

## Consolidated limits of acceptable change, INDIÀF OI KWDWHWP HQWDQG FRQFØMRQV



To enable an overall appreciation of the  
5HSRVDQIWDWHWP HQWDQG FRQFØMRQV  
related to the primary determinants of  
ecological character are presented in  
WIVHFVRQ O XFK RI WHIQIRUP DMRQIV  
WEXDWG IRUHDVRI UHIHUQFH

## Q Consolidated limits of acceptable FKDQJ H WDIÄF QI KVDWHWP HQVDQG FRQFÖMRQV

In Sections 4, 5 and 6 of this report various elements of the description of ecological character have been presented. These have also included numerous quotes from the oral history perspectives of the Ngarrindjeri FRP P XQJVDQG WH WUHH QJ VP HAKHUP HQDQG WHIL families who were consulted as part of the project (see Section 7).

To assist the reader with gaining a complete overview of these conclusions, Table 25 assembles the limits of acceptable change and rationale statements from these earlier sections.

Also to assist readers with appreciating the full scope of WHFRQFÖMRQRI WIVHSRUWKH WDIÄF QI KVDWHWP HQV applied throughout have been consolidated in Table 26.

The order of presentation in the tables begins (appropriately) with what in this report are called the primary determinants of ecological character, and these are then followed by consideration of the twenty-three different wetland types found in the system and then, AQDQ WH 5DP VDUGLI QIAFDQWIRQJ IEDQ&RP SRQHQW



Fish in the Coorong area have depleted in numbers

## 8.1 Challenges presented by this project

The Tender documentation for this project indicated that the outcome being sought was, 'a comprehensive description of the ecological character of the Coorong and Lakes Alexandrina and Albert Ramsar site.' In taking-on this task, the project team did not foresee several aspects of the project which have proven very challenging, and which it is felt should be conveyed through this report.

### 8.1.1 Determining the 'given point in time' for this description

As foreshadowed in Section 2.3, while the expectation of the project team at the commencement of this study was that the date of Ramsar designation, November 1985, was the logical timeframe around which to base this description of ecological character, the strongly vocalised view from a number of those that participated in the consultative workshops (in December 2005) was that this was inappropriate. Their rationale being that the site had been in ecological decline for at least 20–30 years prior to the Ramsar listing and by using 1985 as the benchmark condition, the project team would be 'setting WHEDU WR QZ Z KHQ GHAQJQJ HFRQJ IEDQF KDUDF WUDQG its associated limits of acceptable change.

While the issue of the current condition of the Ramsar VMIVDGGUHVHG EHQZ WIAFH IWW VD\ KHUH WDW the project team formed the view, based on its own investigations, and discussions with the Indigenous and other long-term stakeholders (see Section 7 and below), that there is good evidence to support the view that the 1985 condition was a degraded one, certainly much degraded from what the system was during the youth of some of those consulted. To gain a clearer understanding of this former condition, the reader is urged to consult Section 7 of this report. Some extracts from that section are provided below along with some rather eerily accurate words from the publication *7KH&RRURQJ*<sup>3</sup> *SDWS UH HQVDQG IXWUH* by Dr. John Noye in 1973.

**The Ngarrindjeri community perspectives on the overall health of the Coorong and Lakes** (see Section 7.1)

A major decline in water quality (primarily silt and salt) began from the late 1960s-early 1970s and by 1975 the system was showing signs of major ecological decline.

The water quality of the lakes is the major cause for concern. Up until the late 1960s-early 1970s, the waters of both lakes were drinkable without treatment. Ngarrindjeri people kept swimming in Lake Alexandrina up until the mid to late 1980s when blue-green algal blooms became more prevalent and prevented safe swimming. From the late-1970s, all water needed for domestic use was being 'trucked in' to Ngarrindjeri communities and homes. The lakes are now muddy and polluted from agriculture, cattle grazing and carp feeding, and full of algae which makes water in the lakes undrinkable. Swimming is no longer enjoyed because the water is foul-smelling and the muddy water contaminates the skin leaving it smelly and stained yellow.

**Some perspective of long-time fishermen and their families** (see Section 7.2)

The Coorong was always sweetened by high River Murray flows. It could stand a few years without big flows but it needed regular sweetening (Bob Hera-Singh—Coorong fisher and hunter from the 1940s to the present).

If they don't do something with this soon, it will all be gone (Neil and Nancy Ferguson—long-term residents of south-east, Coorong fishing 30 years).

The wire weed is what we need, water at right temperature and clear. The birds and fish will come, they are not stupid. Emus dig to reach water and keep alive. Ducks and swans know where wire weed is, if we get it back they will come (Frank Gibbs—Coorong fisher and hunter from the 1930s to the present).

§ QG IURP ' U% -RKQ 1 R\H IQ 7KH & RRURQJ<sup>3</sup> SDWW  
S UHVHQVDQG IXWUH  
¶ WVP \ ÁP EHHI WDVWUJ QDVRQ KDVEHHQ VBZ O  
occurring in South Lagoon, due to man-made changes  
which occurred at each end of the Coorong about  
WH .V %DUUJ HVDVU XUUD\ O RXW HQG DQG G  
Drainage scheme and land clearance at southern end  
-Ed.). Fortunately, Nature has given us a respite in the  
IRUP RI WHS UHVHQVYHUO XUUD\ ARRGVZ KIEK Z IOGIXW  
DQG ÁXK RXWRP HRI WHS RRUTXDUVZ DMLUZ KIEK  
has accumulated at the south-eastern end of these  
lagoons. We must make full use of our good fortune and  
commence a complete interdisciplinary investigation at  
once, to determine the true situation and the necessary  
action to be taken. It would be a disaster if another  
unique part of our Australian heritage were to be lost  
forever because we make no effort to convince those  
who spend our money on our behalf, that a tiny measure  
of this should be used to ensure that the Coorong  
deteriorates no further.'

It is appreciated that in contrast to the views of the  
Coorong community, from a legal perspective, those  
DSS OIQJ WH & RP P RQZ HDUW (3% & SFWP D\ KDYH QR  
alternative than to use the condition of the site as it was  
on 1 November 1985 as its benchmark, rather than an  
earlier time when the system was in better condition.

In describing the ecological character of the site  
the authors were cognisant of these two differing  
perspectives. It should be acknowledged that laws and  
community aspirations do not always align and this  
may well be a case in point. The ecological character  
benchmarks recommended in this report (and as  
summarised in Table 25) will be described by some as  
'aspirational' and by others as 'overly conservative'.  
Either way, if they are acted on, it is the view of the  
authors that the incremental decline in the 'health' of  
this system, which the evidence suggests began in the  
V KRXC S DMDX DQG VBZ O WUQ DURXCQ +RZ IDU  
along that pathway of recovery back to the condition it  
once was will be a decision taken by high level decisions  
makers, as will be the rate at which that recovery  
takes place.

