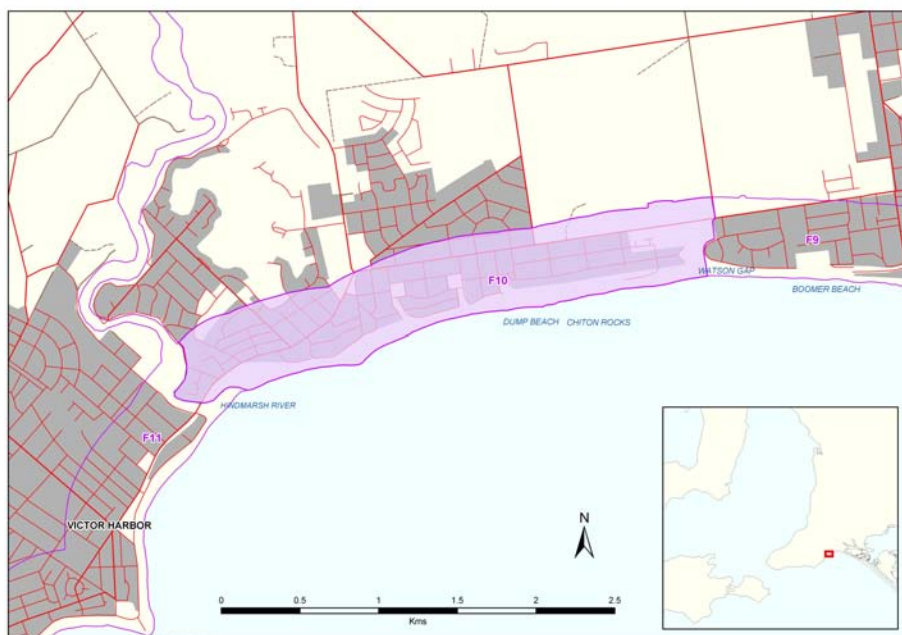
Possible Climate Change Threats

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

Cell F10 Watson's Gap to the Hindmarsh River



Landforms

From Watson's Gap, where a usually closed small creek reaches the beach, to the Hindmarsh River, wave energy steadily decreases from medium high to medium low. Rocky reefs are common, prominent at the reef-controlled foreland Hayborough Point (photograph above) and emerging as rocks on the beach at Chiton Rocks. The medium to coarse sand beach is often steep and is characterised by many small rips. Dunes, 50 to 200m wide and a talus slope front of a 20m bluff, terminating a sloping coastal plain.

Benthic Habitat/ Biota

Platform reef with patches of sand and seagrass (inshore seagrass is rare between Cape Jervis and Lacepede Bay, making Encounter Bay seagrasses regionally significant as habitat). Olivers Reef (off Hayborough Point), limestone reef in 4-6m. Reefwatch monitoring. Medium to high coastal shrubland on the dunes. Rush and sedge in small swamp at Watson's Gap. Swamp paperbark woodland adjacent to the Hindmarsh River.

Land Use/ Land Ownership

Coastal plain is almost entirely residential development. The coastal reserve, including small reserves above the bluff, the bluff and the dunes are under the care and control of Council.

Values (Field visits and local reports)

Recreational beach, narrow dune buffer zone, tourist rail line through the dune. Walking, swimming, surfing, fishing. 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)



Hayborough Point, East of the Hindmarsh Estuary: beach, dune, low bluff and suburban coastal plain (Coast Protection Board, 2003)

Threats (Field visits and local reports)

There is damage from storm drains at a number of locations.

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 that 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. Woody weeds are a problem throughout the dunes, from Hindmarsh River to Knights Beach, (cell F9).

Extensive low lying area at Watson's Gap is potentially subject to storm surge or catchment based flooding; this is outside the coastal zone and that zone's hazard provisions on the Development Plan.

Opportunities

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

Wetlands at Watson's Gap (and planned in the immediate upstream catchment) represent improvement in water quality delivered to the coast.

Conservation Analysis (GIS)

The sum of conservation means is medium to low: medium conservation values characterise Watson's Gap swamp, the dunes and the reserve on the East side of the lower Hindmarsh River. Elsewhere low values are found.

Conservation values are present for vegetation communities, with moderate scores for threatened status, rarity of the community in South Australia, and sites with threatened flora and fauna (34 threatened plant species and 14 threatened animal species). There are also values for species richness, bird habitat, reptile habitat and butterfly larvae habitat. A geological monument is located here.

The state vulnerable *Thinornis rubricollis* (Hooded Plover); the state rare *Cereopsis novaehollandiae* (Cape Barren Goose), *Anas rhyncotis* (Australasian Shoveller), *Egretta garzetta* (Little Egret), *Actitis hypoleucos* (Common Sandpiper), *Plegadis falcinellus* (Glossy Ibis), have been recorded in this cell.

Threat Analysis (GIS)

Combined threat totals gave a high value to this cell, compared to others: the 10th highest threat total in the region.

Development zoning, a high proportion of private ownership, viewshed and viewscape scores, a large proportion of exotic plant species and high weed values combine to give this cell a high total threat score. Viewscape and viewshed scores reflect the local topography.

Coastal reserves, however, are not as reduced in width as in many parts of the urban areas. This lowers the land use and ownership threat scores a little.

The following red alert weeds were found within this cell: *Asparagus asparagoides*, *Ehrharta villosa* var. *maxima*, *Gazania linearis*, *Acacia cyclops*, *Lycium ferocissimum*, *Dipogon lignosus*, *Rhamnus alaternus*, *Chrysanthemoides monilifera* ssp. *monilifera*, *Leptospermum laevigatum*, *Polygala myrtifolia*, *Acacia saligna*, *Euphorbia paralias*, *Euphorbia terracina*, *Olea europaea* ssp. *europaea*, *Oxalis pes-caprae*, *Argyranthemum frutescens* ssp., *Coprosma repens*, *Ehrharta calycina*, *Marrubium vulgare*, *Pinus halepensis*.

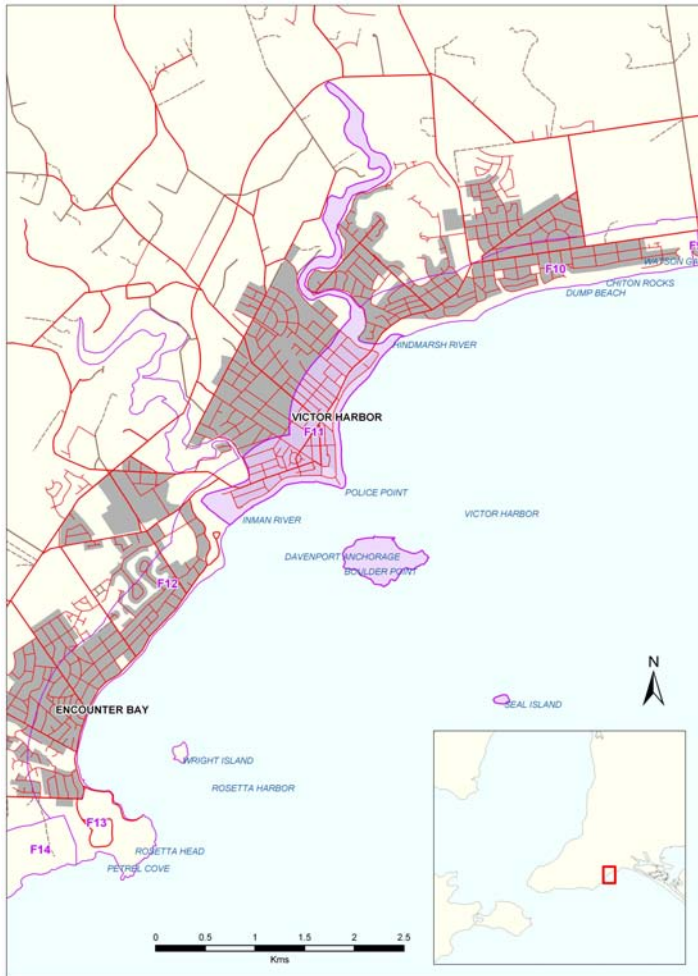
Possible Climate Change Threats

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 5 – 15m over 50 years could be likely, given current IPCC sea level forecasts. Rising sea levels threaten tidal inundation of low lying land at Watson's Gap.

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.

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Dune	Ongoing problems in weed control.	F10.1 Target residences with educational materials, with regard to weeds.	High (Soc / Econ)	Coastcare group and Council
	Re-vegetation with indigenous species. Protection of significant flora and fauna.	F10.2 Implementation of management plan by Taylor (2003).	High (Soc / Econ)	Council and Coastcare group
	Damage and de-stabilisation by foot traffic.	F10.3 Improvement of signage at path entrances and by railway reserve. Strategic use of sand drift fencing.	High (Soc / Econ)	Council and Coastcare group
Bluff	Stormwater erosional damage.	F10.4 Erosion control at outlets. Review of stormwater catchments, to slow peak run-off.	Medium (threat)	Council
Watsons Gap	Potential flooding hazard at Watson's Gap due to sea level rise.	F10.5 Revise zoning provisions to reflect appropriate hazard standards.	Low (Hazard)	Council

Cell F11 Hindmarsh River to Inman River



Landforms

Inman floodplain and the lower Hindmarsh are incised into a relatively flat coastal plain. Low narrow line of dunes, with a narrow low energy beach. Beach plan-shape forms appear to be controlled by the refraction wave patterns resulting from reefs and islands. Offshore reefs and islands reflect the inherited surface form of the granite batholith.

Estuary Assessment (Australian Land & Water Audit, 2000) Hindmarsh River

Transport of fine suspended sediment (2.8 kilotonnes per year) estimated to be fourteen times the rate under pre-European conditions. Fine sediment nitrogen estimated to be four times the rate under pre-European conditions.

Benthic Habitat / Biota

Granite reef, with inshore patches of sand and seagrass (inshore seagrass is rare between Cape Jervis and Lacedpede Bay, making Encounter Bay seagrasses regionally significant as habitat). Granite reef, off South side of Granite Island.

Sand dune low shrubland; eucalyptus woodland and forest in upper part of the Hindmarsh estuary; swamp paperbark in lower estuary.

Land Use/ Land Ownership

Closely urbanised coastal plain. The coastal reserves adjacent to the Causeway, and on both sides, are given over to recreational activities.

A privately owned residential area. Crown land under care and control of the Council along Hindmarsh River and in narrow coastal reserves. Granite Island owned by NPWS.

Draft Encounter Marine Park Zoning

Habitat Protection Zone HP-2 inshore Hindmarsh River to Yacht Club; Special Purpose Area to Causeway; from Causeway to Inman River_Sanctuary zone S-7 begins 200m offshore; Habitat Protection Zone HP-2 inshore

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



Victor Harbor and the Causeway to Granite Island

(Coast Protection Board, 2003)

Values (Field visits and local reports)

The narrow coastal reserves are a major recreational resource for residents and visitors: a 'front window' for the town. The area between the caravan park, the Inman River and foreshore is a significant and highly visible piece of coastal open space. Granite Island Recreation Park is a traditional recreation site to enjoy the coastal and ocean views from the island footpaths, and to glimpse the Little Penguins that nest amongst the granite boulders immediately above the tide line.

Walking trail (Kaiki Trail) on Granite Island. The area and several sites are important in Ngarrindjeri dreaming stories.

Threats (Field visits and local reports)

Granite Island has a considerable inheritance of imported exotic plants. The Little Penguin population is threatened by cats, rats, dogs and foxes, as well as human harassment. The 2006 Penguin census shows there has not been recovery from the 2002 fall in penguin numbers; however the cause of this decline is unclear.

Beach and dune erosion between the Causeway and the Inman River pose a threat to the adjacent reserve. Continued beach and dune erosion between the Inman outlet and the Causeway, with recession focussed on the middle of this beach and damage to a storm water pipe near Stuart Street. Beach erosion at the Warland Reserve is also an issue. These erosion threats are currently under investigation (8/06).

Opportunities

The area between the caravan park, the Hindmarsh River and foreshore is a significant and highly visible piece of coastal open space and should be given active planning and priority for weed control, re-planting as coastal dunes and a small wetland.

Public education through interpretive signage relating to the nearshore zone, the estuary and dune habitat.

Improvement to the estuarine flora and fauna habitats through the employment of an estuary entrance management support system.

Conservation Analysis (GIS)

Total conservation values for this cell are high: this is the seventh largest sum of conservation means within the region. Although this is essentially a suburban cell with small remnant vegetation blocks, those that remain have high values for threatened vegetation associations, for vegetation rare within the state and for total number of species. These high value areas are found adjacent to the Hindmarsh River estuary between Lamont Road and Welch Road and near the river mouth. Granite Island and some small coastal reserves on the mainland show medium values.

Within the suburban south coast this is relatively a biodiversity hotspot, with high values for species richness (a total of 378 plant and animal species have been recorded here) and threatened species richness. This cell also includes Aboriginal sites of significance. Other conservation layers do not add value to this cell.

Two state vulnerable bird species *Thinornis rubricollis* (Hooded plover) and *Melithreptus gularis gularis* (Black Chinned Honeyeater); and state rare *Cereopsis novaehollandiae* (Cape Barren Goose), *Anas rhynchotis* (Australasian Shoveler), *Plegadis falcinellus* (Glossy Ibis), *Falco peregrinus* (Peregrine Falcon), *Porzana tabuensis* (Spotless Crane), *Gallinago hardwickii* (Latham's Snipe), *Actitis hypoleucos* (Common Sandpiper), *Haematopus fuliginosus* (Sooty Oystercatcher), *Neophema elegans* (Elegant Parrot), *Falcunculus frontatus* (Crested Shrike-tit) have been recorded in this cell. A number of other bird species (not state listed) have been recorded including the regionally vulnerable *Rallus philippensis* (Buff-banded Rail); a colony of *Eudyptula minor* (Little Penguin) is found on Granite Island.

Threat Analysis (GIS) Total 48.15

This cell has moderate to high total threats: development zoning, land ownership, land use, vegetation degradation and weed distribution, viewshed and viewscape are the largest contributors to this total. The urban nature of the large proportion of the area is the major reason, in spite of the presence of Granite Island within the cell. Although the high proportion of exotics is no different to many parts of the Fleurieu coast, the prevalence of many red alert weeds within the coastal reserves and on Granite Island gives a relatively high weed distribution score. The caravan park and some dune instability also make minor contribution to the threat score. The following red alert weeds were found within this cell: *Asparagus asparagoides*, *Gazania linearis*, *Lycium ferocissimum*, *Acacia Cyclops*, *Polygala myrtifolia*, *Chrysanthemoides monilifera ssp. Monilifera*, *Dipogon lignosus*, *Leptospermum laevigatum*, *Rhamnus alaternus*, *Acacia saligna*, *Euphorbia paralias*, *Euphorbia terracina*, *Olea europaea ssp., europaea*, *Oxalis pes-caprae*, *Ehrharta calycina*, *Arctotis stoechadifolia*, *Argyranthemum frutescens ssp.*, *Coprosma repens*, *Marrubium vulgare*, *Pinus halepensis*, *Solanum linnaeanum*.

Possible Climate Change Threats

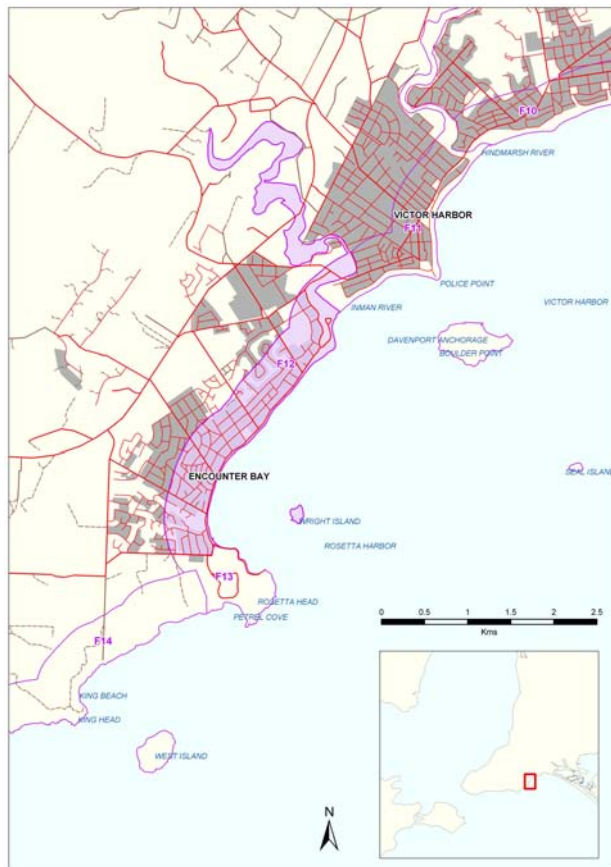
Analysis of climate change projections suggest that the low lying parts of the coastal plain will be subject to both flooding and erosion in the medium term. Rising sea levels will lead to increased foredune damage and recession. Where recession is not possible, beaches in front of hard protection will narrow and may be lost. In the interim beach response to seasonal changes may become more unpredictable. Where the plan form of the shoreline is controlled by reef protection this may suffer radical re-alignment following sea level rise. Changes in wave climate, such that an increasing proportion of energetic long period swell occurs, would have a marked impact on the narrow medium energy beaches and low dunes of this cell, due to refraction effects on long period waves.

(The beach, dune and nearshore sand levels are monitored by a CPB long term monitoring profiles, midway between the Inman River and the Causeway, immediately north of the causeway and near the yacht club. Community beach pole monitoring is carried out, North and West of the Causeway).