### 8.1.2 Current condition of the Coorong and Lakes Ramsar Wetland

At the beginning of this study it was not expected that the project team would feel compelled to articulate its view on the current condition of the site. As indicated above, the expectation was that November 1985 was the high point of the system. It became evident as the information was drawn together, that the ecological character has altered so much, and that these changes are accelerating and rapidly approaching the point of irreversible change in some parts of the system, that it would be irresponsible of the authors not to express their concerns.

Every effort has been made to make the recommended limits of acceptable change provided throughout this study (see Figure 4 on page 9) robust and based on historical data and sound ecology. For the six primary determinants of ecological character (see Section 6), all of those where an LAC was recommended are outside their limits, and in many cases not by a small margin. Simply put, this study shows that the system is in a state of decline for some years.

The light assessments supports this point of view also. The overview of the risk, threat or vulnerability of the various system attributes examined by this study breakdown as shown by Table 24, Figure 5 on page 11 explains these categories, but in simple terms green means 'nothing to worry about' and red means the threats 'are present and significant'. The lights assigned to key functions and attributes of this system by this project, nearly half are 'red' and one-third 'amber', leaving less than a quarter of them in the 'yellow' or 'green' categories.

The dials and gauges in the cockpit of a 767 aircraft; they provide information on how well the vital functions of that highly sophisticated piece of technology are performing. For this complex wetland system they do the same thing. The pilot, as they should for the managers of this site and the State and commonwealth Governments.

These conclusions will not surprise those that know the Coorong and Lakes well and have had long associations with the system. The understanding of ecological character, and it has been in noticeable decline for at least 40–50 years and possibly for as long as 100 years (see Sim and Muller, 2005).

The Australian and South Australian Governments have under the Ramsar Convention to retain the ecological character of the site, it is clear that these incremental changes have been accelerated and exacerbated by water extractions that are too high for the system to be able to sustain itself through the recent drought conditions, as it would have under natural conditions. The drought didn't cause the change in ecological character, it simply brought it forward.

It is true that the changes to the ecological character of the site are proceeding faster in some parts than others. As indicated in Sections 6.3 and 6.5, the Coorong lagoons, once a predominantly estuarine environment with some hyper-saline portions, particularly favoured by *Sarcocornia* spp. and with it declines in much of the *Sarcocornia* spp. Ramsar listing.

Table 24: Light assessment of key functions and attributes			
Light assessment	Number of lights	% of total	% of total
Red	24	45.3	77.4
Amber	18	32.1	
Yellow	9	17.0	22.6
Green	3	5.6	
<b>Total</b>	<b>54</b>		

To summarise the situation, the Coorong ecosystem is EHF RP IQJ IQF UHDMQJ O VP S OAHG DVVKH QWRI 5XSS ID continues; this being a consequence of escalating salinities, increasingly turbid waters and inappropriate water levels. All of these are essentially determined by 5YHUO XUUD\ ARZ VIQW DQG VKURXJ K VWH V\WMP DQG KIVRUE DO E\ ARZ VIURP VWH VRXW HDWRI GRXW S XWDDO Algae and brine shrimp, more typical of a marine environment, have become dominant biota in the South Lagoon and the southern portion of the North Lagoon since spring 2005. The loss of Ruppia, the keystone aquatic plant of this part of the Ramsar site, and with IVVKH VP DOKDG\KHDG AK IVVI QDQQJ D VI QIAFDQW change in how the Coorong functions and the habitats it has to offer.

The components and processes of the estuarine Coorong ecosystem are now only supported in a 30km stretch from the Goolwa barrages to Pelican Point, which represents less than 25% of the original estuarine ecosystem area. All of this indicates that a comprehensive shift in ecological FKUDF VMIUVXQGHZ D\ : IVKRXWU QIAFDQWDQG XU HQW intervention it may prove irreversible. For this reason, the authors are recommending below that the Coorong lagoons and Murray Mouth be proposed for listing as a critically endangered ecological community under the &RP P RQZ HDQK (3%& SFW

The changes to the lakes environments are proceeding at a slower pace, but, like the Coorong, they are being negatively impacted upon by sediments and increasing salinity and turbidity. Again, in simple terms, the lack of ARZ VIV\HIQJ VWH Z KRQI V\WMP EHF RP HD VQIRUNDQV and silt. This is also a direct consequence of the reduced IQARZ VIURP VWH 5YHUO XUUD\ VDWVRQFH S URYIGHG UHJ XDU IUHVKHQJQJ ARZ VVDWVQR GVF KDU HG VDDQGG VORXWVWV sea through the Murray Mouth.

Perhaps of greatest concern is that the overall health of VWH V\WMP IVIQ GHFQQH D YLHZ IQGF DVMG E\ VWH VMDIAF lights' and reinforced by Dr Mike Geddes (among others) who has studied this wetland system since before it was 5DP VDUVMG SIVMUKIV\HG DWHWP HQVRI VWH HFRQJ IFDO health of the North and South Lagoons of the Coorong in July 2004, he wrote as follows:

Almost all of the species of plants and animals collected in 2003 and in the 1980s were collected in VIV\XYH + RZ HYHUVHS OQWDQG DQIP DVIQ VWH Coorong showed lower diversity, restricted distribution and lower abundances than had been observed in the 1980s. The biota of the Coorong is and has been under great salinity stress and populations have

decreased in numbers and retreated to small, more favourable areas, especially in the Murray Mouth. In the South Lagoon the biota was extremely limited. Only small patches of 5 VEHURV were seen, small QXP EHVRI KDUG\KHDG AK VHIQHG DQG VP DQXP EHV of chironomids collected. No micro-crustaceans were seen. This is the poorest biodiversity and abundance record for the South Lagoon. The occurrence of the EUCH VKUP S 3DUDVMQD JIHMDDQ UH\HF VVWH HJ VHP HO high salinities reached in the South Lagoon in 2003/04.

Overall, the ecological health of the Coorong in July 2004 was very poor. It is likely that the biodiversity of plants and macro-invertebrates was lower than in 2003. The poor ecological health indicated by the plants and invertebrates will mean the environment is sub-optimal IRUDU HUDQIP DV HVS HFIDQ EILGVDQG AK 7KH DTXDMV birds of the Coorong depend on its productivity for their foraging (Paton 2002). Waders, ducks and piscivorous birds would all be adversely affected by the poor ecological health of the Coorong. Populations of FRP P HUFIDCQG VP DQDVMH AK Z IQDQR EHDGYHUHO affected. (Geddes, 2005)

,Q GHFVRQ IVZ DVRE VHYHG VDWVQ VMP VRI ARZ VVW assist restoring the ecological character of the system, VWHUH Z HUH AYH S UP DU UHTXUHP HQWDVIRQZ V

6XIAF IHQVZ DVMUW NHHS VWH O XUUD\ O RXW RSHQ without dredging.