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Granite Island	Heavy visitor foot pressure. Many weeds and exotic plantings.	F.11.1 Continue implementation of Granite Island Recreation Park Vegetation Management Plan 2004-2008.	Medium (KP cell; Cons)	Friends of Granite Island.
	Fall in penguin numbers in 2002 and failure to recover.	F11.2 Support research to clarify causes of population decline. As an interim measure, fence the causeway against foxes, dogs and cats. Implement a rat control program.	High (Soc / Econ)	Friends, NPWS, Council.
Beaches and Dunes	Weed and people pressure.	F11.3 Support council and coastcare campaigns to eradicate red alert weeds. Review access control.	Medium (threat)	Coastcare, Council, NRM.
	Current erosion.	F11.4 Continue beach pole observations. Analyse and report back on existing record as a matter of urgency. Complete engineering study.	High (Hazard)	Coastcare, CPB, Council.
	Strong potential for future erosion, due to sea level rise and possible changes in wave climate.	F11.5 Maintain and analyse profile records. Initiate photopoint monitoring of beaches. Ensure the strongest possible protection within the development plan for coastal reserves (recreation now, buffer zones in the future). Where possible, seek to extend coastal reserves.	Low (Hazard)	C.P.B., Council.
	Flooding risk to low lying areas following sea level rise.	F11.6 Detailed high resolution mapping of topography.	Low (Hazard)	DEH, Commonwealth Natural Disasters Mitigation Program.
	Hooded Plover nests in season threatened by disturbance by walkers and dogs.	F11.7 Community monitoring, fences to mark nests. Notices to alert dog walkers.	High (Cons / threat)	Community, Council.
Hindmarsh River Estuary banks and floodplain	Small areas of remnant vegetation adjacent to the river north of Lamont Road show significant biodiversity values.	F11.8 Significance of small areas of vegetation within the river floodplain needs recognition through proactive management: assess opportunities to establish buffers; signage.	High (Cons / threat)	Council, Community groups.
	Estuary entrance currently opened / closed by Council largely for recreational reasons.	F11. 9 Develop an estuary entrance management support system (1), to investigate other options and reasons for making opening / closing decisions.	Medium (Cons / Soc / Econ)	Council.
Coastal reserves	Narrow reserves under threat to climate change (sea level rise and changing wave climate)	F11.10 Maintain reserves as buffer areas (see beaches and dunes above)	Low (Hazard)	Council.

(1) An Estuary Entrance Management Support System has been developed by Deakin University and a number of Victorian Catchment Boards. This system takes into account a number of uses (including recreation use), conservation and hydrological factors in assisting with the decision to open or close an entrance (refer to Appendix 15).

Cell F12 Inman River to Rosetta Harbour



Landforms

Low coastal plain, with beach and dune virtually absent. Large intertidal nearshore limestone reef. Floodplain and estuary of the lower Inman River. The floodplain is a relatively wide depositional feature in this locality, well defined within a trough.

Estuary Assessment (Australian Land & Water Audit, 2000)

Classified as extensively modified, and under very high pressure due to the WWTP (now upgraded) and vegetation clearance within the catchment. Transport of fine suspended sediment (6.6 kilotonnes/yr) estimated to be thirteen times the rate under pre-European conditions. Fine sediment nitrogen estimated to be four times the rate under pre-European conditions

Benthic Habitat/ Biota

Fringing calcareous intertidal and subtidal reef. Offshore granite surfaces on islands and both exposed and sheltered reef habitats. Limestone intertidal reef. Patches of seagrass and macroalgal assemblages. Low shrubland found on dune reserves; Swamp Paperbark on lower estuary; eucalypt woodland in upper part of the estuary.

Land Use/Land Ownership

Much of this cell is privately owned and developed urban residential land. The coastal reserve is narrow to absent. Relatively large council reserves comprise almost the whole of the lower Inman floodplain.

Draft Encounter Marine Park Zoning

Sanctuary Zone S8 for NE half of the cell. Habitat Protection Zone HP-2 inshore. Special Purpose Area at southern corner of cell.

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

Values (Field visits and local reports)

The estuarine environment of the Lower Inman is of great potential value to this area, contingent upon improvement in water quality. Inshore seagrass is rare between Cape Jervis and Lacepede Bay, making Encounter Bay seagrass regionally significant as habitat.

Riparian improvement of the lower Inman floodplain is providing a significant vegetation corridor; however urban stormwater pipes to the river impact on estuarine water quality.



Encounter Bay shore, looking NW across Encounter Lakes development

(Coast Protection Board, 2003)

Threats (Field visits and local reports)

(A recent preliminary proposal for a marina, with residential component has been made for the mouth of the Inman River).

Recent changes to the Victor Harbor wastewater treatment plant has the potential to greatly reduce the very significant past pollution load to the estuary, however the accumulated polluted sediments may continue to impact the area, regardless of the success of the improved facility, which has continued significance for the seagrass and algal habitats of Encounter Bay. The values of the estuary and the nearshore marine environments of Encounter Bay make the water quality issue very significant for this locality. There is continued degradation of the dunes near Kent Reserve, by foot and vehicle traffic.

Stormwater impact on reef adjacent Battye Road, Solway Crescent and Bartel Boulevard (tidal interchange pipe for Encounter Lakes).

Opportunities

The current program of planting the Council reserve adjacent to the Inman River is significant in improving connectivity of the habitat and vegetation block shape within the floodplain, and should be continued and maintained. Rehabilitation of dunes at the Kent Reserve should also be continued.

Public education through interpretive signage at the Kent Reserve, relating to the nearshore zone, the estuary, dune habitat and the Ramindjeri campsite. Considerable educational opportunity for interpretation and the development of educational opportunities at the extensive intertidal platform reef. Community monitoring contributing to the Reefwatch Monitoring Program is in the process of development at this site. The area is important for marine education at Victor Harbor High School. Upgrading of the WWTP provides the opportunity to review actions to reduce urban and farm run-off pollution of the estuary, in order to rehabilitate this extensively modified environment and reduce pollution of the nearshore marine environment.

Conservation Analysis (GIS)

The total of conservation means for this cell is average: the lower Inman floodplain shows medium conservation values totals, residential areas total low values. However, priority based on sites with threatened flora is the highest in the region; rarity of vegetation associations and priority of sites with threatened fauna

also contribute to the total. Smaller values for bird, reptile and butterfly larvae habitat are also present. Vegetation patch size and shape values are not significant. This cell includes Aboriginal sites of significance.

The state vulnerable *Coturnix ypsilophora* (Brown Quail), *Botaurus poiciloptilus* (Australian Bittern), *Rallus pectoralis* (Lewin's Rail), *Thinornis rubricollis* (Hooded Plover), *Sterna nereis* (Fairy Tern), *Melithreptus gularis gularis* (Black-chinned Honeyeater) and 18 state rare bird species have been recorded in this cell.

Threat Analysis (GIS)

Because this cell comprises a residential suburb with small linear remnant vegetation blocks, threat values accumulate to a high total for this part of the coast, the ninth highest for the region. The vegetation blocks are fragmented and their edge to interior ratio adds to this score. Private land ownership proportion of the coastal boundary is high, reflecting the extremely narrow coastal reserve remaining after development. In addition, much of the cell is visible from the sea, giving a high viewshed score. The presence of the sewage treatment plant on the floodplain of the lower Inman further adds to this high threat score. High numbers of exotic plants shows considerable vegetation species value and weed distribution shows numbers of aggressive and invasive weeds within the vegetation remnants.

The following red alert weeds are found within this cell: *Gazania linearis*, *Acacia cyclops*, *Lycium ferocissimum*, *Leptospermum laevigatum*, *Acacia saligna*, *Euphorbia paralias*, *Euphorbia terracina*, *Olea europaea ssp. Europaea*, *Arctotis stoechadifolia*, *Argyranthemum frutescens ssp.*, *Coprosma repens*, *Pinus sp.*

Possible Climate Change Threats

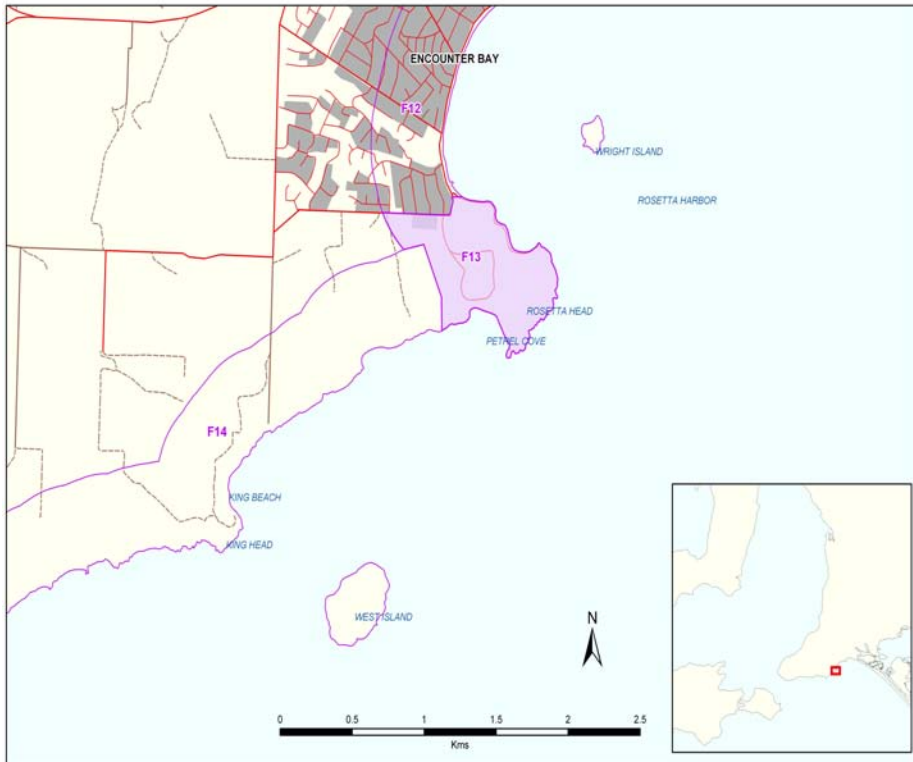
Analysis of climate change projections suggest that the low lying parts of the coastal plain will be subject to both flooding and erosion in the medium term. Rising sea levels will lead to increased foredune damage and recession. Where recession is not possible, beaches in front of hard protection will narrow and may be lost. In the interim beach response to seasonal changes may become more unpredictable. Where the plan form of the shoreline is controlled by reef protection this may suffer radical re-alignment following sea level rise. Changes in wave climate, such that an increasing proportion of energetic long period swell occurs, would have marked impact on the narrow medium energy beaches and low dunes near the mouth of the Inman, due to refraction effects on long period waves.

(The beach, reef and nearshore sand levels are monitored by a CPB long term monitoring profiles opposite Tabernacle Road and NE of Bartel Boulevard)

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Reefs	The location of a significant reef on the urban foreshore, (Sanctuary Zone S8 in Draft Marine Park Plan).	F12.1 Development of interpretive signage relating to biota of platform reef. Development of educational materials in conjunction with High School.	High (Cons / threat)	DEH (Marine Conservation) Victor Harbor High School Council
	Need for increased knowledge on intertidal and subtidal reefs and impacts on their systems	F12.2 Support setting up of community Reefwatch intertidal monitoring group (data collection, kits, methodology).	High (Cons / threat)	Reefwatch, Flinders University, NRM.
Lower Inman floodplain	Management of high value habitats	F12.3 Continue revegetation program of the Lower Inman floodplain, and habitat management to improve vegetation patch connectivity.	High (Cons / threat)	Council & community.
Dunes near Kent Reserve	High level of foot traffic	F12.4 Continued weed control and access management within the dune area adjacent Kent Reserve. Pursue opportunities for signage.	Medium (Cons)	Council & community.
Estuary Entrance	Estuary entrance blocked with increasing frequency due to low flows	F12.5 Develop an estuary entrance management support system for the Inman, (1), to investigate other options and reasons for making opening / closing decisions.	Medium (Cons)	Council.

(1) An Estuary entrance management support system has been developed by Deakin University and a number of Victorian Catchment Boards. This system takes into account a number of uses (including recreation use), conservation and hydrological factors in assisting with the decision to open or close and entrance (refer to Appendix 15).

Cell F13 The Bluff



Landforms

The Bluff (and Wright Island) represents the eroded surface of an ancient and extensive granite batholith. Petrel Cove (immediately South West of the Bluff) shows exposures of metamorphic contact zone to Kanmantoo Series. Beach at Petrel Cove displays materials weathered materials from the granite, including a heavy minerals suite.

Benthic Habitat / Biota

Extensive platform reef. Exotic grasses and low coastal heath, also areas of acacia woodland.

Land Use/ Land Ownership

This small cell is entirely coastal recreation reserve under care and control of Council, preserving the scenic amenity of the regionally visible Bluff headland.

Values (Field visits and local reports)

Several hundred thousand visitors walk up to the crest of the Bluff from the carpark, annually, to enjoy the view along the coast and, in winter, to observe whales. This activity is serviced by 3 carparks, an interpretation sign and a rocky loop path to the summit. There has been considerable Council and community effort invested in path improvement, weed control and revegetation within this Council reserve.

Draft Encounter Marine Park Zoning

Sanctuary zone S-7 begins 200m offshore; Habitat Protection Zone HP-2 inshore

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



The Bluff, West Island Conservation Park, Kings Head and Newland Head (Coast Protection Board, May 2003)

Threats (Field visits and local reports)

Foot traffic, especially during whale watching times, may be heavy and extend well beyond the marked tracks.

Opportunities

Interpretation of Geology, Aboriginal significance, European history and whale migration.

Bechervaise (2004, a) proposes the development of a toilet facility.

Conservation Analysis (GIS)

The sum of conservation means makes this one of the more valuable cells within the region: almost the whole cell demonstrates medium to high values. Layer totals for this cell which are relatively high within the region include priority of vegetation species based on the threatened status of the community; priority of the vegetation assemblage based on rarity within South Australia; numbers of endemic plant species that have more than 50% of records within the Southern Fleurieu; significant bird habitat; habitat based on reptile conservation status; European, natural and Aboriginal heritage.

36 threatened plant species and 10 threatened fauna species have been recorded in this cell.

A number of state rare bird species have been recorded in this cell: *Egretta sacra* (Easter Reef Egret), *Falco peregrinus* (Peregrine Falcon), *Actitis hypoleucos* (Common Sandpiper), *Haematopus fuliginosus* (Sooty Oystercatcher), and *Neophema elegans* (Elegant parrot).

Threat Analysis (GIS)

A number of moderate and low scores give this cell a low summary total overall. A high proportion of exotic plant species, but few aggressive weeds, viewshed and viewscape give potential threats. There are modest contributions from vegetation block isolation, shape and size, land use and ownership, and cliff stability.

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

Asparagus asparagoides, Lycium ferocissimum, Leptospermum laevigatum, Euphorbia paralias, Euphorbia terracina, Olea europaea ssp. Europaea, Ehrharta calycina, Solanum linnaeanum, Carpobrotus edulis, Coprosma repens, Marrubium vulgare

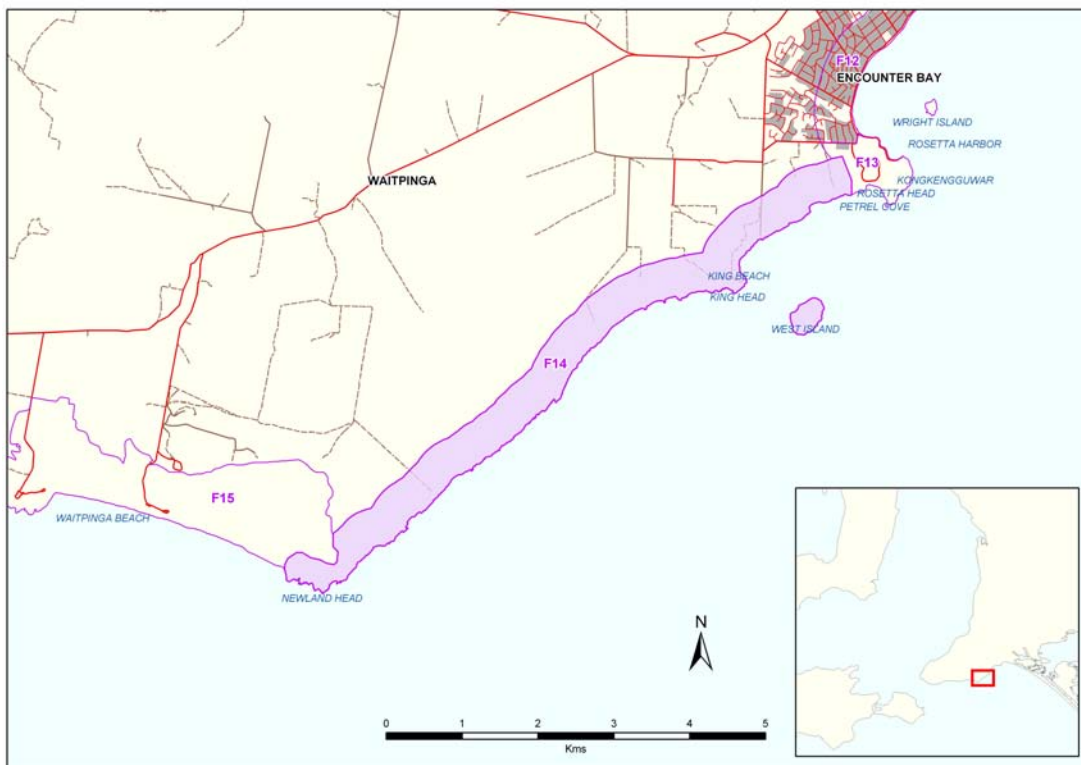
Possible Climate Change Threats

This cell is resilient to some effects of climate change, but plant and animal survival of the displacement of climate zones is a serious concern. Over time increasing aridity will increase stress on remnant vegetation and slow natural recovery from damage. Seasonal surface run-off on slopes will be drastically reduced by soil water budget changes; however, unpredictable intense rainstorms will locally cause fast run-off on slopes. Changes in wave climate, likely to increase the long period swell component, would accentuate high tide changes to backshores in pocket beaches and to talus slopes at the base of cliffs. Tide and water depth dependent habitats on reefs will be impacted by sea level rise.

(Increasing plant and animal resilience to progressive climate change is important for this area, and can be assisted by improving connectivity between remnant vegetation patches).

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Carpark at base of walking track; walking track	Care in use of site: potential impact of very high visitor numbers. Safety on steep slopes.	F13.1 Maintenance and improvement of car park and walking track and interpretation.	High	Council.
Whole cell	Improvement of native vegetation values (see above).	F13.2 Continuation of Bluff Revegetation Plan.	High (Cons / threat)	Council & Community.
	Reduction in pressure of invasive weeds.	F13.3 Continuation of Bluff Revegetation Plan Target priority weeds.	High (Cons / threat)	Council & Community.

Cell F14 Petrel Cove to Newland Head



Landforms

Dissected plateau, cliffs and reefs of Kanmantoo Series sediments. Some cliff-top dunes and calcarenite. The shoreline includes steep high cliffs in the Western half of the cell; low cliffs with pebble and sand beaches near Kings Head to Petrel Cove. West Island is part of the eroded surface of the Victor Harbor granite batholith.

Benthic Habitat/ Biota

Inshore sand with platform reef offshore. Low to medium coastal heath in conservation park and through the cliff tops from Newland Head Conservation Park to Kings Head.

Land Use/ Land Ownership

The SW quarter of the cell is part of Newland Head Conservation Park. Unallotted Crown land <200m back from cliff edge from conservation park to near Kings Head; otherwise private. Coastal strip from park to near Kings Head was acquired in 2000 with the intention of dedication as part of the Conservation Park. Heritage Agreements 1077 and 1215 SW of Kings Head.

Draft Encounter Marine Park Zoning

Bluff to Kings Head: Sanctuary zone S-7 begins 200m offshore; Habitat Protection Zone HP-2 inshore. At Kings Head and 2km to W: S-7. Then HP-2 to 2 km E of Newland Head, which is S-6. Restricted Area along North side of West Island.

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



Looking East across Newland Head toward The Bluff and West Island

(Coast Protection Board May 2003)

Values (Field visits and local reports)

Scenic amenity of rugged cliffs and small sandy coves; views of seabirds and marine life. Extension of conservation park east along the cliffs accompanied by considerable erosion control (cliff top dunes) and revegetation by the Friends of Newland Head, both within the park and East of the park.

Threats (Field visits and local reports)

Significant weed infestation (mallow, boxthorn) is reported from West Island; also displacement of Penguins from burrows on the island by seagulls. There is a fall in numbers of penguins.

Within and near Newland Head CP it is reported that high kangaroo numbers threaten regeneration efforts.

Opportunities

The proximity of blocks of valuable cliff top native vegetation on Crown land adjacent to Newland Head Conservation Park, suggests that an extension of the park within the coastal boundary should be considered.

Bechervaise (2004, a) proposes an upgrading of the informal footpath from Petrel Cove to Kings Head, where the path joins the Heysen Trail.

Conservation (GIS Analysis)

The sum of conservation means shows this to be the third most valuable cell within the region. The highest values are found within the remnant vegetation of the eastern half of the cell: the remainder shows totals within the medium range.

Outstanding values accrue for numbers of species, numbers of threatened species, threatened vegetation communities, for bird, reptile and butterfly larvae habitat, also Aboriginal and geological heritage. Average to high values are found for rarity of plant associations within South Australia, numbers of endemic species, vegetation block connectivity, patch size and shape.

Surprising statistics lie behind these values: 155 threatened flora species and 23 threatened fauna species; a total of 567 plant species and 44 animal species have been recorded within this cell.

The state endangered *Haliaeetus leucogaster* (White bellied Sea-Eagle), *Calamanthus pyrrhopygius parkeri* (Chestnut-rumped Heathwren); the state vulnerable *Coturnix ypsilophora* (Brown Quail), *Thinornis rubricollis* (Hooded Plover), *Sterna nereis* (Fairy Tern) and 10 state rare bird species have been recorded in this cell.

Threat analysis (GIS Analysis)

The total of the threat summary layers gives a relatively moderate total for this cell. Principal threat scores arise from the viewscape and viewshed layers, numbers of exotic plants, cliff instability, land ownership and land use. Minor, but significant contributions to the total are made by the distribution of aggressive weeds, dune instability (cliff top dunes near Newland Head Conservation Park), the proximity of the dump to the cell, vegetation block isolation, shape and size.

The following red alert weeds have been detected within this cell: *Asparagus asparagoides*, *Asparagus declinatus*, *Lycium ferocissimum*, *Chrysanthemoides monilifera ssp. Monilifera*, *Leptospermum laevigatum*, *Rhamnus alaternus*, *Acacia longifolia ssp. Longifolia*, *Disa bracteata*, *Euphorbia paralias*, *Olea europaea ssp. Europaea*, *Oxalis pes-caprae*, *Ehrharta calycina*, *Coprosma repens*, *Juncus acutus*, *Solanum linnaeanum*.

Possible Climate Change Threats

This cell is resilient to some effects of climate change, but plant and animal survival of the displacement of climate zones is a serious concern. Over time increasing aridity will slow natural recovery from damage to remnant vegetation. Seasonal run-off in small creeks will be drastically reduced by soil water budget changes; however, unpredictable intense rainstorms will locally cause fast run-off in small catchments. Changes in wave climate, likely to increase the long period swell component, would accentuate high tide changes to backshores in pocket beaches and to talus slopes at the base of cliffs. Tide and water depth dependent habitats on reefs will be impacted by sea level rise.

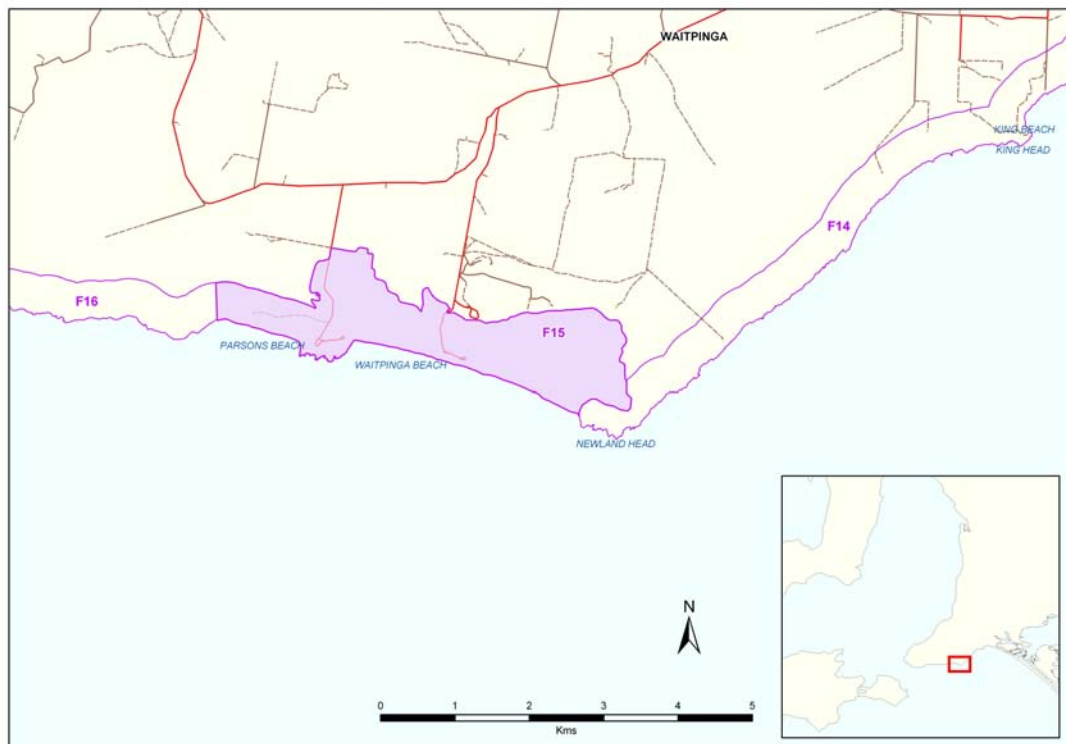
(Increasing plant and animal resilience to progressive climate change is important for this area, and can be assisted by improving connectivity between remnant vegetation patches).

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Cell outside park	Significant plant associations and fauna habitats along extensive coastal strip	F14.1 Assign high priority to the continuation of work to conserve this area.	High (Cons / threat)	NRM.
		F14.2 Explore opportunities to link remnant vegetation blocks; improving connectivity and long term resilience.	Medium (Cons)	DEH, NRM.
		F14.3 Explore opportunities to buffer remnancy values, through land acquisition or land management agreements.	Medium (Cons)	DEH, NRM.
		F14.4 Explore possibility of further extending the park, to include the whole of this cell.	Medium (Cons)	DEH, NRM.
	High scenic amenity (Viewscape score) strongly linked to tourism opportunity at the Bluff	F14.5 Explore options for protection based on landscape values; cp. Adelaide Hills Face	Medium (Cons)	Planning SA. Tourism SA
		Zone legislation.		
Whole cell	The conservation and threat assessments detected high value vegetation together with many high priority weeds.	F14.6 Continue detailed work to promote indigenous species through erosion control, weed control and planting. Continue and extend targeted weed control strategies aimed at 'red alert' weeds.	High (Cons / threat)	NRM, Friends and Coastcare groups.

The Newland Head Conservation Park, which comprises the SW quarter of this cell, has undergone a recent management plan process, completed in 2004. This involved extensive consultation and review of drafts (2001 – 3). The GIS – based conservation and threats analysis supports the evaluation within that plan, that this is an area of great conservation significance appropriate to its designation and needing priority in effort to implement the management plan.

This project has detected one matter not identified within the park management plan, namely, the significance of the butterfly larvae habitat, as recorded by Grund, 1997.

Cell F15 Newland Head to Parsons Beach



Landforms

Kanmantoo metasediments overlain by calcarenite. Dunes at Parsons and Waitpinga over a sloping calcarenite ramp. Clifftop dunes at Newland Head. Quaternary parabolic dune on Newland Head described by Bourman, 1973.

Benthic Habitat/ Biota

Inshore sand, then platform reef offshore. Well developed dune vegetation succession at Waitpinga and Parsons; coastal heath on Newland and Waitpinga headlands.

Land Use/ Land Ownership

Newland Head Conservation Park. NPWS. Acquired by the Crown in 1976 and dedicated in 1985.

Draft Encounter Marine Park Zoning

Habitat Protection Zone HP-2



Waitpinga Beach, Newland Head Conservation Park

(Coast Protection Board, May 2003)

Values (Field visits and local reports)

Extensive area of remnant native vegetation at the intersection of the Mount Lofty Ranges with the coastal environment. Access to the South Coast of this part of the peninsula is limited: public ownership and road access allow significant walking and fishing opportunities.

Threats (Field visits and local reports)

Large kangaroo numbers threaten revegetation projects. Camping sites within the park focus people pressure.

Conservation Analysis (GIS Analysis)

The total of means of conservation layers for this cell is the highest in the region: almost the entire cell shows high total means. Only small foredune areas show medium totals.

Outstanding values accrue for numbers of species, numbers of threatened species, threatened vegetation communities, for rarity of plant associations within SA, priority of sites with threatened flora and sites with threatened fauna, numbers of endemic species, for vegetation block connectivity, patch size and shape, for bird, reptile and butterfly larvae habitat, also Aboriginal and geological heritage.

155 threatened flora species and 56 threatened fauna species and a total of 566 plant species and 164 animal species have been recorded within this cell. The state endangered *Haliaeetus leucogaster* (White bellied Sea-Eagle), *Calamanthus pyrrhopygius parkeri* (Chestnut-rumped Heathwren); the state vulnerable and EPBC listed *Thinornis rubricollis* (Hooded Plover), and 9 state rare bird species have been recorded in this cell.

Geological Monument 1112, Fleurieu Peninsula South Coast from Coalinga Gully along entire coast to Waitpinga Creek: excellent exposures/ type section of the metasediments of the Kanmantoo Group.

Threat Analysis (GIS Analysis)

This cell, which comprises Newland head Conservation Park, has the lowest threat total in the region. Analysis suggests that the major threats within this cell are dune instability and the distribution of listed weeds. Camping and viewscape contribute minor ratings.

The following red alert weeds were found in this cell: *Asparagus asparagoides*, *Asparagus declinatus*, *Ehrharta villosa* var. *maxima*, *Lycium ferocissimum*, *Chrysanthemoides monilifera* ssp. *Monilifera*, *Euphorbia*

paralias, Euphorbia terracina, Oxalis pes-caprae, Acacia longifolia ssp. Longifolia, Disa bracteata, Olea europaea ssp. Europaea, Ehrharta calycina, Solanum linnaeanum, Carpobrotus edulis, Pinus radiata

Possible Climate Change Threats

This cell is resilient to some effects of climate change, but plant and animal survival of the displacement of climate zones is a serious concern. Over time increasing aridity will slow natural recovery from damage to remnant vegetation and some species may be unable to adapt to reduced soil water levels and die out. Seasonal run-off in small creeks will be drastically reduced by soil water budget changes; however, unpredictable intense rainstorms will locally cause fast run-off in small catchments. Changes in wave climate, likely to increase the long period swell component, would accentuate high tide changes to backshores at Waitpinga and Parsons Beaches. Given the IPCC projections of sea level rise, beach recession of an order of 5 to 15 metres in 50 years could be expected. Some low lying areas adjacent to the Waitpinga Creek estuary, appear to be vulnerable to flooding following sea level rise. Tide and water depth dependent habitats on reefs will be impacted by sea level rise.

(Increasing plant and animal resilience to progressive climate change is important for this area, and can be assisted by improving connectivity between remnant vegetation patches).

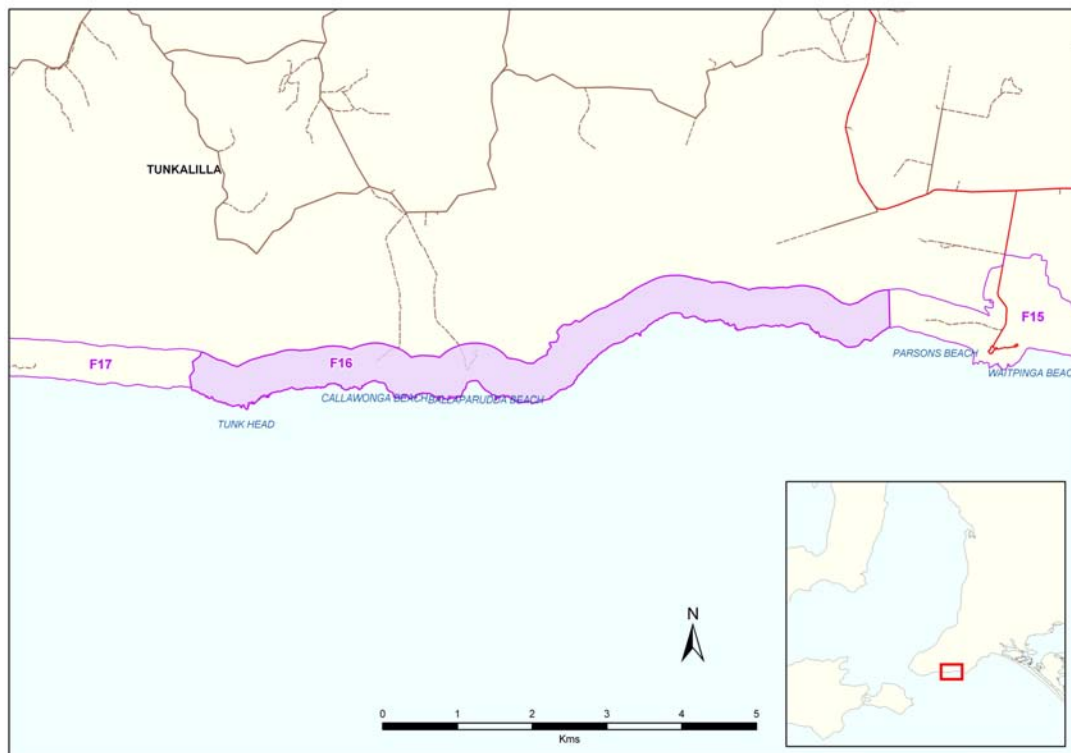
(The beach, dune and nearshore sand levels are monitored by a CPB long term monitoring profile at Waitpinga Beach)

Management Comment

The Newland Head Conservation Park, which comprises the entirety of this cell, has undergone a recent management plan process, completed in 2004. This involved extensive consultation and review of drafts (2001 – 3). The GIS-based conservation and threats analysis supports the evaluation within that plan, that this is an area of great conservation significance appropriate to its designation and needing priority in effort to implement the management plan.

This project has detected one matter not identified within the park management plan, namely, the significance of the butterfly larvae habitat as recorded by Grund, 1997. Friends of Newland Head have commenced revegetation of *Gahnia trifida* within the estuary flat and now manage the area for weeds. The larvae have been seen in 2005 and 2006.

Cell F16 Parsons Beach to Tunk Head



Landforms

Dissected hills and plateau of the Southern Fleurieu Ranges. The coast is dominated by high cliffs, sloping boulder strewn platforms and pocket sandy beaches. This is generally a high energy shore, with limited access.

Benthic Habitat/ Biota

Inshore reefs and bare sand offshore. Terrestrial vegetation has been largely cleared; however the isolated remnant Heritage Agreement 126 remains immediately west of Ballaparudda Beach.

Land Use/ Land Ownership

Private, grazing.

Draft Encounter Marine Park Zoning

General Managed Use zone.

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



The dissected plateau of the Southern Mount Lofty Ranges: unnamed headland, Ballaparudda Beach in background (Coast Protection Board May 2003)

Values (Field visits and local reports)

High scenic amenity of spectacular coastal cliffs and pocket beaches. The Heysen Trail follows the platforms and small beaches for the eastern half of the cell, before taking an inland loop to 'Balaquider'.

Threats (Field visits and local reports)

Damage by grazing animals to steep coastal slopes is causing accelerated erosion, leading to episodic turbidity in small estuaries and nearshore waters. [Bechervaise (2004, p.8) also comments that "Private ownership to top of coastal headlands and top of coastal dunes" and "Stock grazing right to edge of coastline" are significant.]

Opportunities

There may be opportunity to negotiate track improvement and signage to the Heysen Trail, allowing improved access to the spectacular coastal views through the eastern part of this cell.

Conservation Analysis (GIS)

The total of conservation means is medium to low. This large cell shows low values throughout; however, Heritage Agreement 126 and one small area of remnant vegetation show medium values.

There are a number of high conservation ratings, these include: presence of endemic plant associations, significant bird habitat and some heritage values.