,QF UHDMHG IUHTXHQF\ RI P HGIXP VJHG RUEHVMU\RRGV V\ AXK DQG IUHVKHQ VWH V\WMP 5HGXFHG GXUDVRQDQG IUHTXHQF\ RI QR ARZ SHURGV which are extremely detrimental to the system.

6XIAF IHQVZ DVMUW RS VP DO RS HUDVM VWH AKZ D\VDQG provide habitat connectivity between fresh, estuarine and saline units.

- 5. The opportunity to have the so-named here 'Ramsar site contingency allocation' water available to allow managers scope for strategic on-site water DQFDVVRQV EHQH\WVH 5DP VDUU QIAFDQWVQRJ IFDO Components.

Keeping the Murray Mouth open at all times with barrage UHGDVHVUDVHUKDQG GUHGJ IQJ VKRXC EHV VWH AVWVU HVMV recovering the ecological character (see Section 6.6.2 and 6.6.4) of this site. To this end, a secure allocation of at least 2,000 ML/day needs to be made for the Murray O RXW DVGDWG XUQJ VXS QVARZ SHURGVV DQZ IRUKH GUHGJ HVV EHIQVUP IVWQW VRS SHG Z KIDVYHUARZ VDUH great enough to keep the mouth open. This allocation should then build up over time to the point that dredges are no longer needed. It is noted that a simplistic cost-EHQH\WDDQV VDWVH DP IQHV\QDQF IDCF RQVGHUVRQV

only, may indicate that retaining the dredges is a preferred option over securing the water necessary to NHS with RXVRS HQZ V ARZ V + RZ HYHUIL WH YDØH RI WH IXØXMM RI HFRV VMP DQG RVKHUEHQHAWKDW Z RXG FRP HIURP WH ARZ RS VRQZ HUH IDFVUHG IQ WHQ it should be the clearly preferred approach. The CSIRO DUHF XUHQW IQYHVV DVQJ WHVHP RUH GILAF XØVV TXDQV YDØHVVRXJK WHIL+ HDØ\ & RXQV ) ØJ VKS 3URJ UDP and the Coorong, Lakes and Murray Mouth Ecology Cluster program. This data should be available in 2006 to XØGHVNDH D EHVHUVS ØERVWP ØH EDVHG FRWEHQHAW analysis of dredging operations.

2 SHUVRQ RI WH AKZ D\ VDQG UHGXFVRQVIQGXUVRQ DQG IUHTXHQF\ RI QR ARZ SHURGVFDQEH HHHFVWHØ achieved with water that is currently available at the site in most years. This can be done by improving river and barrage operations and utilisation of storages, such as /DNH ØIFVUD V P IP IE KU KHUÁRZ VRUH VQØ ARZ HYHQV

7KLV VMP IRUP HG IQ UHSRQVH V YDUDE ØVRI ARZ V VHH several comments from stakeholder in Section 7). That variability has now been lost, in large part, and the once UHVRODEØ IUHTXHQV HGXP V ØU H ÁRRGVNDVXKHG and freshened the system are becoming less and less frequent through the combined impacts of upstream water diversions and climate. It will only be with the return RI VILFHHQÁRZ VV WH UYHUVØDVP HGXP VJHG ÁRRGV can be 'manufactured' by the river managers through WH VSSIQ XS RI WH P RUH IUHTXHQV DØARRGV ) RU recovering the ecological character of this site, the IUHTXHQF\ RI P HGXP VJHG ÁRRGV <sup>2</sup> Ø / G\ QHGVV EHV DØDWRQFH HYHU ÁYH \HDV DQG ÁRZ VRYHU 100,000ML/day need to occur at least once in every ten years to 'reset' the system.



Dredging machinery at the Murray Mouth

It is also clear from historical accounts (see Section 7), and indicated by recent core sampling and diatom DQØV \* HØDQG + D\ QHV VØDVQ WHS DWWKH GRXV /DJ RRQ RI WH & RRURQJ UHFHYHG VJ QIAFDQVØVØDØ ARZ VIURP WH GRXV (DWHU IRQ 7KHV HLYHG V KHS freshen that end of the system, considering that it is 140 kilometres from the Murray Mouth. According to the 1 J DUEGMLVSRNHV HQ VHH ØHFVRQ ÁRZ VIURP WH GRXV (DWHVHG V ÁRZ DØQJ D FØDUFKDØØHRI IDVWU moving water in the centre of the lagoons all the way from Salt Creek to the Murray Mouth and would provide AXKIQ ARZ VIRUVH & RRURQJ /DJ RRQV 7KHV ARZ VDUH no longer provided. The construction of the Upper South (DWH UØDQJ H ØFKHP H QRZ UH XØVHVVHV ARZ VDQG discharges only small volumes into the South Lagoon based on a ten year rolling average. Some Coorong stakeholders have expressed concerns about the impact this water may have on the ecology of the southern end of the system given that it is 'drainage' water and comes IURP DQDJ UFXVH JRQZ V VJ QIAFDQVØVØDØ VØØV issues. Any attempt to use this water to try to reduce the hyper-salinity being experienced in the South Lagoon will need to ensure the water is of a suitable quality. These issues are being investigated by the Department of : DMU/DQG DQG %ØRGYHUV & RQHYDVRQ DVS UHFVWHH Everingham et al., 2005).

The conclusions are therefore that the Coorong portions of the Ramsar site are critically endangered and that there are clear signs of concern that the lakes will follow WH VDP HSDVZ D\ Z ØRXXV QIAFDQVØVØDØ DQDJ HP HQW intervention. It is the recommendation of the authors that, in accordance with Article 3.2 of the Ramsar Convention, WHV ÅQIQ VEH FRP P XQFDVHG V WH ØHFUHVØDVRRI the Convention, and, that consideration be given to including the site onto Ramsar's Montreux Record of sites where change in ecological character is occurring, or has taken place.

### 8.1.3 Urgent need for a data 'warehouse'

In order to build a comprehensive description of the site it was necessary to consult widely, and most notably, with a number of State Government Agencies, many of which have direct management roles with aspects of the Coorong and Lakes. While high levels of cooperation were experienced, it remained a major impediment to this project from the outset (and even until its end) that much of the data relating to the ecological character of the site is housed across these agencies, it is not simple to access, not well integrated, or even well known among the day-to-day practitioners involved with this site. Our strong recommendation is that a full inventory of these data holdings, and those held by researchers and the

As far as possible with a view to building an integrated and comprehensive data 'warehouse' for the Coorong and Lakes. This will serve several purposes. It will assist those that take on followup work to this report and will help to identify strengths and weaknesses in the current data gathering approaches being used. It may also facilitate more integrated management actions among the various arms of government.