This cell includes Aboriginal sites of significance. Geological Monument 1112, Fleurieu Peninsula South Coast from Coalinga Gully along entire coast to Waitpinga Creek: excellent exposures/ type section of the metasediments of the Kanmantoo Group.

The state vulnerable *Thinornis rubricolis* (Hooded Plover), state rare *Egretta sacra* (Eastern Reef Egret), *Falco peregrinus* (Peregrine Falcon), *Actitis hypoleucos* (Common Sandpiper), and *Neophema elegans* (Elegant Parrot) have been recorded in this cell.

Threat Analysis (GIS)

Threat ratings give a moderate total for this cell. Weed pressure is unusually low for the region, although there are high proportions of exotic plant species. Land use and land ownership and viewscape threat ratings are high, and cliff and slope instability contribute to the threat total.

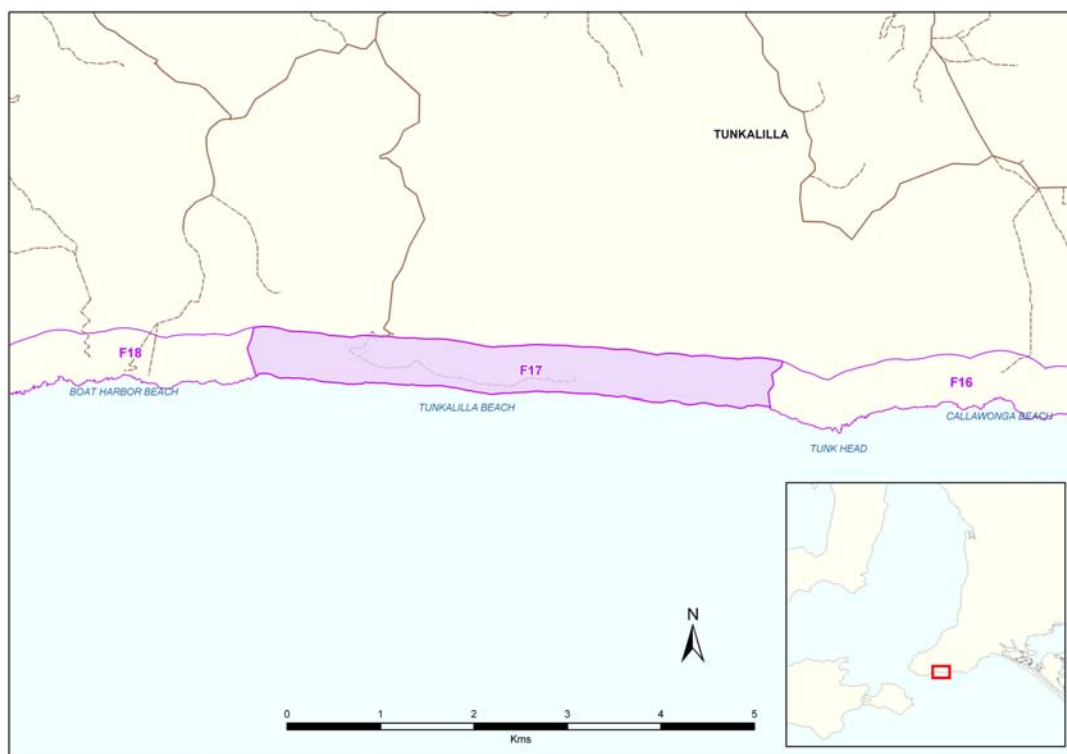
The following red alert weeds are found in this cell: *Leptospermum laevigatum*, *Euphorbia paralias*, *Ehrharta calycina*, *Solanum linnaeanum*

Possible Climate Change Threats

Over time increasing aridity will stress remnant vegetation and slow natural recovery from damage. Seasonal run-off in small creeks will be drastically reduced by soil water budget changes, however, unpredictable intense rainstorms will locally cause fast runoff in small catchments. Changes in wave climate, likely to increase the long period swell component, would accentuate high tide changes to backshores in pocket beaches. Tide and water depth dependent habitats on reefs will be impacted by sea level rise.

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Whole cell	Lack of low impact access to spectacular coastal scenery	F16.1 Improve signage and upgrade the Heysen Trail where possible, (whole cell)	Medium (Soc / Econ)	DEH, Natural & Cultural Heritage.
Cliffs and lower slopes of valleys	Accelerated erosion, apparently due grazing pressure on steep slopes, causing episodic raised turbidity levels in coastal waters	F 16.2 For cliffs and lower valley slopes undergoing accelerated erosion, negotiate improved land management practices with landholders	Medium (Threat)	NRM Landowners
	Stock grazing to small creeks (e.g. Coolawang Creek) and on beaches, leading to pollution of small estuaries.	F16.3 Fence estuaries and riparian land against stock.	Medium (Threat)	NRM Landowners

Cell F17 Tunk Head to Deep Creek CP



Landforms

Tough ancient sediments form cliffs and reefs. C. 5km of high energy beach and narrow dune, backed by talus slopes and degraded cliff slopes at Tunkalilla Beach. There are several small catchments draining to this coast, the largest being Tunkalilla Creek at the eastern edge of the cell. Seasonal flows cross the beach.

Benthic Habitat / Biota

Narrow boulder and cobble inshore reefs and extensive areas of bare sand.

Land Use / Land Ownership

Grazing. Private ownership (with the exception of Coast Protection Board land at southern end of Tunkalilla Beach access track).

Values (Field visits and local reports)

Scenic amenity of rugged headlands and extensive remote ocean beach.

Walking trail: Heysen Trail, Whalers Way extension, along Tunkalilla Beach.



Tunkalilla Beach

(Coast Protection Board May 2003)

Draft Encounter Marine Park Zoning

Sanctuary zone S-5, from Tunk Head to Boat Harbor Beach. Beach fishing will be an issue in the implementation of this plan.

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

Threats (Field visits and local reports)

Damage by grazing animals to steep coastal slopes is causing accelerated erosion, with episodic turbidity in small estuaries and nearshore areas. Weeds and stock threaten the sustainability of the dunes, and therefore the beach within this cell.

Opportunities

There are limited opportunities for public access to the coastline. Bechervaise suggests that “better signage at Tunkalilla Beach as to the extent of public access” would assist usage of coastal assets. The Heysen Trail runs the length of Tunkalilla Beach. There may be opportunity to negotiate track improvement and signage to the Trail at the ends of the beach, improving access to this spectacular coast.

Conservation Analysis (GIS)

The total of conservation means gives a moderate to low total for this large cell. Distribution of conservation priority scores around the cell shows no areas of high values.

Small remnant areas retain vegetation communities that are rare within SA. There are also priority values for endemic plant communities and bird habitat.

This cell includes Aboriginal sites of significance. Geological Monument 1112, Fleurieu Peninsula South Coast from Coalinga Gully along entire coast to Waitpinga Creek: excellent exposures/ type section of the metasediments of the Kanmantoo Group.

The state vulnerable *Thinornis rubricolis* (Hooded Plover) has been recorded in this cell.

Threat Analysis (GIS)

Land ownership, land use, viewscape, viewshed, and vegetation degradation are the principal threat scores; there are also threat scores for illegal camping, coastal slope instability, dune instability and the distribution of significant weeds.

The following red alert weeds have been detected within this cell: *Leptospermum laevigatum*, *Euphorbia paralias*, *Oxalis pes-caprae*, *Ehrharta calycina*, *Solanum linnaeanum*.

Potential Climate Change Threats

Climate change issues pose a long term threat for this cell in 2 major respects: 1. Aridity will slow the natural recovery of dune vegetation to damage. 2. 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. Nearshore reef species will be threatened by sea level rise.

(The beach, dune and nearshore sand levels are monitored by a CPB long term monitoring profile at Tunkalilla Beach)

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Beach and dune	Stock grazing and weed infestation threaten the sustainability of the dune, (and beach).	F17.1 Fencing to exclude stock from the beach and dune, (a)	Medium (threat)	Landowners, NRM
		F17.2 Weed eradication and re-vegetation program for the dunes	Medium (threat)	Landowners, NRM
	Lack of clarity with regard to access to public foreshore land	F17.3 Signage of Heysen Trail entrance and exit to Tunkalilla Beach	Medium (Soc / econ)	DEH, Natural & Cultural Heritage
	Hooded Plover species recovery	F17.4 Community monitoring of Hooded Plover nesting sites on beach and dunes. Interpretive signage at Heysen Trail entrances to beach.	High (Cons./ threat)	Community NRM
Coastal slopes	Soil erosion due to stock pressure on steep pasture	F17.5 Where coastal slopes show accelerated erosion, negotiate improved land management practices with landholders.	Medium (threat)	Landowners, NRM

(a) Although current conservation values are not high, the extensive beach and dune are a major coastal asset for the region.

Cell F18 Deep Creek CP to Fishery Beach



Landforms

Steep Palaeozoic sedimentary metamorphic cliffs. Pocket beaches. Incised creeks to small estuaries. Serrated shore platforms in Cambrian metasediments.

Benthic Habitat/ Biota

Narrow inshore reefs and then clear sand. Small area of inshore seagrass near Fishery Beach.

Land Use/ Land Ownership

Conservation Park. NPWS. Crown and private land at the western end, and private land at the eastern end of the cell.

Values (Field visits and local reports)

Walking (Heysen Trail, Cape Jervis to Newland Head Section). Pristine coastal and offshore areas. Scenic ocean views to Kangaroo Island. Camping facilities.

Rock fishing and diving. Swimming (Blow Hole Beach). Surfing (Blow Hole Beach and Boat Harbour Beach).

Draft Encounter Marine Park Zoning

Sanctuary zone S-4 from Deep Creek Cove to the Aaron Creek.



Deep Creek Conservation Park

(Coast Protection Board, May 2003)

Threats (Field visits and local reports)

Limited access to beaches due to isolated terrain combined with illegal camping

Trail Bike 4WD off-road impact, both near the dirt road, approaches to pocket beaches and at beaches and dunes.

Opportunities

Upgrading of interpretation of the exceptional conservation values of the park; particularly delivered to accommodation facilities dependent on the natural values of the park.

Conservation Analysis (GIS)

The sum of conservation means for this cell is the second highest in the region. As might be expected, the highest value areas within the cell lie within the Deep Creek Conservation Park; while small cleared and cliff areas along the coastline, and cleared land at the east and west perimeters of the park show medium values.

Nearly all conservation layers contributed to the high priority score: outstanding value accrued from priority based on the status of the vegetation community, priority of sites with threatened flora, priority of vegetation assemblages containing a high % of endemic flora, on the habitat of significant birds and the priority of habitat for reptiles with a high degree of coastal dependency.

This cell includes Aboriginal sites of significance.

Geological Monument 1112, Fleurieu Peninsula South Coast from Coalinga Gully along entire coast to Waitpinga Creek: excellent exposures/ type section of the metasediments of the Kanmantoo Group.

A small but significant colony of the EPBC listed endangered Southern Emu-Wren (*Stipiturus malachurus intermedius*) is found in heathland within the coastal boundary; this species is managed through a recovery

plan. State endangered *Calamanthus pyrrhopygius parkeri* (Chestnut-rumped Heathwren); State vulnerable *Thinornis rubricolis* (Hooded Plover), *Calyptorhynchus funereus* (Yellow-tailed Black-Cockatoo); state rare *Egretta sacra* (Eastern Reef Egret), *Falco peregrinus* (Peregrine Falcon), *Haematopus fuliginosus* (Sooty Oystercatcher), *Neophema elegans* (Elegant parrot), *Petroica multicolor boodang* (Scarlet robin) and *Stagonopleura bella bella* (Beautiful Firetail) have been recorded in this cell.

Lands on the western boundary of Deep Creek CP have been re-planted and fenced to re-instate the habitat of the Glossy Black Cockatoo.

Threat Analysis GIS)

The total of threat summary layers shows this cell to have one of the lowest threat scores within the region. Scores for cliff instability, viewshed and viewscape stand out, as does the score for illegal camping, which is the second highest in the Southern Fleurieu. It is notable that in a region with high scores for vegetation degradation (exotic plant %) and invasive weeds, the scores in this cell are only moderate in this respect; the weed distribution score is the lowest in the region.

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

Lycium ferocissimum, *Euphorbia paralias*, *Melianthus comosus*, *Olea europaea ssp. Europaea*, *Oxalis pes-caprae*, *Solanum linnaeanum*, *Ehrharta calycina*

Possible Climate Change Threats

Over time increasing aridity will stress remnant vegetation and slow natural recovery from damage. Seasonal run-off in small creeks will be drastically reduced by soil water budget changes; however, unpredictable intense rainstorms will locally cause fast runoff in small catchments. Changes in wave climate, likely to increase the long period swell component, would accentuate high tide changes to backshores in pocket beaches. Tide and water depth dependent habitats on reefs will be impacted by sea level rise.

Management Comment

The Newland Head Conservation Park, which comprises the entirety of this cell, has undergone a recent management plan process, completed in September 1997. This involved consultation and review of drafts. The GIS – based conservation and threats analysis of this project supports the evaluation within that plan, that this is an area of great conservation significance appropriate to its designation and needing priority in effort to implement the management. The conservation analysis of this study shows that this cell is a core area for plants and animals of the Southern Fleurieu coast, with habitat and biodiversity of state significance.

Cell F19 Fishery Beach to Cape Jervis



Landforms

Coastal slopes and low bluffs. Between Cape Jervis and Fishery Beach resistant Pre-Cambrian and Palaeozoic meta-sedimentary rocks appear mainly in reefs and serrated shore platforms; these are overlain by Pleistocene aeolianite limestone and slope talus materials, which form slopes and cliffs above the ancient shore platforms.

Benthic Habitat/ Biota

Inshore reef and then mixed sand and reef habitat seaward of the platform. Some patches of seagrass. This cell contains an unusually large number of distinct vegetation associations, including *Triodia compacta* tussock grassland, *Acacia paradoxa* shrubland, *Olearia axillaries shrubland* and *E. porosa* woodland.

Land Use/ Land Ownership

Extensive coastal reserves managed by the CPB and by Council. Private land: grazing and farmland along inner edge of coastal boundary.

Values (Field visits and local reports)

Reef and boat fishing. Walking (Heysen Trail, Cape Jervis to Newland Head Section). Heritage whaling station at Fishery Beach.

Conservation of publicly owned land: coastal land owned by the Coast Protection Board and private land owners at Cape Jervis, and adjacent to Lands End and Fishery Beach have had considerable investment of effort by the community (individually and in voluntary association); the CPB, in conjunction with greening Australia and the Council in weed and access control and revegetation.

Draft Encounter Marine Park Zoning

Habitat Protection Zone HP-1

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



Lands End, looking NW towards Cape Jervis. Heysen trail in foreground. (Coast Protection Board, May 2003)

Threats (Field visits and local reports)

Excessive use of Fishery Beach by day visitors, using off road bikes and heavy vehicles and causing damage to access control fences, to re-vegetated areas and to create tracks along the coast. Informal camping at Fishery Beach has damaged the former whaling station heritage site. Slope instability adjacent to lower Fishery Creek is due to ORV activity, leading to inshore and estuarine turbidity.

Opportunities

The Glossy Black Cockatoo Recovery Program revegetation component aims to increase feeding habitat between potential nesting areas in and adjacent to Deep Creek Conservation Park and the closest landfall to Kangaroo Island (Mooney & Pedler, 2005, p.22)

Continued riparian weed control, revegetation and fencing along Fishery Creek (Cape Jervis Landcare). Linkage of this vegetation corridor to biodiversity plantings by Greening Australia on CPB land to east of Fishery Creek.

Fenced car park and access control at Fishery Beach provide opportunity to control and remediate the damage caused by ORV to the rehabilitation area.

Bechervaise (2004) proposes linking the Heysen Trail, Fishery Beach and Talisker Mine as a loop walking trail.

Conservation Analysis (GIS)

The sum of conservation means shows this to be the fourth most valuable cell within the region. The highest value areas within the cell are located within large blocks, mainly on private land between Fishery Beach and Lands End. Medium to low values are found along the shore and along Fishery Creek.

Values linked to the rarity of vegetation associations, numbers of threatened plant species, numbers of threatened bird species, total number of threatened species, and the significance of butterfly larvae habitat

were all high for this cell. Aboriginal and European natural heritage, vegetation patch size, shape and connectivity all added values to the sum of means.

Biodiversity values are high: 363 plant and animal species are recorded; of these, 73 plant species and 8 fauna species are threatened. The state rare species *Egretta sacra* (Eastern Reef Egret), *Porzana tubuensis* (Spotless Crake), *Actitis hypoleucos* (Common Sandpiper), *Haematopus fuliginosus* (Sooty Oystercatcher), and *Neophema elegans* (Elegant Parrot), have been reported in this cell. Some *Gahnia lanigera* heath (the southernmost in the state) is found in this cell. *A. atralba* is present. The area is suitable for the re-introduction of *T. alabocinta* and *M. trimaculata*.

Threat Analysis (GIS)

The threat summary layers total for this cell is the fifth highest within the region. The major contributors to this total are informal camping, land ownership, land use, percentage of exotic plants, vegetation block isolation small remnant vegetation patch sizes, viewshed and viewscape. There is also a significant total for weed distribution in this cell.

The following red alert weeds were found in this cell: *Asparagus asparagoides*, *Gazania linearis*, *Lycium ferocissimum*, *Acacia cyclops*, *Euphorbia paralias*, *Melianthus comosus*, *Olea europaea ssp. Europaea*, *Oxalis pes-caprae*, *Ehrharta calycina*, *Solanum linnaeanum*, *Marrubium vulgare*.

Within the region and the state this cell is part of a biodiversity hot spot. In general terms it could be argued that the combination of high conservation values and high threat values gives a high priority for immediate action in this cell to prevent degradation of the values by the various threats.

Possible Climate Change Threats

This cell is resilient to some effects of climate change, but plant and animal survival of the displacement of climate zones is a serious threat. Over time increasing aridity will slow natural recovery from damage to remnant vegetation. Seasonal run-off in small creeks will be drastically reduced by soil water budget changes; however, unpredictable intense rainstorms will locally cause fast run-off in small catchments. Changes in wave climate, likely to increase the long period swell component, would accentuate high tide changes to backshores in pocket beaches. Tide and water depth dependent habitats on reefs will be impacted by sea level rise.

(Increasing plant and animal resilience to progressive climate change is important for this area, and can be assisted by improving connectivity between remnant vegetation patches).

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Coastal slopes within reserves, Crown and CPB land	Damage to fences, heritage site and vegetation at Fishery Beach by ORV.	F19.1 Maintenance of access control at Fishery Beach carpark.	High (Cons / threat)	Council, CPB.
	Informal ORV tracks in Crown coastal reserves.	F19.2 Rehabilitation of tracks and planting within Crown coastal reserves.	High (Cons / threat)	CPB.
	Presence of a high profile walking track through a high conservation priority area	F19.3 Ensure high level of track maintenance and marking.	High (Cons / threat)	CPB.
Council land and adjacent to carpark	Invasive weeds	F19.4 Weed control, to prevent spread.	Medium (threat)	Council.
Riparian slopes, adjacent to Fishery Creek	Creation of biodiversity corridor; improvement in creek water quality; exclusion of stock from creekline.	F19.5 Extension of riparian planting and fencing program adjacent to Fishery Creek.	High (Cons / threat)	Cape Jervis, Landcare.
	ORV damage to slopes by Fishery Creek.	F19.6 Rehabilitation of damaged slopes adjacent lower Fishery Creek.	Medium (threat)	NRM.
Whole cell	The potential for improved connectivity between remnant areas of native vegetation of high conservation value provides the opportunity to sustain the high biodiversity values of this cell.	F19.7 Develop a strategy to acquire land and land management agreements to improve connectivity between remnant vegetation blocks	High (Cons / threat)	DEH, Council, Community.

Cell F20 Cape Jervis to Rapid Head



Landforms

High cliffs and pocket beaches. At Morgans Beach, fine sands, of Permian glacial origin, form a 20 – 40m wide beach backed by a foredune and a dune wind driven up a 30 degree cliff slope to c.50m. High cliffs in this section, especially north of Morgans Beach, show active fluvial erosion and mass movement, with incised gullies, slumping, sliding, and long talus slopes fronting high cliff crests. Part of the cliff slopes between Morgans Beach and Cape Jervis has exposed Permian glacial sediments <30m thick, consisting of sandy clay and boulder clay, and containing erratics. Granite boulder erratics are found on the adjacent shore platform. The cliff slopes are undergoing active gullying.

Benthic Habitat/ Biota

Heavy limestone inshore reef, then clear sand. Some inshore seagrass c.1km north of Morgans Beach. Deep water in Backstairs Passage (to - 60m), gives a steep gradient and changing benthic environment relatively close to Cape Jervis, with unusual invertebrate fauna. The high cliffs which form the shore of most of this cell have been largely de-vegetated by grazing. Some significant native shrubs, herbs and grasses remain.

Land Use / Land Ownership

Extensive coastal reserves owned by the Crown and Coast Protection Board, in part under the care and control of Council. Private ownership. Reserves. Extensive parking areas associated with ferry services.

Draft Encounter Marine Park Zoning

Habitat Protection Zone HP-1 from Cape Jervis to Rocky Point; then Sanctuary Zone S-3.

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



Morgans Beach. Shore platform (geological monument) and Permian glacial sediments in foreground. Starfish Hill in background. (Coast Protection Board, May 2003)

Values / Use (Field visits and local reports)

Ferry port and boat ramp at Cape Jervis. Coastal land owned by the Coast Protection Board and private land owners at Cape Jervis adjacent to Morgan's Beach have had considerable investment of effort by the community (individually and in voluntary association), the CPB and the Council in weed and access control and revegetation. Swimming, diving and fishing at Morgans Beach.

Threats (Field visits and local reports)

Extension of the parking area to the NW of the ferry carpark, through the dumping and spreading of fill. This activity is causing the fill to cover and spill onto the shore platform – a geological monument. The over-extension of the car parking area creates access control problems for ORV activity onto the shore platform and adjacent steep bluffs. Sand boarding at Morgans Beach. Vehicle access and parking at Morgans Beach – vehicle turn around subject to erosion.

Bechervaise (2004,p10) notes the degraded vehicle impacted appearance of areas adjoining Cape Jervis and Fishery Beach.

The Cape Jervis Reserve Restoration Plan identifies 7 'Priority One' weeds: *Asparagus asparagoides* (bridal creeper), *Leptospermum laevigatum* (coastal tea tree), *Gazania sp.* (gazania), *Pennisetum villosum* (feather top), *Scabiosa atropurpurea* (pincushion/ scabiosa), *Ehrharta calycina* (perennial veldt grass), *Oenothera stricta spp. Stricta* (evening primrose). Adjustment to this plan has followed the identification of rare irongrass grassland, threatened with shading out by proposed plantings. The coastal slopes and cliffs along the northern section of the reserve are identified as having a significant gully problem.

Opportunities

The Cape Jervis Reserve Restoration Plan outlines a detailed revegetation plan for the 38 ha. immediately north of the Main Road at the tip of the peninsula.² The Plan outlines a weed and revegetation strategy, involving a direct seeding strategy using seeds collected locally.

Continued effort to implement the Cape Jervis Reserve Restoration Plan (funded); refining of planting strategies to ensure native grass sites not shaded out.

Important revegetation initiatives underway at Fishery Beach and Lands End should be complemented in the areas closer to Cape Jervis, with sensitive, informal and appropriate planting programs. The Glossy Black Cockatoo Recovery Program revegetation component aims to increase feeding habitat between potential nesting areas in and adjacent to Deep Creek Conservation Park and the closest landfall to Kangaroo Island (Mooney & Pedler, 2005, p.22).

Bechervaise (2004, p.10) proposes the following opportunities:

- Establishment of walking trail Cape Jervis – Morgans Beach combined with interpretation, revegetation and minimisation of the extent of vehicle impacted areas.
- Upgrading the Cape Jervis Ferry Port / Terminal within an agreed Management Plan, including the landscape at visitor arrival and parking areas adjoining ferry terminal; the recreational / commercial boat ramp (upgrading and widening), and the landscape of parking areas and foreshore generally.
- Establishment of a southern trail head for Heysen Trail, and upgrading of visitor facilities and revegetation at Cape Jervis next to the ferry terminal.
- Revegetation of areas adjoining the access road at Morgans Beach, and areas north of truck parking area at lighthouse.

Conservation Analysis (GIS)

Sum of conservation mean values gives this cell medium to high value. High to medium values are found in cliff top areas between Cape Jervis and Morgans Beach and isolated vegetation remnants near Rapid Head.

Vegetation assessment within a state context give values: threatened status rating, rarity, and number of endemic associations. Threatened status of flora and fauna also add priority. Biodiversity values are high: over 300 plant and animal species, including 69 threatened plant species and 16 threatened plant species are recorded here. The state rare *Falco peregrinus* (Peregrine falcon) has been identified here. *Caretta caretta* (Loggerhead Turtle) and the *Litoria ewingii* (Brown Tree Frog) are reported in this cell. This cell includes Aboriginal sites of significance. Geological Monument 1113, Cape Jervis to Morgans Beach, shore platform, cliff and clifftop: type section of the Cape Jervis Formation, unconformity with underlying Kanmantoo Formation; also erratics from Permian glaciation. Listed on the Register of the National Estate and the State Heritage Register.

Threats Analysis (GIS)

The threat summary total is the sixth highest in the region. This is due to high threat values for viewscape, viewshed, distribution of significant weeds, numbers of exotic species, cliff instability, private ownership of significant areas, and land use. Zoning, mining licences and dune instability add further threat totals.

The following red alert weeds have been found in this cell: *Asparagus asparagoides*, *Gazania linearis*, *Acacia Cyclops*, *Lycium ferocissimum*, *Polygala myrtifolia*, *Euphorbia paralias*, *Melianthus comosus*, *Olea europaea ssp. Europaea*, *Acacia saligna*, *Oxalis pes-caprae*, *Ehrharta calycina*, *Marrubium vulgare*,

Solanum linnaeanum

² Cape Jervis Reserve Restoration Plan by Peter Tucker, Trees for Life for the Cape Jervis and Delamare Progress Association, September, 2002.

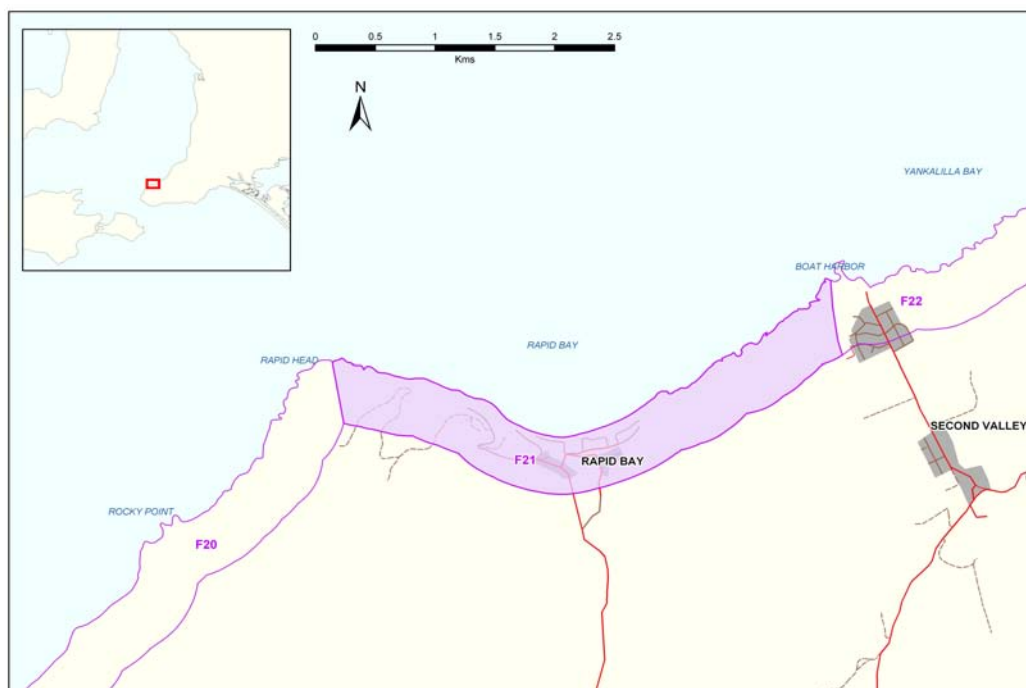
Possible Climate Change Threats

This cell is resilient to some effects of climate change, but plant and animal survival of the displacement of climate zones is a serious threat. Over time increasing aridity will slow natural recovery from damage to remnant vegetation. Seasonal run-off in small creeks will be drastically reduced by soil water budget changes; however, unpredictable intense rainstorms will locally cause fast run-off in small catchments. Changes in wave climate, likely to increase the long period swell component, would accentuate high tide changes to backshores in pocket beaches. Given the range of sea level rise projected by the IPCC (2001 report), many talus slopes at the base of sea cliffs will be trimmed back. Tide and water depth dependent habitats on reefs will be impacted by sea level rise.

(Increasing plant and animal resilience to progressive climate change is important for this area, and can be assisted by improving connectivity between remnant vegetation patches).

COMPONENT of CELL	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Morgans Beach and dune	Prevent further degradation of cliff slopes and dune behind beach. Vehicle impact on lower dunes and beach.	F20.1 Exclude 4WD access to steep coastal bluff and dune at Morgans Beach. F20.2 Reconfigure car parking at Morgans Beach to reduce vehicle access to beach and shore platform.	High (Cons / threat)	DEH Coast Protection, Council, Aboriginal Partnership – Department of Premier & Cabinet, Aboriginal Heritage.
	Pedestrian damage to dunes and slopes.	F20.3 Access control from carparks at Morgans Beach.	High (Cons / threat)	Council, DEH CPB.
		F20.4 Interpretive signage re vegetation at carpark.	Medium (Cons)	DEH, Land Administration Branch, NRM, Cape Jervis volunteers.
Shore platform: Morgans to Cape Jervis	Degradation of shore platform by dumping to extend lorry parking.	F20.5 Erect interpretive signs re Geological Monument at both ends of the shore platform between Morgans Beach and Cape Jervis.	Medium (Cons)	Council, Geological Society of Australia, SA Branch.
		F20.6 Negotiate with ferry operators and users to prevent further dumping to extend lorry parking.	High (Cons / threat)	DEH CPB, EPA, Council, Australian Maritime Authority.
Coastal slopes	ORV damage to plantings and native grassland remnants.	F20.7 Exclusion of ORV by fencing coastal slopes.	High (Cons / threat)	Council, NRM, CPB.
	Development and extension of gully through run-off and ORV damage.	F20.8 Run-off diversion from paths and tracks to reduce rill and gully development on coastal slopes.	High (Cons / threat)	Council, NRM, Coastal Protection Board.
Coastal Crown land NE of Morgans Beach	Lack of public access to coastal reserves.	F20.9 Development of regional coastal trail.	Medium (Soc / Econ)	NPW Visitor. Management Services

Cell F21 Rapid Bay



Landforms

The bulk of the foreshore at Rapid Bay is spilled limestone pebble wastes from the quarry cliffs to the SW and from the former loading gear on the jetty. Bourman, 1990, reports that between 1942 and 1982 1.8M tons were spilled, resulting in a progradation of the shore of 250 metres; older cadastral maps show the caravan park as under the tide line. After mining ceased in 1982 rapid recession of the shoreline of Rapid Bay occurred until 1984; by 1988 the Bay appears to have stabilised. Limestone gravel was also transported NE in the nearshore zone: aerial photos indicate these wastes have now covered the sea floor to 300m offshore and from Rapid Bay to near Second Valley. Transported gravel has buried parts of the sea floor and covered pocket beaches. Some intertidal and sub-tidal reefs have been destroyed.

Benthic Habitat/ Biota

Large dense seagrass meadows form valuable habitat. Gravel close inshore.

Land Use/ Land Ownership

Approximately 50% of this cell is privately owned to the h.w.m., including the limestone quarry and the cliff areas to the east of the Rapid Bay embayment. Much of the private land is in grazing, or quarrying and associated infrastructure.

Draft Encounter Marine Park Zoning

Sanctuary zone S-3 from Rapid Head to the Rapid Bay Jetty, then Habitat Protection Zone HP-1.

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



Rapid Bay and cliffs to the NE, taken 1997. Nearshore gravel train shows as light blue and is now approaching Second Valley (Coast Protection Board)

Values (Field visits and local reports)

Recreational fishing by boat and formerly from the jetty: calamari, KG whiting, Tommy Ruff, leatherjacket.

Diving from jetty (Leafy Sea Dragon) and offshore at HMS Hobart; local dive sites are internationally known.

Beach walking. Coastal views from headlands.

Threats (Field visits and local reports)

Turbidity in estuary of the Yattagolinga River and nearshore following storm run-off from farmland in catchment and from cliffs adjacent to quarry. The continued migration of quarry gravel nearshore, burying nearshore habitats, pocket beaches and shore platforms, to Second Valley and beyond, is a medium term threat.

Opportunities

The closure of the caravan park gives opportunity for considerable creative vegetation plantings on public land within the extensive gravel plain of the centre of the embayment. Locally there is a clear need for improved facilities for dive clubs and individual groups of divers. Regionally there is an opportunity to build on the marine attractions of the jetty and the Hobart wreck, at the time when the Marine Protected Area is being created; this could include the development of a marine interpretation centre in association with the Rapid Bay Primary School.

Conservation Analysis (GIS)

The sum of conservation means indicates significant priority for this cell. Highest values are also found at remnant vegetation patches at cliff top locations at Rapid Head and the headland East of Rapid Bay to Second Valley.

Vegetation associations (threatened status rating, rarity of the community within South Australia, numbers of species endemic to this region, and priority of sites with threatened flora); habitat for significant bird species and geological heritage, all give value to this cell. This cell includes Aboriginal sites of significance.

The state vulnerable *Calyptorhynchus funereus* (Yellow-Tailed Black-Cockatoo) and the state rare *Falco peregrinus* (Peregrine falcon) and *Actitis hypoleucos* (Common Sandpiper) have been recorded in this cell.

Threats Analysis (GIS)

High threat values for proportion of exotic plants, for viewscape and viewshed, for land ownership and land use (mining) give a high threat total to this cell. Coastal reserves are narrow to non-existent: only the embayment at Rapid Bay has an extensive coastal reserve

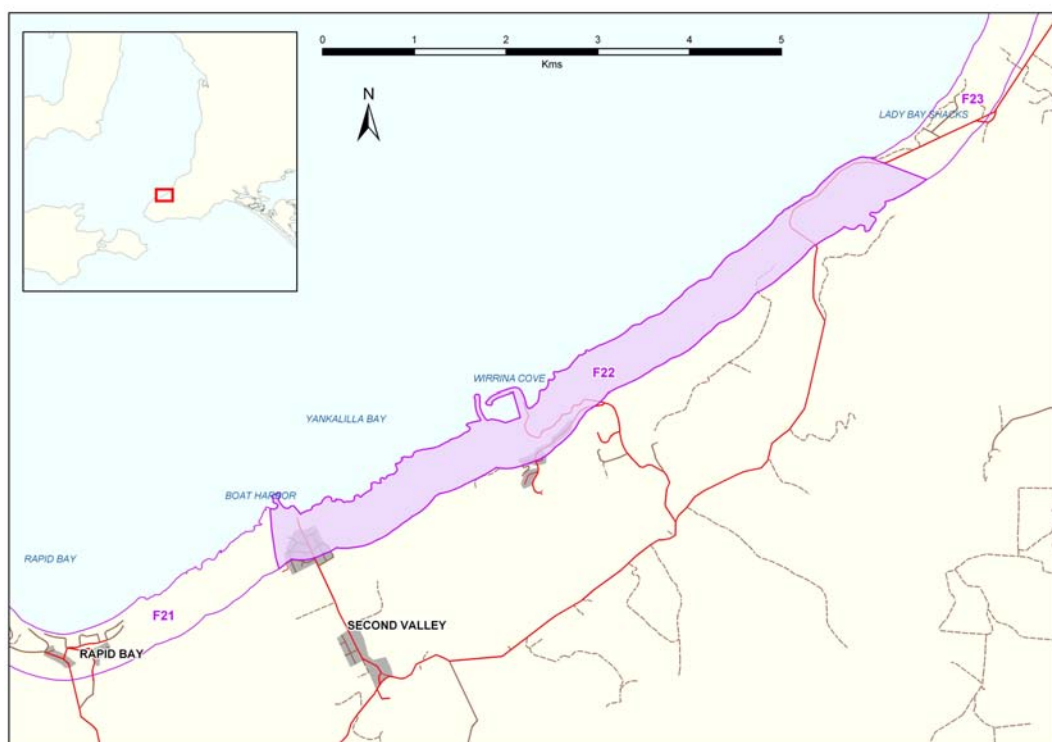
The following weeds were detected within this cell: *Acacia cyclops*, *Lycium ferocissimum*, *Olea europaea ssp. Europaea*, *Oxalis pes-caprae*, *Marrubium vulgare*, *Solanum linnaeanum*.