### View of this report

Related to the foregoing section, it is the view of the authors that this report would be best published in a form that can be incorporated into this description of ecological character through updated sections. Like a plan of management, this report should be considered 'adaptive' and be able to accommodate new information as it is presented. It is also true that throughout the report many 'knowledge gaps' have been identified. Investigations of these will lead to the strengthening or development of limits of acceptable change. The report needs to be able to evolve and improve as further investigations are completed.

### 8.1.5 Merging of Asset Plan and Ramsar Plan processes

Another issue that provided some challenges for the project team (but did also assist in other ways) is the parallel processes in place for planning how to manage the Coorong and Lakes Ramsar site. As one of the Living Murray Initiative, an Asset Environmental Management Plan was prepared for this site and released in June 2005 (and then adopted formally in November). This coincided with the time when the data gathering for the description of ecological character began in earnest and so this provided some help with locating information and identifying gaps. At this time how the description of ecological character will be used in the revision of the Asset Plan, commencing now. There is considerable overlap between them, understandably. The ecological character description considers the needs of additional biota such as threatened species and ecological communities (for example) in more depth than the Asset Plan, which focuses on 'the health of the Ramsar environment'.

The intention is that this description of ecological character will now be used to underpin the revision of the existing Ramsar Management Plan for the site, and this will be happening in parallel (it is understood) with the ongoing revisions of the Asset Plan for the same area. The authors of this report urge that consideration be given to merging these processes so that one plan is developed that serves the needs and expectations of both The Living Murray Initiative and the Ramsar site managers. Such a move would be welcomed by the local stakeholders as well, we believe.

## 8.2 Recommendations

The following operational and administrative actions by the South Australian and Commonwealth Governments:

Operationally:

1. Pursue, as a matter of high priority, the measures needed to be able to meet the limits of acceptable change recommended by this report, and, in particular, the following:
  - dredging without dredging
  - the removal of the barrier between the fresh and saline units
  - the removal of the barrier between the fresh and saline units
  - the opportunity to have so-called here 'Ramsar site contingency allocation' water available to allow managers scope for strategic on-site water allocation
2. Ensure that barrage operations in the critical period at ensuring no further reduction in the area of the remnant 25% of the former estuarine habitat now found only from the Goolwa barrages to Pelican Point.
3. Accelerate the examination of the feasibility and ecological merits of using water from the Upper South East Drainage Scheme to reduce the very high salinities of the South Lagoon in the short term.

Administratively:

4. In accordance with Article 3.2 of the Ramsar Convention, the Government of South Australia has communicated to the Secretariat of the Convention, and, that consideration be given to including the site on Ramsar's Montreux Record of sites where change in ecological character is occurring, or has taken place.
5. The Coorong lagoons and Murray Mouth portion of the site be nominated immediately for listing under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as a critically endangered ecological community.  
The Government of South Australia, in partnership with the Commonwealth Government, will participate in the 'hot spots' initiative to see a range of the highest priority remedial actions directed at restoring ecological character undertaken immediately.
7. The South Australian Government, with the Murray-Darling Basin Authority and the Commonwealth Government, undertake a full inventory of relevant data holdings (including those held by researchers), with a view to building an integrated and comprehensive data 'warehouse' for the Coorong and Lakes.
8. The South Australian Government, with the Murray-Darling Basin Authority and the Commonwealth Government, agree to merge the planning and implementation processes for the Asset Environmental Plan and the Coorong and Lakes Ramsar Management Plan.
9. Publish this report as loose leaf folder, signaling the intent to see it continuously improved as new information comes to light.



Murray Mouth and Mundoo Channel

<p>7DEΘI &amp; RQMRQEDVWG QP IWRI DFFHS VDEΘI FKDQJ H</p>		
<p>Element of ecological character</p>	<p>/IP IW RI SFFHS VDEΘI &amp; KDQJ H UHFRP P HQGHG</p>	<p>Page in the Report</p>
<p>3UP DÜ GHMUP IQDQWRI HFRRQJ IF DCFKDUDFWNU</p>		
<p>6DQIQW</p>	<p><b>Freshwater XQW</b></p> <p>/DNH SΘI DQGUCQD 6DQIQW P DIQMIQHG EHRZ (&amp; EDVHG RQD AYH \HDUDYHJDJ H 7KIVDQZ VIRUS HURGV RI KU KHUADQW GXUQJ QZ ARZ VDVZ RXG KDYH EHFHQH[S HUEHQFHG QDWDQD. %DVHG RQ VHG DWD IRUO IQDQJ VHS SSSHQGI + VKH \HDUDYHJDJ H (&amp; VQFH KDYH EHFHQ as follows: 1971–1980: 672 EC; 1981–1990: 769 EC, 1991–2000: 693 EC, and the 2001–2005: 1062 EC.</p> <p>/DNH SΘHUV 6DQIQW P DIQMIQHG EHRZ (&amp; EDVHG RQD AYH \HDUDYHJDJ H 7KIVDQZ VIRUS HURGV RI KU KHUADQW GXUQJ QZ ARZ VDCG IRUVH IDFVWDWDNH SΘHUV DQZ D'VP RIH VDCQ VDCQ /DNH SΘI DQGUCQD VQFH IWKDVQR ARZ VURXJ K 7KIV/S &amp; IVE DVHG RQ VHG DWD IRUVH VVV IQ /DNH SΘHUV HFRRQGHG IQ <sup>2</sup> VHS SSSHQGI +</p> <p>7UEXWU Z HMDQGA LAC should be set for each tributary based on historical and other data. For the four VEXWUHVZ KHU VFK GDW KDVEHFHQH[DP IQHG KHUH VHDERYHDQG SSSHQGI + it is apparent that each should be treated separately. For these, the following are recommended based on preliminary analysis only at this time. Monitoring salinities at point RI GDFKDU H IQW VHDNH IUFRRP P HQGHG VFRQAP VHMΘP IW</p> <ul style="list-style-type: none"> <li>• Tookayerta Creek: Salinity maintained below 500 EC at summer or drought peak, based RQD AYH \HDUDYHJDJ H</li> <li>• Finnis River: Salinity maintained below 1,200 EC at summer or drought peak, based on a AYH \HDUDYHJDJ H</li> <li>• Currency Creek: Salinity maintained below 2,400 EC at summer or drought peak, based RQD AYH \HDUDYHJDJ H</li> <li>• %HFP HUSYHU 6DQIQW P DIQMIQHG EHRZ (&amp; DWXP P HURUGURXJ KVS HDN EDVHG RQD AYH \HDUDYHJDJ H</li> </ul> <p>Groundwater salinities feeding the tributary wetlands not to exceed 1,500 mg/l (= approx. (&amp; V P DIQMIQ VHXFRP SΘP HQWRI IUFKZ DMUREQI DM AKHVDQG SΘQW (see Sections 5.6.1).</p>	<p>168</p>
	<p>(VADUQH VDCQH XQW)</p> <p>0 XUW\ P RXW DQG (VADU Salinity not to exceed 58,000 EC (sea water) with parts below 39,000 EC. These are based on Table 21, for the period 1981–2000.</p> <p>1 RUW /DJ RRQ Salinity ranging from 8,000–60,000 EC for most of the time, with the following limits: Northern end: Salinity not exceeding 50,000 EC (at Long Point) in the summer peak. Southern end: Salinity not exceeding 100,000 EC (at McGrath Flat) in the summer peak.</p> <p>6RXW /DJ RRQ Seasonal and spatial variability: Salinities around 30,000 EC in some parts in winter/spring with the following limits: Northern end: Salinity not exceeding 100,000 EC (at Villa dei Yumpa) in the summer peak. Southern end: Salinity not exceeding 130,000 EC (at Sandspit Point) in the summer peak.</p>	<p>171</p>
<p>7XUEIGIWDQG sedimentation</p>	<p><b>Freshwater XQW</b></p> <p>/DNH SΘI DQGUCQD 7XUEIGIWP DIQMIQHG EHRZ 1 78 EDVHG RQD AYH \HDUDYHJDJ H. This allows for periods RI KU KHU VUEIGIMFVXUQJ KU K ARZ V %DVHG RQ VHG DWD IRUO IQDQJ VHS SSSHQGI + VKH average annual NTU level for the 18 years from 1983–2000 has been 76.2 NTU, with a range of &lt;1 to 390 NTU.</p> <p>/DNH SΘHUV 7XUEIGIWP DIQMIQHG EHRZ 1 78 EDVHG RQD AYH \HDUDYHJDJ H. This allows for periods RI KU KHU VUEIGIMFVXUQJ KU K ARZ V This is based on the historical and more recent data SURYIGHG IQ SSSHQGI +</p> <p>7UEXWU Z HMDQGA Unlike salinities (see Section 6.1) which seem to vary between tributaries, for the three VEXWUHVDEΘI VEHFRQGHUHG KHUH VHDERYHDQG SSSHQGI + VUEIGIMFV HUHTXMM consistent, and low by comparison with the lakes. The LAC is therefore to maintain turbidity in the tributaries at less than 12 NTU based on D AYH \HDUDYHJDJ H V DQZ IRUSHURGVRI KU KHU VUEIGIMFVXUQJ KU K ARZ V</p>	<p>177</p>