Possible Climate Change Threats

This would be one of the most resilient beaches in the region to sea level rise. A projected rise of 0.3m in 50 years would cause minor recession to the gravel beach face and minor flooding to low ground near the creek. The water table under the broad gravel plain would directly reflect tide heights. Flow in the creek would become irregular, mainly occurring following unpredictable intense rainstorms.

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Cliffs	Remnant vegetation fragments are of high conservation value, are relatively inaccessible, and are on private land. In the long term, vegetation links along this coastline could be of biogeographical value.	F21.1 It is proposed that DEH champion a 'Coastlinks' project along this coast, aiming to link remnant vegetation patches in coastal reserves and adjacent lands.	High (Cons / threat)	DEH, AML, NRM Board.
	Lack of public access to coastal reserves.	F21.2 Establishment of a coastal footpath.	Medium (Soc / Econ)	NPWS Visitor Management Services.
Beach and gravel backshore	Extensive use as a caravan park has now ceased. Experimental planting of this site desirable.	F21.3 Extend current work to plant the gravel backshore.	Medium (Cons)	Rapid Bay Primary School, Council.
Nearshore dive sites	Need to upgrade facilities for divers, in association with jetty construction.	F21.4 Project support for upgraded facilities for scuba divers in the context of planning the jetty and approaches construction.	Medium (Cons)	DTEI, Council.
Rapid Bay settlement	A regional need, in association with the Encounter Marine Park, to develop coastal and marine interpretation in the area.	F21.5 Planning and development of an interpretation centre based on Rapid Bay Primary School or adjacent site.	High (Soc / Econ)	DEH (Marine Conservation, Coast Protection), Rapid Bay Primary School, Council.

Cell F22 Second Valley to Lady Bay



Landforms

High cliffs (c.50m), with talus slopes, discontinuous boulder beach fronted by shore platforms. Low wave energy pocket beaches are found. Small creeks are incised in their lower courses.

Benthic Habitat / Biota

Dense seagrass. Coastal shrubland.

Land Use / Land Ownership

Marina and resort development at Wirrina Cove and in the Congaratinga valley and slopes. Grazing land. There are fragmented coastal reserves to the north of Wirrina and north of Second Valley.

Values (Field visits and local reports)

Pocket recreation beach and fishing jetty at Second Valley. Marina and boat ramp at Wirrina. Tiny estuarine environments at Second Valley and at Wirrina (modified by works at the coastline and dam), are found in this cell. Scenic values of rugged, undeveloped high cliffs. Boating, fishing, diving and snorkelling are the primary activity at the limited beach spaces. A number of historic shipwrecks are located offshore from Second Valley.

Draft Encounter Marine Park Zoning

Habitat Protection Zone HP-1.

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



Worrina marina, the site of 'Sunset Cove' Worrina resort.

(Coast Protection Board May 2003)

Threats (Field visits and local reports)

Grazing of cliff tops and faces increases cliff instability, especially through rill and gully development, leading to periodic increases in turbidity in the nearshore zone. Land management practices in coastal catchments appear to have led to hillside erosion scarring, eroded creek banks, raised sediment transport and creek nutrient levels. Proposed extension of residential subdivision along the Worrina cliff line threatens scenic values of this coast (and appears to contravene some objectives of the Worrina Cove zone).

Opportunities

At the time of this survey, Second Valley foreshore appeared to be under considerable visitor pressure, which could be relieved by making the small carpark drop off only, with parking near the shop.

Bechervaise (2004) notes the following opportunities:

- Designation of a coastal headland walking trail between Rapid Bay, Second Valley and Worrina may be achievable by agreement with private owners.
- Revegetation of the coastal headlands adjoining these settlements associated with the establishment of a fenced off area for a coastal walk, would achieve both environmental and leisure activity objectives.
- Interpretation at Worrina Cove boat ramp of HMAS Hobart and other shipwrecks.

Conservation Analysis (GIS)

The sum of conservation means indicates significant priority for this cell. Medium value vegetation remnant patches are found along cliff tops from Second Valley to Worrina; north-east of Worrina values are low, apart from isolated vegetation blocks.

Habitat for significant bird species, geological heritage and vegetation associations (threatened status rating, rarity of the community within South Australia, numbers of species endemic to this region, and priority of sites with threatened flora), all give value to this cell. This cell includes Aboriginal sites of significance.

Thirty-six threatened flora species and 6 threatened fauna species, and a total of 171 plant species and 28 fauna species have been recorded in this cell. The state rare *Falco peregrinus* (Peregrine falcon) and *Actitis hypoleucos* (Common Sandpiper) have been recorded.

Some of the most ancient rocks in the state are exposed in this part of the coast: Geological Monument 1110 Little Gorge – Mouth of the Congeratinga River – shore platform: basement rocks (Aldgate Sst.), folding, metamorphism, intrusions, pegmatite (Barossa Complex). Geological Monument 1111 coast and hinterland at Wirrina: basement contact overturned, deformed pebbles, folding, Permian glacial deposits. Geological Monument 1120 Second Valley Beach and Headland: mesoscopic folds, lineation not easily seen elsewhere in the Mt Lofty Ranges.

Tiny estuarine environments at Second Valley and at Wirrina, (modified by works at the coastline) are found in this cell: no water quality records are available; however, riparian condition suggests periodic flows of suspended sediment.

Threat Analysis (GIS)

The total of threat summary layers is relatively high within the region: cliff instability, land ownership, land use, percentage of exotic plants, viewshed, viewscape and development plan zoning sum to the third highest threat total.

The following red alert weeds were found within this cell: *Acacia cyclops*, *Lycium ferocissimum*, *Chrysanthemoides monilifera ssp. Monilifera*, *Euphorbia paralias*, *Euphorbia terracina*, *Melianthus comosus*, *Olea europaea ssp. Europaea*, *Oxalis pes-caprae*, *Ehrharta calycina*, *Marrubium vulgare*, *Solanum linnaeanum*.

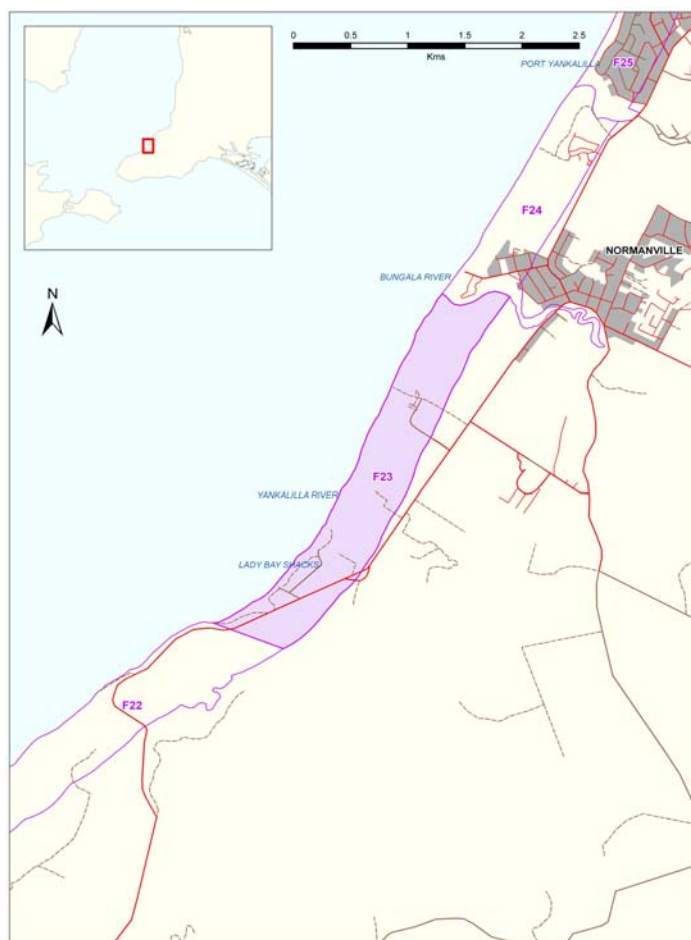
Possible Climate Change Threats

This cell is resilient to some effects of climate change, but plant and animal survival of the displacement of climate zones is a serious threat. Over time increasing aridity will slow natural recovery from damage to remnant vegetation. Increasing plant and animal resilience to progressive climate change is important for this area, and can be assisted by improving connectivity between remnant vegetation patches.

Seasonal run-off in small creeks will be drastically reduced by soil water budget changes; however, unpredictable intense rainstorms will locally cause fast run-off in small catchments. Changes in wave climate, likely to increase the long period swell component, would accentuate high tide changes to backshores in pocket beaches. Given the range of sea level rise projected by the IPCC (2001 report), many talus slopes at the base of sea cliffs will be trimmed back. Tide and water depth dependent habitats on reefs will be impacted by sea level rise. Some intertidal sloping reefs will accommodate species migration. Flat low tide reef platforms will see species change.

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Cliff tops	Maintenance of scenic amenity.	F22.1 Review of Development Plan protection of cliff top land.	High (Soc / Econ)	Council.
	Improvement / creation of regional coastal biodiversity corridor.	F22.2 Development of a program of acquisition of coastal land to link coastal reserves.	High (Cons / Threat)	DEH (Naturelinks Group), NRM.
	Maintenance and enhancement of the conservation values of remnant vegetation fragments	F22.3 Fencing of remnants on Crown land.	High (Cons / Threat)	DEH. NRM.
	Grazing pressure threatens remnant vegetation patches.	Consideration of other remnants for landowner Heritage Agreement. As above.		
	Lack of public access to coastal reserves.	F22.4 Development of regional coastal trail.	Medium (Soc / Econ)	NPW Visitor Management Services.
Foreshore	Community education. Protection of geological heritage.	F22.5 Erection of interpretive signs at access points to geological monuments at Second Valley and Wirrina.	Medium (Cons)	Geological Society of Australia – SA Branch.
	Community education.	F22.6 Interpretation of HMAS Hobart and offshore shipwrecks placed at the Wirrina boat ramp.	Medium (Cons /Soc / Econ)	DEH, Marine Heritage, Council.
	Boatsheds at Second Valley are unsightly, and occupy a crowded site.	F22.7 Re-develop site, to cater for day visitors.	Medium (Soc / Econ)	Council.
Parananacook a River estuary	Water quality, due to land-based discharges and bank erosion.	F22.8 Continued fencing and revegetation of riparian land at the Parananacooka River estuary.	High (Cons / threat)	Council, Landholders, NRM.

Cell F23 Lady Bay to Bungala River



riding, fishing; across the beach, boat launching (tractor only) near Lady Bay CT, defined dune access points, fenced dune in places, beach-side caravan park.

Draft Encounter Marine Park Zoning

Habitat Protection Zone HP-1

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

Landforms

Medium energy, microtidal, reflective beach. Narrow dune barrier (c.50 – 70m), pure silica white Holocene sands. Flat coastal plain. Toeslopes of high degraded former sea cliffs, with local slumping within talus. Yankalilla River estuary.

Benthic Habitat/ Biota

Sand close inshore and then dense seagrass. Dune shrub and grassland, with area of *Melaleuca* at rear of the dune. *Nitraria billardieri* shrubland near former shacks.

Land Use/ Land Ownership

Residences, holiday homes; grazing and camping are found within the degraded dune at Lady Bay CT. The Crown lands reserve (Normanville dune) is under the care and control of the council; most of the land within the cell is privately owned.

Values (Field visits and local reports)

The presence of a functional beach – dune sedimentary system in part of this cell is valuable to the settlement. Swimming, diving, boating, beach walking, camping / caravanning, horse



Lady Bay: holiday homes within the dunes

(Coast Protection Board, May 2003)

Threats (Field visits and local reports)

Lack of field volunteers. Weed pressure, including numerous domestic escapes: there is a need to implement the weed strategy. Pressures from real estate development adjacent to dunes. Continuing access control issues, with visitor and surfer pressure on tracks through dunes. Anecdotal reports of a fall in numbers of shorebirds over time (pressure of dog walking in spring nesting season).

Sandboarding is making an impact on foredunes. Lack of knowledge of occasional visitors a problem.

Farm dam construction and below average rainfall in small coastal catchments has reduced environmental flows in creeks (N.B. vegetation corridors within small inaccessible creeklines are significant for bird and reptile movement).

Horse access to dunes, though limited to a defined area, is a continuing source of weeds. There is a limited number of public access points to the Lady Bay foreshore.

The shacks on foreshore south of Little Gorge are unsustainably located.

Opportunities

Upgrading of community education / capacity building.

Better use of public land near Little Gorge as a rest area for tourists – provision of picnic facilities, shade and interpretation.

Bechervaise (2004) has proposed the possible development of walking trail south to Wirinna and north to Normanville and the upgrading of public access point at Lady Bay CT, with the development of a proper parking, shade and picnic area.

Conservation Analysis (GIS)

The sum of conservation means is high: the eighth highest in the region. This appears to be the result of average to high scores in all categories considered. High conservation scores are found within the Normanville Dune north east of Yankalilla River, medium values in the shack dune area. The cleared coastal plain records low values.

Cultural and natural heritage values are high: there are Aboriginal sites of significance; Little Gorge is a State Geological Monument; Geological Monument 1109 Normanville Sand Dunes: Holocene siliceous sand dune system. Aboriginal remains are also reported in dunes immediately south of the Bungala (Ross, p.20).

Normanville Dunes listed on the Register of the National Estate. The Dunes remain a significant plant habitat and contain coastal vegetation assemblages that are rare in South Australia. The dunes have bird and reptile habitat values which, when averaged over the cell give moderate averages for these layers. The state vulnerable *Thinornis rubricollis* (Hooded Plover) and the state rare *Neophema elegans* (Elegant Parrot) have been recorded in this cell.

Threats Analysis (GIS)

Moderate to high total threat score. High values for viewshed, percentage of exotic plants, land and ownership. Development zoning gives moderate scores, however, the low dunes fronting the Lady Bay dunes are inappropriately zoned as 'Country Township', and in the long term are subject to potential flooding and erosion risk. [Much of the former dune protective buffer has been removed here by sand removal several decades ago, and adjustment to accelerated sea level rise could be rapid].

A Coast Protection Board long term beach profile monitoring line at the SW edge of this settlement should provide an indication of any significant change occurring here.

The following red alert weeds were found within this cell: *Asparagus asparagoides*, *Lycium ferocissimum*, *Acacia cyclops*, *Ulex europaeus*, *Rhamnus alaternus*, *Acacia saligna*, *Euphorbia paralias*, *Euphorbia terracina*, *Oxalis pes-caprae*, *Olea europaea ssp. Europaea*, *Ehrharta calycina*, *Arctotis stoechadifolia*, *Marrubium vulgare*, *Pinus radiata*, *Solanum linnaeanum*.

Possible Climate Change Threats

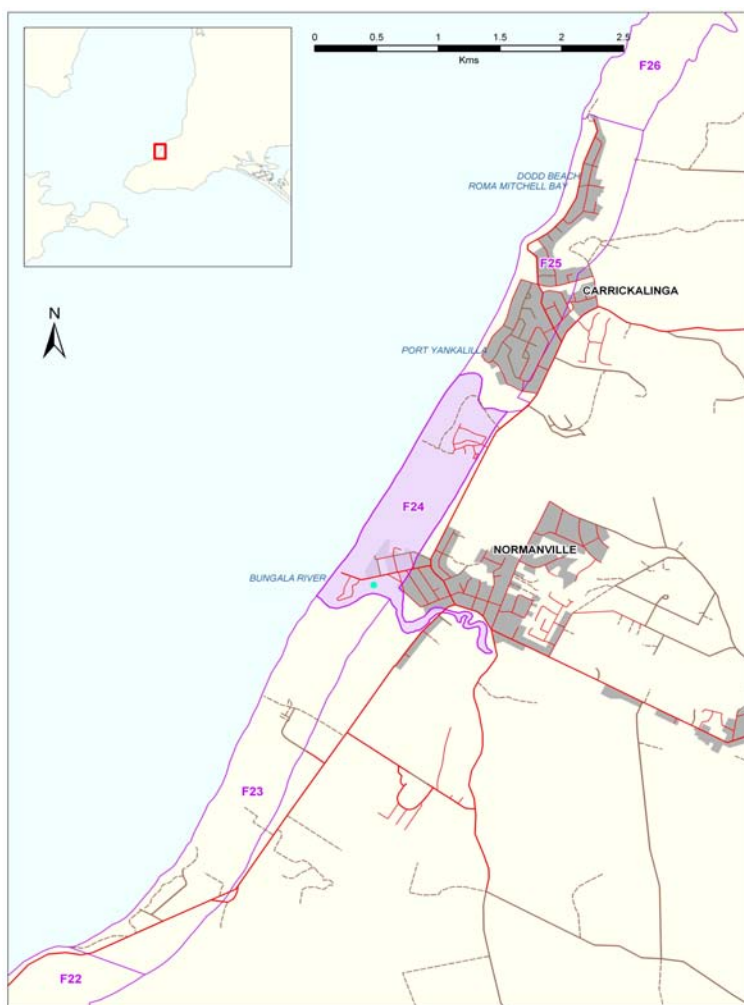
Rising sea levels will see increased storm damage to foredunes; Bruun Rule calculations of beach change suggest a recession of the order 5 – 30m over 50 years could be likely, given current IPCC sea level forecasts. Both beach and dune recede under this process and over time consideration will have to be given to dune recession. CSIRO forecasts suggest fewer storms, but a small increase in storm magnitude, increasing the level of unpredictability of seasonal beach change. Rising sea levels threaten tidal inundation and / or erosion of the former dune area south of Yankalilla River.

All climate models project drier conditions for southern South Australia, together with increased evapo-transpiration: it is clear that in some years soil field capacity may not be reached in winter and seasonal run-off in the Yankalilla River may be greatly reduced; however, fast run off from intense storms in summer may give irregular flows. Over time, increasing aridity will slow natural recovery from damage to dune vegetation.

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Whole cell	Need to raise public awareness of the value of Normanville Dune.	F23.1 Development of a strategy to involve and raise capacity within the community to conserve natural coastal heritage.	High (Cons / threat)	NRM, Council, Community Groups.
Dunes north of Yankalilla River	The dunes include significant habitats, but have ongoing problems with invasive weeds.	F23.2 Implement existing weed strategy for the Normanville Dunes.	High (Cons / threat)	NRM, Council, Community Groups.
	Conservation analysis confirms the high value of the dune within the region. In spite of its reserve status, there have been incursions of various kinds into the dune.	F23.3 Continued effort in dune revegetation. Resist further development incursions into dunes	High (Cons / threat)	Council Community DEH (Land Admin. Branch, Coast Protection).
Dunes south of Yankalilla River	Coastal erosion potential. Ongoing damage to dune areas.	F23.4 Review development plan provisions: consider change from 'Country Township, to 'Coastal Zone' to recognise coastal dunes and hazard potential; consider changing area immediately landward of the dunes from 'Tourist Accommodation' to incorporate a buffer zone with a minimum distance of 50 metres between the landward edge of the ear of the dunes to the western edge of any future development. This allows for protection to the dune from development, protects development from dune drift hazard and allows for maintained public access between the dune and any future development.	Medium (threat); Low (hazard)	Council.

Foreshore SW of Little Gorge	Unsustainable shacks on the foreshore.	F23.5 Review the lease provisions of these shacks, with a view to their removal	Low (hazard)	Council.
Beach	Pressure of use on nesting Hooded Plover.	F23.6 Community monitoring. Warning fencing at nests. Notices to dog owners and pedestrians.	High (Cons / threat)	Community, Council, DEH.
	Lack of clarity with regard to public access to Lady Bay beach.	F23.7 Signs indicating access to beach at Lady Bay.	Low (Soc / Econ)	Council.

Cell F24 Bungala River to SW bank of Carrickalinga Creek



Landforms

Estuarine section of the Bungala River, with seasonally barred entrance. Fine to medium, pure quartz, Holocene sand beach and dune. Intermediate wave energy, low tide terrace beach: relatively steep beach face to flat bar at low tide, then a steep drop. Waves generally below 1m, but larger waves can generate dangerous minirips on bar. Dune barrier (c.50 – 200m wide, and up to 16 m. high).

The beach, foredune and nearshore to 1km offshore are monitored long term by profile survey adjacent to the surf club.

The coastal plain landward of the dunes is relatively flat, and the floodplain of the Bungala River is incised into the coastal plain.

Biota / Benthic Habitat

Inshore limestone reef to c. 300m, from 2km NE of Carrickalinga Head; then extensive dense seagrass to 1 km offshore, mostly *Posidonia* species and *Amphibolis*.

Foredune grasses and coastal shrubland is found at the front of the dunes; *Allocasuarina verticillata* woodland over mixed shrubs at the rear.

Land Use/ Land Ownership

The Crown lands reserve (Normanville dune) is under the care and control of the council; most of the land within the cell is privately owned.

Values (Field visits and local reports)

The presence of a functional beach – dune system is valuable to this settlement. The foreshore and reserves support a number of activities, including swimming, snorkelling, boating, fishing, walking, camping, caravanning. Facilities include surf life saving club, café, kiosk, car parking, caravan park, boat ramp, jetty.

Draft Encounter Marine Park Zoning

Habitat Protection Zone HP-1 inshore; Sanctuary Zone S-1 200m offshore.



Normanville: the Bungala River Estuary, Normanville Dune, caravan park and carpark (Coast Protection Board, May 2003)

Threats (Field visits and local reports)

Local concerns are expressed over pressure on the foredune from weeds, the dumping of garden waste and sandboarding on the foredune. The quality of some dune paths under heavy use has fallen.

Water quality concerns over the Bungala estuary: hard rubbish; weeds along bank; raised turbidity, bacterial, nutrient levels, from rural and urban uses. Farm dam construction in small coastal catchments has reduced environmental flows in creeks. Adjacent to the Surf Club there is foredune damage and sand blow; excavation of dune has occurred.

Fall in numbers of shorebirds over time (pressure of dog walking in spring nesting season). Sandboarding pressure on foredunes. Lack of knowledge of occasional visitors is a problem.

Opportunities

Community education and capacity building.

Development of a linear open space corridor along the Bungala River

Development of walkway behind dune linking north to Carrickalinga, with a small number of defined access points. Upgrading of dune access points to minimise pedestrian impact. The walkway represents an opportunity to fence adjacent to the track and manage encroachments into the conservation area.

Conservation Analysis (GIS)

Summary of conservation means makes this the eleventh most valuable cell in the region. Normanville Dunes from the surf club to the Carrickalinga Creek floodplain shows high values, except for medium values in the foredune areas. However, the small area extent of the dunes within the coastal boundary lowers the means for the cell as a whole. The lower Bungala floodplain and the coastal plain records low values.

Cultural and natural heritage values are high: there are Aboriginal sites of significance; Normanville Dunes listed on the Register of the National Estate and listed as Geological Monument 1109.

This cell includes Aboriginal sites of significance. Aboriginal remains reported in dunes immediately north of the Bungala, by Ross, C14 dated at 1660 +/-80 BP, p.20. A number of historic shipwrecks are located offshore from Normanville. Dunes remain a significant plant and animal habitat, with high values in several categories; notably habitat for butterfly larvae is significant. Threatened and common butterfly species are reported by Grund (1997, who also notes that that the area is suitable for rehabilitation as habitat for *T. albocincta*, *A. cynone gracilis*, *O. amyryllis*, *O. otares*. The state vulnerable *Thinornis rubricollis* (Hooded Plover) and the state rare *Neophema elegans* (Elegant Parrot) have been recorded in this cell.

Threat Analysis (GIS)

Total for threat summary layers is moderate for this cell. Land ownership, land use, development zoning, vegetation block shape, isolation, and degradation contribute to this total, as does distribution of significant weeds and viewscape values. The following red alert weeds were found within this cell: *Asparagus asparagoides*, *Gazania linearis*, *Lycium ferocissimum*, *Acacia Cyclops*, *Ulex europaeus*, *Rhamnus alaternus*, *Oxalis pes-caprae*, *Acacia longifolia ssp. Longifolia*, *Acacia saligna*, *Euphorbia paralias*, *Euphorbia terracina*, *Melianthus comosus*, *Olea europaea ssp. Europaea*, *Ehrharta calycina*, *Arctotis stoechadifolia*, *Argyranthemum frutescens ssp. Foeniculaceum*, *Solanum linnaeanum*

Possible Climate Change Threats

Rising sea levels will see increased storm damage to foredunes; Bruun Rule calculations of beach change suggest a recession of the order 5 – 30m over 50 years could be likely, given current IPCC sea level forecasts. Both beach and dune recede under this process and over time consideration will have to be given to dune recession. CSIRO forecasts suggest fewer storms, but a small increase in storm magnitude, increasing the level of unpredictability of seasonal beach change. Rising sea levels threaten tidal inundation of small areas of low lying land adjacent to Bungala Creek.

All climate models project drier conditions for southern South Australia, together with increased evapo-transpiration: it is clear that in some years soil field capacity may not be reached in winter and seasonal run-off in the Bungala River may be greatly reduced; however, fast run-off from intense storms in summer may give irregular flows. Over time, increasing aridity will slow natural recovery from damage to dune vegetation.

(The beach, dune and nearshore sand levels are monitored by a Coastal Protection Branch long term monitoring profile adjacent to the Normanville Jetty).

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Whole cell	Need to raise awareness of natural and heritage values of the coastal region.	F24.1 Development of a strategy to involve and raise capacity within the community to conserve natural coastal heritage.	Medium (KP; Cons)	NRM Councils
Beach	Concern over fall in numbers of shorebirds, and threats to the Hooded Plover.	F24.2 Community monitoring of Hooded Plover nests on beach and foredunes in spring and summer. Temporary fencing of nests. Interpretation of dangers to birds and request for restraint to dogs by owners.	High (Cons / threat)	Council, Community, DEH.
Dune	Conservation analysis confirms the high value of the dune within the region. In spite of its reserve status, there have been incursions of various kinds into the dune.	F24.3 Continued effort in dune revegetation. Resist further development incursions into dunes.	High (Cons / threat)	Council, Community, DEH (Land Admin. Branch, Coast Protection)
	Pressure of foot traffic resulting in multiple paths.	F24.4 Improve access control through fencing, notices and upgrading existing paths.	High (Cons / threat)	NRM, Council, Community.
	Many invasive weeds.	F24.5 Implement existing weed plan for the dunes.	Medium (threat)	NRM, Council, Community.
	Damage to foredunes by sandboarding.	F24.6 Maintain Council effort to inform public of the ban on sandboarding.	Medium (threat)	Council.
	Presence of butterfly larvae feeding plants.	F24.7 Vegetation rehabilitation to enhance butterfly larvae habitat within the dunes.	Medium (Cons)	NRM, Council, Community.
Bungala River estuary	Poor water quality, with potential effects on seagrass beds.	F24.8 Catchment management to reduce sediment and nutrient load to Bungala estuary.	Medium (threat)	Landcare, NRM, Marine Park.
	Gross pollutants in lower river course.	F24.9 Investigation, with a view to use of gross pollutant traps.	Medium (threat)	Council.
	Concern over fall in river flow, and reduced seasonal connection to the Gulf.	F24.10 Develop an estuary entrance management support system (1), to investigate other options and reasons for making opening / closing decisions.	Low (Cons)	Council.

	Degraded state of river floodplain within the town.	F24.11 Investigation of options to improve the Bungala floodplain above the caravan park.	Low (Soc/ Econ)	Council.
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(1) An Estuary Entrance Management Support System has been developed by Deakin University and a number of Victorian Catchment Boards. This system takes into account a number of uses (including recreation use), conservation and hydrological factors in assisting with the decision to open or close an entrance (refer to Appendix 15).

Cell F24 Carrickalinga Creek to Carrickalinga Head



Landforms

Beach composed of pure silica white Holocene sands.

Low tide terrace beach; intermediate to low energy, with waves usually less than 1m. Steep beach face to low tide, then flat terrace of flattened bar to c.50 metres. Low barrier dunes <2m, 50 to 100m. wide; this barrier is very narrow north of Haycock Point (see photo below). Talus slope at base of c.25° hillslope.

Estuarine section of the Carrickalinga Creek, with sand bar impeded flow in summer.

Biota / Benthic Habitat

Clear sand to c.200m then extensive dense seagrass. Cobble patch reefs throughout the area; inshore reef at Haycock Point. Dune grasses with open shrubland. Grasses on slopes.

Land Use / Land Ownership

Crown Lands Act Reserve is small dune area immediately south of Haycock Point. Flood plain of the

Lower Carrickalinga Creek Council Council Reserve, and Private land holder. Holiday home and residential development; grazing on steep slopes and crests.

Values (Field visits and local reports)

Beach swimming, boating, diving / snorkelling, beach fishing, walking, picnics. Foreshore access facilitated by car parks, steps and defined access through dunes. The presence of a functional beach – dune sedimentary system is valuable to this settlement.

Draft Encounter Marine Park Zoning

Habitat Protection Zone HP-1 inshore; Sanctuary Zone S-1 200m. offshore to Haycock Point; Dodd Beach is Sanctuary Zone S-1.



**Carrickalinga, showing narrow unfenced dune, talus slope and steep hill slopes.
(Coast Protection Board, May 2003)**

Threats (Field visits and local reports)

Weeds – domestic escapes within dunes, e.g. *Leptospermum laeviagatum* and *Gazania linearis*. Access control needs improvement. Sandboarding pressure on foredunes. Visitors and surfer pressure on tracks through dunes. Lack of knowledge of occasional visitors a problem. The stormwater drain at the northern end of the dune continues as an erosion problem and weed dispersal point. Poor parking area definition along side of road (which allows vehicle access to dune).

Fall in numbers of shorebirds over time (pressure of dog walking in spring nesting season)

Farm dam construction in small coastal catchments has reduced environmental flows in Carrickalinga Creek. The creekline vegetation corridor is potentially significant in this area.

The car parking near the Tjilbruke monument appears excessive in area.

Bechervaise (2004) notes: the last house on the northern headland appears to have privatised public open space; and the walking trail north to Secret Beach (cell F26) is poorly defined.

A population study by Hugo & Rudd showed that Carrickalinga has an unusually high proportion of non-resident property owners.

Opportunities

Wetland feasibility study for lower Carrickalinga Creek completed – wader habitat, re-introduction of native wetland / floodplain flora.

Raising awareness of conservation and management issues amongst residents and visitors.

Better definition of access points, fencing of dunes and revegetation and upgrading the public walkway north to Secret Beach. Better definition and management of off-road car parking.

Environmentally sensitive stormwater management to remove gross pollutants and reduce discharge velocity into dunes. Limitations on further subdivision and housing development adjoining the foreshore to limit additional road and stormwater infrastructure

Interpretation on the need to protect native flora and fauna of the dunes, the estuarine wetland, and the cliff faces.

Bechervaise (2004) suggests a number of opportunities, including landscaping and upgrading of carpark rest area next to toilets and at Haycock Point; walking path connection along roadside from Carrickalinga Creek north; a pedestrian path connection along rear of dune between Carrickalinga and Normanville.

Conservation Analysis (GIS)

The sum of conservation means for this cell is low to moderate. Moderate values are recorded within the lower Carrickalinga floodplain, the rest of the cell shows low values, including the dune area.

Some heritage values include the Normanville Dunes listed on the Register of the National Estate; Geological Monument 1109 Normanville Sand Dunes: Holocene siliceous sand dune system; Aboriginal camp sites recorded at Carrickalinga Head and Haycock Point (Ross, 1984, p.21). There are high mean values for plant associations rare in South Australia and for bird habitat; however, within the region biodiversity values are low, with a relatively small number of species.

Species recorded in this cell include the state vulnerable *Thinornis rubricollis* (Hooded Plover) and the state rare *Neophema elegans* (Elegant Parrot), *Actitis hypoleucos* (Common Sandpiper) and *Cereopsis novaehollandiae* (Cape Barren Goose).

Threat Analysis (GIS)

The total for threat summary layers is high for this cell. Land ownership and land use, development zoning, vegetation block degradation, viewshed and viewscape all contribute to this. The following red alert weeds were found within this cell: *Gazania linearis*, *Lycium ferocissimum*, *Leptospermum laevigatum*, *Melianthus comosus*, *Olea europaea ssp. Europaea*, *Oxalis pes-caprae*, *Arctotis stoechadifolia*, *Carpobrotus edulis*, *Ehrharta calycina*.

Possible Climate Change Threats

Acceleration of current sea level rise will see increased storm damage to foredunes; Bruun Rule calculations of beach change suggest a recession of the order 5 – 30m over 50 years could be likely, given current IPCC sea level forecasts. CSIRO forecasts suggest fewer storms, but a small increase in storm magnitude, increasing the level of unpredictability of seasonal beach change. Rising sea levels threaten tidal inundation of low lying land adjacent to Carrickalinga Creek.

All climate models project drier conditions for southern South Australia, together with increased evapo-transpiration: it is clear that in some years soil field capacity may not be reached in winter and seasonal run-off in the Carrickalinga Creek may be greatly reduced; however, fast run-off from intense storms in summer may give irregular flows. Over time increasing aridity will slow natural recovery from damage to dune vegetation.

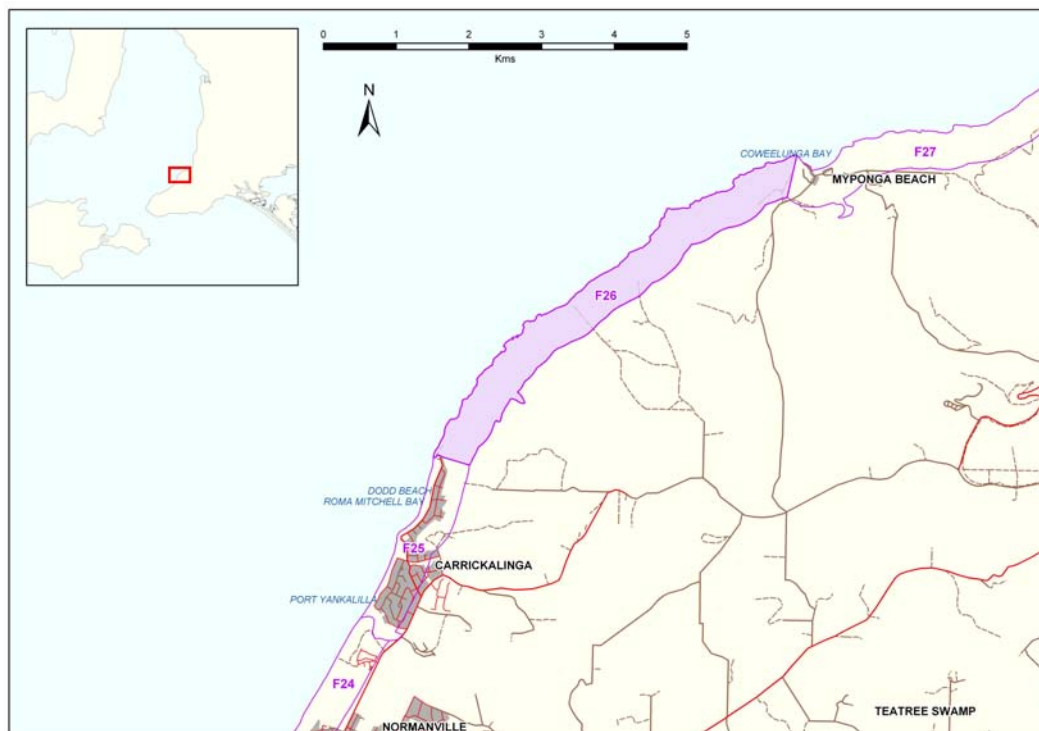
(The beach, dune and nearshore sand levels are monitored by a CPB long term monitoring profile south of Haycock Point)

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Beach	EPBC listed Hooded Plover recorded on this beach.	F25.1 Community monitoring of Hooded Plover nesting on beach and dune. Temporary fencing of nests. Notices alerting public to the presence of this species and requesting owner control of dogs.	High (Cons / threat)	Council, DEH, Community.
Dune	Pressure of foot traffic resulting in multiple paths.	F25.2 Access control to dunes, through fencing, notices and paths.	Medium (threat)	Council, Community.
	Many invasive weeds.	F25.3 Weed control and re-planting.	Medium (threat)	Council, Community.
	Damage to foredunes by sandboarding.	F25.4 Continue and maintain notices proclaiming Council ban on sandboarding.	Medium (threat)	Council.
	Impact of stormwater.	F25.5 Improvements in the stormwater system to reduce gross pollutants and erosive impact of stormwater discharge into the dunes.	Medium (threat)	Council.