<sup>a</sup> FRQMIQXHG RYHΘDI <sup>a</sup>

Element of ecological character	/IP IW RI SFFHS WEΘI & KDQJ H UHFRP P HQGHG		Page in the Report
3UP DUX GHMUP IQDQWRI HFRGJ IEDCFKDUDFWU			
<p>7XEIGIWDQG sedimentation (Continued)</p>	<p>(VWDUQH VDCQH XQJW)</p>	<p>There is relatively little long-term data available at present upon which to base LAC for turbidity, apart from that indicated above, and also what is known about the light transmission requirements for the reproduction and growth of the 5XSSIL keystone species (see above and the following section). These have been used to recommend the following limits.</p> <p>O XUD\ O RXWDQG (VWDU) Secchi disc transparency depths of no less than 2m.</p> <p>North Lagoon: Secchi disc transparency depths of no less than 90cm. To encourage <i>R. megacarpa</i> return and expansion back to former distribution (see above and Section 6.3).</p> <p>South Lagoon: Secchi disc transparency depths of no less than 90cm. To encourage 5 WEHURV return and expansion back to former distribution (see above and Section 6.3).</p>	179
<p>. HWRQH species</p>	<p>Freshwater XQJW</p>	<p>Areal extent: Given their critical role in the functioning of the freshwater units, any further loss of these keystone species would be a matter for great concern. As such, the limit of acceptable of change is 0% of areal extent, even though it is acknowledged that at present we do not know that extent. Surveys and mapping to set that baseline should be a high priority. Ideally, the management target should be to reinstate these keystone species to areas they have been lost from during the past 20 years, at least. Consultations with long-term stakeholders should assist with gaining this understanding, and for target setting within the Ramsar plan for the site, similar to that done for the keystone species in the estuarine-saline units (see below).</p> <p>Connectivity: As noted above, these keystone species are critical habitat for biota, and as such it is vital that efforts be made to reinstate connectivity between these areas so that the problem of habitat fragmentation can be addressed. The LAC is recommended as 0%, although, as with areal extent above, it acknowledged that surveys and gaining an historical perspective are high priority so that this LAC can meaningful, and used to set management targets.</p>	183
	<p>(VWDUQH VDCQH XQJW)</p>	<p>Given their critical role as keystones of the ecological character of the estuarine-saline units, the apparent loss of 5XSSID P HJDFDSL IURP VWH 1 RUK QJ RRQ DQG VWH VJ QAFDQW decline of 5 WEHURV in the South Lagoon is a matter of grave concern for this Ramsar site.</p> <p>The Asset Plan's interim targets provide a starting point for management action, and these ZIOEH YHIAHG RUP RGIAG RQFHIXWHLZ RUNVGRQH RQ VHS UHGIFVHP DSSIQJ IRUERW 5XSSIL species (see Figure 24). As noted above, observations by local stakeholders and long-time researchers suggest that the predictive map produced for <i>R. megacarpa</i> P D\ ZHOHAFVWHIRUP HUH VMCWRI VHS VHFILVQ VWH 1 RUK /DJ RRQ</p> <p>Irrespective of the estimates of the former areal extent and the targets set by the Asset Plan, the LAC for these keystone species has to be 0%. Any further loss cannot be tolerated if the ecological character of the estuarine and saline system units is to be recovered.</p> <p>As was noted for the keystone species of the freshwater units (see Section 6.3.1), these species are critical habitat for biota, and a primary food source for many of the Ramsar-VJ QAFDQVEILGVDCG AK RI VIVVM. As such, it is vital that efforts be made to reinstate connectivity between these areas so that the problem of habitat fragmentation can be addressed. The LAC for connectivity is recommended as 0%, although, as with areal extent above, it is acknowledged that surveys and gaining an historical perspective are high priority so that this LAC can meaningful, and used to set management targets.</p>	185