Carrickalinga Creek estuary	Poor water quality.	F25.6 Catchment management to reduce sediment and nutrient load to Carrickalinga Estuary. Further implementation of wetland management plan.	Medium (threat)	NRM, Community, Council.
	Concern over fall in river flow, and reduced seasonal connection to the Gulf.	F25.7 Develop an estuary entrance management support system (1), to investigate other options and reasons for making opening / closing decisions.	Medium (Threat)	Council.
	Estuarine flats show highest conservation values for this cell.	F25.8 Give local priority to efforts to improve and conserve high conservation values of the estuarine flats. Further implementation of wetland management plans.	High(Cons /Threat)	Council, Community.
	Current IPCC climate change sea level rise projections suggest impact on lower river flats.	F25.9 Review wetland feasibility study in the light of the IPCC projections for sea level rise	Low (Hazard)	Council.

(1) An Estuary Entrance Management Support System has been developed by Deakin University and a number of Victorian Catchment Boards. This system takes into account a number of uses (including recreation use), conservation and hydrological factors in assisting with the decision to open or close and entrance (See Appendix 15).

Cell F26 Carrickalinga Head to Myponga Head



Landforms

High bedrock cliffs (>50m), discontinuous boulder beach fronted by shore platforms. Pocket beaches at mouths of small creeks. Moderate to low wave energy.

Biota/ Benthic Habitat

Inshore limestone reef to c. 300m; then dense seagrass to 1 km offshore.

Land Use/ Land Ownership

The coastal reserves and cliff tops are coastal reserves (near to Carrickalinga owned by the Coast Protection Board); inland there is privately owned grazing land.

Values. (Field visits and local reports)

Spectacular coastal scenery of cliffs and pocket beaches.

Biodiversity and butterfly larvae habitat value of remnant vegetation patches in small valleys within cliffs: remnant vegetation block 76 (Coastal boundary key map) has *Olearia ramulosa* shrubland by the cliffs and clifftops and *E. diversifolia* woodland within the valley.

Draft Encounter Marine Park Zoning

Carrickalinga Head NE for 3km is Sanctuary Zone S-1, to boundary of proposed marine park. (http://www.environment.sa.gov.au/coasts/pdfs/encounter_marine_park_zp_tech.pdf)



View to north-east from off Carrickalinga Head along cell 26; Secret Beach in foreground (Coast Protection Board, Feb. 1997)

Threats (Field visits and local reports)

The coastal reserves are unfenced against grazing pressure: fragments of remnant native vegetation, including threatened species are continuing to be degraded as a result.

Bechervaise (2004) notes:

Continued subdivision and development of land for urban purposes is eroding the natural seaside attributes and attraction of the coastal settlements. Grazing to top of headlands reduces the opportunity for native vegetation to recolonise the coastal edge. Government land ownership is in part narrow and confined to steep cliff top (for example around Secret Beach). Access for public walking along the coastline is currently not possible as the government land is not fenced.

Grazing also occurs on some cliff slopes, leading to accelerated soil erosion.

Opportunities

Definition of areas of valuable native vegetation with a view to obtaining Heritage status, or fencing by the Coast Protection Board.

Bechervaise (2004) has identified a possible route for the “establishment of a fenced area for a coastal walk to link between...Myponga Beach to Carrickalinga”. This proposed regional coastal footpath along the coastal reserve, would represent significant regional tourism potential. Barriers to this include land ownership boundaries and steep slopes; however, inland loop connecting paths may represent an opportunity.

Conservation Analysis (GIS)

The sum of conservation means is low for this area. Only remnant vegetation block shows medium values, the entire remainder of the cell is in low values.

Geological heritage, bird habitat, butterfly larvae habitat, species richness, and some vegetation associations give values, but other conservation data sets do not contribute high values.

Grund has identified significant butterfly habitat in valley-side scrub, c. 1.5km north of Carrickalinga Head.

Geological Monument 1119 Carrickalinga Head: Cambrian rocks (Carrickalinga Head Formation, Kanmantoo Group, Normanville Group, Heatherdale Shale), metasediments, slumps, unconformity, disrupted bedding.

The state rare *Falco peregrinus* (Peregrine Falcon) has been recorded in this cell.

Threats Analysis (GIS)

The sum of threat means is the eighth largest for the region. Notable threats include viewscape and viewshed, vegetation block degradation, land use, land ownership, and cliff instability. The cliff instability at this cell is various forms of accelerated soil erosion, including gully and rill development on the cliff faces and cliff tops.

The following red alert weeds were found within this cell: *Asparagus asparagoides*, *Gazania linearis*, *Lycium ferocissimum*, *Oxalis pes-caprae*, *Acacia saligna*, *Euphorbia paralias*, *Olea europaea ssp. Europaea*, *Solanum linnaeanum*

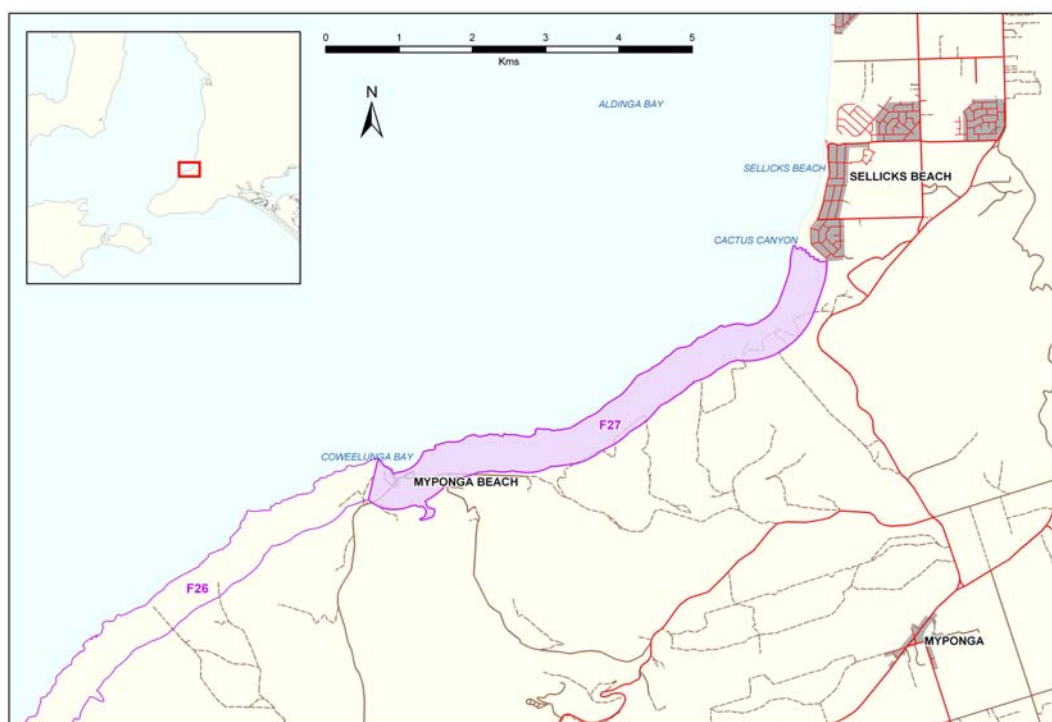
Possible Climate Change Threats

This cell is resilient to some effects of climate change, but plant and animal survival of the displacement of climate zones is a serious threat. Over time increasing aridity will slow natural recovery from damage to remnant vegetation. Seasonal run-off in small creeks will be drastically reduced by soil water budget changes; however, unpredictable intense rainstorms will locally cause fast run-off in small catchments. Changes in wave climate, likely to increase the long period swell component, would accentuate high tide changes to backshores in pocket beaches. Given the range of sea level rise projected by the IPCC (2001 report), many talus slopes at the base of sea cliffs will be trimmed back. Tide and water depth dependent habitats on reefs will be impacted by sea level rise; some intertidal sloping reefs will accommodate species migration; flat low tide reef platforms will see species change.

(Increasing plant and animal resilience to progressive climate change is important for this area, and can be assisted by improving connectivity between remnant vegetation patches).

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Cliff tops	Threats to scenic amenity values through development proposals for cliffs and coastal slopes adjacent to Carrickalinga.	F26.1 Review of Development Plan protection of cliff top land.	Medium (threat)	Council.
	Improvement of connectivity between isolated remnant vegetation blocks / creation of regional coastal biodiversity corridor.	F26.2 Development of a program of acquisition of coastal land to link isolated vegetation remnants. Take opportunities to link to inland vegetation.	High (Cons / threat)	DEH, (Naturelinks Group), NRM.
	Maintenance and enhancement of the conservation values of remnant vegetation fragments. Grazing pressure threatens remnant vegetation patches.	F26.3 Fencing of remnants on cliff-top Crown land. Consideration of other remnants for landowner Heritage Agreement.	High (Cons / threat)	DEH, NRM.
	Lack of public access to coastal reserves.	F26.4 Development of regional coastal trail.	Medium (KP)	DEH, Natural & Cultural Heritage
Foreshore	Community education.	F26.5 Erection of interpretive signs at access points to geological monuments at Carrickalinga Head.	Medium (Cons)	Geological Society of Australia – South Australian Branch.

Cell F27 Myponga to Sellicks



Landforms

High cliffs (c.50m), with a discontinuous boulder beach fronted by a shore platform. Myponga estuary and floodplain, with seasonal connection of creek with sea. Low energy north-facing Myponga white sand beach with single low barrier dune. Western end of beach (shown below) has an extensive rocky intertidal shore platform.

Estuary Assessment (Australian Land & Water Audit, 2000)

Classified as extensively modified (presence of the reservoir), and under high to very high pressure due to the STP and high vegetation clearance proportion within the catchment (98%). Transport of fine suspended sediment (0.6 kilotonnes per year) and dissolved nitrogen 13.7 tonnes per year) estimated to be double the rate under pre-European conditions.

Biota / Benthic Habitat

Dense seagrass to 1 km offshore; except for 2km NE of Myponga Head where inshore reef extends to 200m.

Land Use/ Land Ownership

The coastal reserves and cliff tops are coastal reserves; inland there is privately owned grazing and cropped land. Former holiday homes on Crown land located on the Myponga dune have been freeholded.



Myponga Beach, with former shacks on foredune. Myponga Creek estuary, with sediment plume.

Values (Field visits and local reports)

This north-facing, pocket beach is used for swimming, boating, rock and beach fishing, surfing (rarely), and snorkelling. There is an informal boat ramp to beach, public toilet, and gravel carparks at eastern and western ends of beach.

The embayment, rock platforms and headlands are of visible geological interest and contribute to the scenic amenity of the area.

The estuarine waters and flats are a rare environment in South Australia (see state estuary policy), with significant potential environmental and economic benefits for nearshore waters.

Threats (Field visits and local reports)

The coastal reserves are unfenced against grazing pressure: fragments of remnant native vegetation, including threatened species are continuing to be degraded as a result. There has been pressure to obtain access along the public lands of the cliff-top; Bechervaise (2004) notes: "Government land close to Myponga beach currently accessed by day visitors and holiday makers is under licence to a local farmer who is concerned with public safety".

Creek flows to the Myponga River estuary have been reduced by reservoir and farm dam construction. Turbidity of the estuary (and seasonally the nearshore zone) raised by accelerated soil erosion of the lower valley slopes (see photo above) and by long term sediment transport by the creek from the reservoir site. Sediment burial of some estuarine flats appears to have occurred. There is stock grazing on the flats adjacent to the estuary.

Holiday home location at the front of the foredune has led to rockwall construction, which threatens beach stability. Vehicle movement on the beach and removal of shellfish from the rocky platform are mentioned as of concern by Bechervaise.

Opportunities

Definition of areas of valuable native vegetation within the Myponga valley and along coastal cliff reserves, with a view to obtaining Heritage status, or fencing by the Coast Protection Board.

Bechervaise (2004) has identified a possible route for a regional coastal footpath to be developed along the coastal reserve, representing significant regional tourism potential. He proposes " establishment of a fenced area for a coastal walk to link between Myponga Beach and Sellicks Beach and Myponga Beach to Carrickalinga" and also an inland link: "designation of a gravel road walk / bike trail inland from Myponga Beach and Carrickalinga to Myponga to link with the Heysen Trail and a potential north to south bike trail which parallels the Heysen Trail to Victor Harbor".

Enhancement of council reserve, such as landscaping, parking areas next to the beach, paths, provision of shade and picnic facilities and a rain water tank.

The estuary and adjacent flats management plan for wetlands.

Conservation Analysis (GIS)

The remnant vegetation blocks in this cell show medium values. Although conservation values averaged over the cell are not high, some parts of the cell are significant and require high priority within the region for action: these are located on the cliff tops and adjacent land to the Myponga Estuary. The remainder of the cell shows low values. The sum of conservation means for the whole cell is ranked low to medium within the region.

The total of means includes values from vegetation assemblages: priority based on the status of the community, priority based on the rarity of the community within South Australia, priority of sites with threatened flora, priority of sites with more than 50% of records within the Southern Fleurieu. Habitat values for birds are present. Numbers of significant bird species have been recorded within this coastal cell, including state vulnerable *Thinornis rubricollis* (Hooded plover); state rare *Cereopsis novaehollandiae* (Cape Barren Goose), *Actitis hypoleucos* (Common Sandpiper) and *Neophema elegans* (Elegant Parrot).

This cell includes Aboriginal sites of significance.

Geological Monument 1327, Sellicks Cliffs: cliffs and shore platforms show Pleistocene gravels and sands, Port Willunga (limestone), uplift and block tilting and the Willunga fault. Geological Monument 1118, Myponga headlands and shore platform: Cambrian limestones; Archaeocyatha, Hyolithes, Hyolithids.

Threats Analysis (GIS)

The total of means for threat summary layers for this cell is the highest in the region. A high proportion of exotic plant species, high viewscape and viewshed scores, ownership and land use are all relatively high threat values. This total is increased by an extensive mining lease covering the slopes of the eastern half of the cell, as well as the highest readings for cliff instability in the region. (This instability appears to be initiated on the coastal reserves of the cliff tops and cliff faces, apparently by grazing pressure). Distribution of significant weeds gives moderate values for this cell; vegetation block size, shape and isolation add minor values. The Red Alert weeds found in this cell include:

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

Possible Climate Change Threats

This cell is resilient to some effects of climate change, but plant and animal survival of the displacement of climate zones is a serious threat. Over time increasing aridity will slow natural recovery from damage to remnant vegetation. Seasonal run-off in small creeks will be drastically reduced by soil water budget changes; however, unpredictable intense rainstorms will locally cause fast run-off in small catchments.

Myponga Beach and the dune will recede in the face of sea level rise. This is likely to occur in widely spaced storm events. Approximate Bruun Rule calculations would put recession at 5 to 30m for a 0.3m sea level rise over 50 years. Change of this order would require protection or relocation of the houses built on the dunes. Changes in wave climate, likely to increase the long period swell component, would increase the unpredictability of seasonal change to the beach. Given the significance of the low narrow dune as a buffer and first line of defence against storm damage, improved dune management is a priority.

Tide and water depth dependent habitats on reefs will be impacted by sea level rise. Those reef platforms sloping through the tidal range could allow some species migration.

(Increasing plant and animal resilience to progressive climate change is important for this area, and can be assisted by improving connectivity between remnant vegetation patches).

COMPONENT	ISSUE	PROPOSED ACTION	PRIORITY OF ACTION	KEY PLAYERS
Cliffs	Overgrazing leading to accelerated soil erosion.	F27.1 Stock exclusion, through fencing of coastal reserves along cliffs.	Medium (threat)	NRM.
	Threats to small vegetation fragments on cliff faces and small valleys, including rare plants and butterfly habitat, because of their isolation, and because of stock grazing.	F27.2 Stock exclusion, through fencing of coastal reserves. F27.3 Review of opportunities to link remnant vegetation patches along cliff top. Review opportunities to create vegetation corridors to link coastal remnants with inland vegetation.	High (Cons / threat)	NRM, DEH Naturelinks Group.
Estuary	Raised sediment and nitrogen levels. Weed numbers on estuarine flat. Stock grazing on estuarine flats.	F27.4 Construction and implementation of an estuary and estuary flats management plan, in order to address the complex issues involved in estuarine improvement.	High (Cons / threat)	DEH, DC Yankalilla, Local landowners.
Beach and Dune	Weed numbers in dune.	F27.5 Weed control and revegetation of dune areas.	Medium (threat)	Yankalilla & Myponga Dunecare.
	Low dune levels.	F27.6 Retention of sand through sand drift fencing.	Medium (threat)	DEH, local dunecare.
	Existing privately constructed protection for inappropriately located holiday homes threatens beach loss.	F27.7 Beach pole monitoring of beach sand levels.	Medium (threat)	DEH, local dunecare.
Reefs	Removal of shore platform lifeforms.	F27.8 Erection of warning sign explaining that harvesting from the shore platform is a prohibited action. Interpretation of inter tidal fauna.	Medium (Cons)	PIRSA, DEH.