7DEΘI & RQVRQEDVWG QP IWRI DFFHS VDEΘI FKDJH FRQMQXHG		
Element of ecological character	/IP IW RI SFFHS VDEΘI & KDQJ H UFRP P HQGHG	Page in the Report
3UP DU GHMUP IQDQWRI HFRQJ IF DCFKDUDFWNU		
: DNWUQYHQ	<p><b>Freshwater XQIW</b></p> <p>Lake levels need to be drawn down in summer and raised in winter in order to mimic natural, seasonal variations, thereby reducing erosion and allowing for expansion of more complex ecological communities. The current proposal contained in the Asset Plan ' : /%&amp; 3 VHH DERYH IVW KDYH D UVM RI UM DQG IDQRI QR P RIH VWDQ FP SH day in the pattern described below (see Figure 26). This is being tested at present and developed as on-going work of the Lakes and Coorong Environmental Flows Working * URXS P XQMDJ HQF\ FRQYHQHG E\ ' : /%&amp; .</p> <p>Until this further work is done, no LAC is recommended.</p>	190
( VWDUQH VDDQH XQIW	<p>Coorong lagoon levels need to vary with a natural pattern of high water levels in winter and low in summer. GHDRQDOVKRUVWUP DQG VGDOS DVMQVDUH QWUL VKHUH IVQXIAF IHQW IQARZ RUFROQH VVWV W KH GRXWHHQ 2 FHDQ YID W H O XUD\ O RXW DQG VQXVDQRS HQ Murray Mouth at all times is essential.</p> <p>/S &amp; O XUD\ O RXW 2 SHQ RI VHVMP H S UHIDEO YID UYHUARZ VWDQGUHGJ HV</p> <p>In terms of LAC for water levels, variation across time and space and absolute depths at critical times, are the key parameters. The Lakes and Coorong Environmental Flows : RUNQJ * URXS P XQMDJ HQF\ FRQYHQHG E\ ' : /%&amp; KDYH GHYHRS HG WHSURS RVHG IGHDO hydrograph (Figure 27). This proposal integrates the Asset Plan targets into an ecological envelope of target water depths throughout the year and will be tested in terms of capacity to achieve the hydrograph and observed ecological outcomes from delivery.</p> <p>Until this further work is done, no LAC is recommended.</p>	194
Habitat FRQHFVWVW	<p><b>Freshwater and ( VWDUQH VDDQH XQIW</b></p> <p>/DNH S ΘI DQGUQD</p> <p>No further reduction in habitat availability. Reduced turbidity and maintenance or restoration of habitat connections are considered critical for listed species and under-represented habitats.</p> <p>/DNH S ΘHV</p> <p>No further reduction in habitat availability. Reduced turbidity is essential for plant growth and improved hydrological connectivity between the Lakes via the Narrung Narrows is essential for the integrity of this otherwise closed part of the system.</p> <p>7IEXWUX Z HMDQGVDDQG + IQGP DUX VDDQ</p> <p>No further reduction in habitat availability. Maintaining or restoring habitat connectivity is UHTXUHG W P DQVDDQ DQG HQKDFH IRQVMG UFP QDQWAK S DQVDDQ EILG SRS XDVQVDDQ allow for migration of species between habitats to escape adverse local conditions.</p> <p>Murray Mouth and Estuary, North Lagoon and South Lagoon:</p> <p>No further reduction in habitat availability.</p> <p>Appropriate management targets for restoring ecological character are:</p> <ul style="list-style-type: none"> <li>• Reinstatement of the former estuarine habitats of the Coorong, which it is estimated currently sit at 25% of the former coverage (see Sections 6.3.2 and 6.4.2). This is a matter of some urgency</li> <li>• Interim target for 5XSSE as contained as interim targets in the Asset Plan (see above).</li> </ul>	198
Water regime	<p>.QARZ VIURP the Eastern O RXQWRIW Ranges (O /5 VEXWUHV RI /DNH S ΘI DQGUQD</p> <p>No greater than 30% of winter run-off to be taken from each sub-catchment, as per the 5BYHU XUD\ &amp; DWKP HQW DVMU DQDJ HP HQVSDQ (2003).</p> <p>3DVMQVRI IQARZ VQHGG W EHSURVFWMG. In particular, disconnection or untimely drying out of critical tributary habitats should be avoided, particularly given the high diversity and DEXQGDQFH RI VJ QAFDQVMD D XMDQJ VKNH KDEMDW VHH GHFVRQ</p> <p>* URXQZ DVMUS XP SIQJ SRQFHV VFK DV]RQH VRI IQXHQFH VDDVW IVS XP SIQJ RQD VS DMDO DQG VHDVQDCE DVMDDQ IP SURYHG GHYHU RI QZ W P HGLP ARZ VDUH QHGHG W S UYHQW VQCFDVRQRI ARZ HYHQWDQG DGYHUH FKDJH VHQZ DVMUHU IP HDQZ D VMDUXDQV</p>	202

<sup>a</sup> FRQMQXHG RYHUQDI <sup>a</sup>



DEΘI & RQMRQEDVWG AP IWRI DFFHS DEΘI FKDJ H FRQMQXHG			
Element of ecological character	/IP IW RI S FFFHS DEΘI & KDQJ H UHFRP P HQGHG		Page in the Report
3UP DU GHVUP IQDQWRI HFRQJ IFDCF KDUDFWU			
Water regime (Continued)	Barrage Operating	No limits of acceptable change are indicated here as it is assumed the new %DUJ H 2 SHUDVQJ 6WDMU \ %2 6 Z KODFFRP P RGDVM DOKRVH VKDWHDM directly to the timing, duration and volumes of these releases. It is anticipated VHKQZ %2 6 Z KOEHEDVHG RQ VHKARZ S UHIFHQF HVRI IQGIE DWRUS HF IIVDQG VKH individual LAC recommended in this report. See also the LAC recommended in VHS UHFHGQJ VHFVRQ UHDMQJ VR 5YHUO XUD\ ARZ V	212
	O XUD\ O RXWRSHQJ	O XUD\ O RXWR V EHNHS VRS HQ S UHIFHQE E\ ARZ VGF KDUIQJ IURP /DNH SΘI DQG UQD VR VDWVH R VKHUEHQ HAWIURP VKNH IUFKZ DVMUQARZ VFDQEH experienced through more natural functioning of the wetland complex. To achieve this, River Murray discharges to the sea need to be increased to a minimum of 1000 GL/year delivered at a minimum rate of 2,000 ML/day. See DQR /S & UHFRP P HQGHG IQ UHDMRQ VR 5YHUO XUD\ ARZ VIQ GHFVRQ The Asset Management Plan (see above) proposes a diurnal tide ratio (cf. 9IFWU+ DIERU RI DW RRQ D DQG DWDXZ IAKHUIH %DVHG RQ FXUHQW understanding this is considered the absolute minimum required to sustain the ecological character of the Murray Mouth, Estuary and the Coorong.	215
	.QARZ VIURP VKHSSSHU GRXW (DW UDIQJ H Scheme	No LAC is recommended here as the possible use of USEDS water would be aimed primarily at improvements to the salinity, turbidity and keystone %XSSE species in the South Lagoon in particular. The LAC recommended for salinity (Section 6.1.2), turbidity (Section 6.2.2) and keystone plants (Section 6.3.2) are relevant here.  Any escalation of USEDS water discharges should be delivered in a natural seasonal pattern, peaking during late winter/spring. Inter-annual variation with DU H DQG VP DQURZ \HDVZ RXQ UHAFWRUP HUQDWDQHU IP H DOKRXJ K VKH related LAC (see above) should be the key driver for decision making.	218
: HMDQG WSHV			
Freshwater V.VWP XQW	D - 5RFM P DUQH VKRUFH; includes rocky offshore islands, sea cliffs	DUHCH VQW VKHU IVHDMHO DMH DUHD RI VIV WSH DQG Z KQI VKH IXOHFRQJ IFDORQV DUH HWV EHG HQHG DQ /S & RI IVDSS OIQ VKH precautionary approach.	42
	E - Sand, shingle or pebble shores; includes sand bars, spits and sandy islets; includes dune systems and humid dune slacks	DUHCH VQW VKHU IVHDMH DUHD UHP DIQJ DQG IVS URYGHVKDEIMVGYHUW for waterbirds in particular.	43
	M - 3HUP DQH QWYHUW WFDV V FUFHN; includes waterfalls	DUHCH VQW VKHU IVHDMHO DMH DUHD VIV V D YXQH UDEΘI WSH DQG plays important ecological roles. KDEIMVFRQHFVWV <sup>3</sup> KDEIMVZ IAK IUFK YDUDEΘI Z DVMUHU IP HVDUH critical for connections across time and space.	44
	N - 6HDVRQDO IQANP IWWQWUHU XDU UYHUW WFDV V FUFHN	DUHCH VQW VKHU IVHDMHO DMH DUHD VIV V D YXQH UDEΘI WSH DQG plays important ecological roles. KDEIMVFRQHFVWV <sup>3</sup> IP SRUQVZ HMDQG WSH IQ + IQGP DUK VMDG assemblage.	45
	O - Permanent IUFKZ DVMUQNH (over 8ha); includes large oxbow lakes	DUHCH VQW VKNH DUHDVSΘ\ IP SRUQVFRQJ IFDORQV WEXMUHVZ DVMUHU IP HF VHH GHFVRQ DQR <sup>3</sup> VHS DVMUQV DQG YRQPHV of EMLR tributaries need to be maintained to maintain these habitats.	46

<sup>a</sup> FRQMQXHG RYHUQDI<sup>a</sup>

7DEΘI & RQMRQEDWIG QP IWRI DFFHS WEΘI FKQJ H FRQMQXHG

Element of ecological character	/EP IW RI SFFHS WEΘI & KDQJ H UHFRP P HQGHG	Page in the Report	
: HMDQG WSHV			
<b>Freshwater</b> V VNP XQW (Continued)	P - GHDVRQDOIQMIP IWQW IUHKZ DVMUONHV (over KD IQFGHVARRGS OIQ lakes	DUHDCH WQW <sup>3</sup> WHUH IVUHDVHO QMHI DUHD WIVVD YXQHDEΘI WSHDQG plays important ecological roles. KDEMDVFRQHFVW <sup>3</sup> IP SRUWQVFRQJIFDURΘV QHDUF RQXHQFHV DQG WXV connection between ephemeral and permanent habitats.	47
	Ss - GHDVRQDOIQMIP IWQW VDCQH EUDFNK DNDQCH P DUKHV SRRO	DUHDCH WQW <sup>3</sup> WHUH IVUHDVHO QMHI DUHD WIVVD YXQHDEΘI WSHDQG plays important ecological roles. KDEMDVYDIDEIOW <sup>3</sup> FRQHFVRQVEHW HHC KDEMDWRI YDUIQ VDCQHV in good condition, across time and space are considered critical, particularly connections with wetland types Tp, O, W, Xf and Ss.	48
	Ts - GHDVRQDOIQMIP IWQW IUHKZ DVMUP DUKHV <b>pools</b> on inorganic soils; includes sloughs, potholes, seasonally ARRGHG P HDGRZ V sedge marshes	DUHDCH WQW <sup>3</sup> WIVSHSΘ\VIP SRUWQVFRQJIFDURΘV KDEMDVYDIDEIOW <sup>3</sup> RQFH GRP IQDQWASH QRZ UHMFVWG W FRQXHQFHV & UMF DCRUKDEMDVFRQHFVW DQG 5DP VDU6J QAFDQVFRQJIFDQR P SRQHQW	50
	Tp - <b>Permanent</b> IUHKZ DVMUP DUKHV <b>pools</b> ; ponds (below 8ha), marshes and swamps on inorganic soils; with emergent vegetation water-logged for at least most of the growing season	DUHDCH WQW <sup>3</sup> WIVSHSΘ\VIP SRUWQVFRQJIFDURΘV KDEMDVYDIDEIOW <sup>3</sup> DQVHFWRI KDEMDVYDIDEIOWFRQGHG important for maintaining species assemblages. Maintaining connectivity between Tp, O, W, Xf and Ss types is considered essential.	51
	W - 6KXE GRP IQDVG <b>wetlands</b> ; shrub swamps, shrub-dominated freshwater marshes, shrub carr, alder thicket on inorganic soils	DUHDCH WQW <sup>3</sup> WIVSΘ\VIP SRUWQVFRQJIFDURΘV KDEMDVFRQHFVW <sup>3</sup> FRQHFVRQVEHW HHC 2 : ; I DQG 6V considered essential.	54
	Xf - ) UHKZ DVMU WFIH <b>dominated wetlands</b> ; includes freshwater swamp forests, VHDVRQDO ARRGHG forests, wooded swamps on inorganic soils	DUHDCH WQW <sup>3</sup> KRΘI VAM <sup>3</sup> WHUH IVUHDVHO QMHI DUHD WIVVD YXQHDEΘI type and plays important ecological roles. DUHDCH WQW IQGP DUK , VDCG <sup>3</sup> FUMFDQRFDVRQDQG XQGHUHS UHFHQMG type. KDEMDVFRQHFVW <sup>3</sup> FUMFDQRQHFVRQV WSHV 2 : ; I DQG 6V	55
	4 - GHDVRQDO ARRGHG DJ UFXQMDQDQG (including intensively managed or grazed wet meadow or pasture)	None indicated as these are not natural wetlands. I RWH <sup>3</sup> \QGJ DMH SURSHUWRQ+ IQGP DUK , VDCG FRQDQVARRGHG DJ UFXQMDQDQG P DQDJ HG IRU&DSH %DUHQ* HFMH VHI GHFVRQ	56
	6 - <b>Water storage areas</b> ; reservoirs/barrages/dams/impoundments (generally over 8ha)	None indicated as these are not natural wetlands.	57
9 - <b>Canals and drainage channels, ditches</b>	DUHDCH WQW <sup>3</sup> WHUH DUH QRVDWDCZ HMDQGVEXVUHF RQMGHUG important habitat because type is now rare in freshwater units.	58	
( VMDUQH VDCQH XQW	A - <b>Permanent shallow marine waters</b> in most cases less than six metres deep at low tide; includes sea bays and straits F - ( VMDUQH Z DMU; permanent water of estuaries and estuarine systems of deltas	DUHDCH WQW <sup>3</sup> WIVSΘ\VIP SRUWQVFRQJIFDURΘV	66

<p>7DEΘI &amp;RQVRQGDWAG AP IWRI DFFHS WEΘI FKDJH FRQMQXHG</p>			
<p>Element of ecological character</p>	<p>/AP IW RI SFFHS WEΘI &amp;KDQJH UHF RP P HQGHG</p>		<p>Page in the Report</p>
<p>: HWDQGVVSHV</p>			
<p>(WADUQH VDOQH XQW (Continued)</p>	<p>D - 5RFN P DUQH KRUFH; includes rocky offshore islands, sea cliffs</p>	<p>DUHDCH VQW* KHUH IVUHDVWHO QMΘ DUHD RI KIVWSH IWVXQGHUWUHDWURP sedimentation and it plays important ecological roles.</p>	<p>67</p>
	<p>E - <b>Sand, shingle or pebble shores</b>; includes sand bars, spits and sandy islets; includes dune systems and humid dune slacks</p>	<p>DUHDCH VQW* KHUH IVUHDVWHO QMΘ DUHD KIVVD YXQHUDEΘI WSH DQG plays important ecological roles.</p>	<p>68</p>
	<p>G - QNVGDP XG VQG RUMDQADW</p>	<p>DUHDCH VQW* Z KIB KHUH IVU QAFDQVUHD KIVVYMDRIZ DGIQJ EILQV.</p>	<p>69</p>
	<p>+ <b>Intertidal marshes</b>; includes salt marshes, salt meadows, salttings, raised salt marshes; includes tidal brackish and freshwater marshes</p>	<p>DUHDCH VQW* KHUH IVUHDVWHO QMΘ DUHD DQG IVS O\VIP SRUWQWFRQJ IEDO roles.</p>	<p>70</p>
	<p>I - <b>Intertidal forested wetlands</b>; includes mangrove swamps, nipah swamps and tidal freshwater swamp forests</p>	<p>DUHDCH VQW* KHUH IVUHDVWHO QMΘ DUHD KIVVD YXQHUDEΘI WSH DQG S O\VIP SRUWQW ecological roles.</p>	<p>71</p>
	<p>J - &amp;RDWCEUENK <b>saline lagoons</b>; brackish to saline lagoons with at least one relatively narrow connection to the sea</p>	<p>DUHDCH VQW* Z KIB KHUH IVU QAFDQVUHD IVS O\VIP SRUWQWFRQJ IEDO roles. O XUO\ O RXW DQG (WADUQ * KH XQTXH IFRYH IHDMUFDUH FRQMGHUF critical remnant habitats.</p>	<p>72</p>
	<p>K - <b>Coastal freshwater lagoons</b>; includes freshwater delta lagoons</p>	<p>DUHDCH VQW* KHUH IVUHDVWHO QMΘ DUHD KIVVD YXQHUDEΘI WSH DQG plays important ecological roles.</p>	<p>74</p>
	<p>M - 3HUP DQHQMVHV WFDP V FHFH; includes waterfalls</p>	<p>DUHDCH VQW* KHUH IVUHDVWHO QMΘ DUHD KIVVD YXQHUDEΘI WSH DQG plays important ecological roles.</p>	<p>75</p>
	<p>R - 6HDVRQDOLQMP IWKW VDOQH EUDFNK DODQH QNHVDQG ADW</p>	<p>DUHDCH VQW* KIVWSH S O\VIP SRUWQWFRQJ IEDORQV KDEMWF RQHF WTW<sup>3</sup> FRQHF WWSH V* : 6VDQG ; I DWKJ K HBYDVRQV around the lagoon.</p>	<p>76</p>
	<p>Ss - 6HDVRQDOLQMP IWKW VDOQH EUDFNK DODQH P DUKHV SRRV</p>	<p>DUHDCH VQW* KIVWSH S O\VIP SRUWQWFRQJ IEDORQV KDEMWF RQHF WTW<sup>3</sup> FRQHF WWSH V* : 5 DQG ; I DWKJ K HBYDVRQV around the lagoon.</p>	<p>77</p>
	<p>W - 6KXE GRP IQDWG <b>wetlands</b>; shrub swamps, shrub-dominated freshwater marshes, shrub carr, alder thicket on inorganic soils</p>	<p>DUHDCH VQW* KIVWSH S O\VIP SRUWQWFRQJ IEDORQV KDEMWF RQHF WTW<sup>3</sup> FRQHF WWSH V* 5 6VDQG ; I DWKJ K HBYDVRQV around the lagoon.</p>	<p>78</p>

<sup>a</sup> FRQMQXHG RYHΘDI <sup>a</sup>

Element of ecological character	/IP IW RI SFFHSWEΘI &KDQJ H UHFRP P HQGHG		Page in the Report
: HMDQGVVSHV			
(VWDUQH VDCQH XQVW (Continued))	Xf - <b>Freshwater wetlands</b> ; includes freshwater swamp forests, seasonally wooded swamps on inorganic soils	DUHDCH[VMQV* WHUHIVUFDVWYHO QMΘ DUHD WIVIVD YXQIHDEΘI WSHDQG SΘ\ V important ecological roles. KDEMDVFRQCFVWVW <sup>3</sup> FRQCFVWVW WSHV* 5 6VDQG : DVKU K HΘYDVRQV around the lagoon.	79
	Y - <b>Freshwater springs; oases</b>	DUHDCH[VMQV* WHUHIVUFDVWYHO QMΘ DUHD UHP DIQIQJ WHMH DUH D YXQIHDEΘI WSHDQG play and important ecological role.	80
5DP VDU6U QIAFDQVIRQJ IFDQ&RP SRQHQW			
<b>Endangered DQG YXQIHDEΘI plant species</b>	While there is an acknowledged gap of comprehensive survey data at present, these species are listed as endangered and vulnerable species either nationally or within South Australia. Therefore, applying a precautionary approach, the limit of acceptable change is recommended as 0%, meaning that any losses EHRQG QDVUDCS RS XDVVRQ AXF VDVVRQVVRXG EH FRQMGHUHG XQDFHS WEΘI XQMQXFK VP H DVIXUWHUXIYHV provide indications of a contrary view.		84
<b>Swamps of VHI) ΘXUHX 3HQQXD</b>	It is not possible to establish the areal extent of this wetland type at or around the time the site was Ramsar-listed, and even today there are strong caveats placed on the estimated areal extent currently (see above). ) XUKHLZ RUNIVXU HG W FRQALP WHH[VMQVRI WIVUIMFDQ HQGDQJ HUHG HFRQJ IFDQFRP P XQVWZ IMIQ VHI Ramsar site so that appropriate planning and management can be provided. From the perspective of setting limits of acceptable change there are three primary considerations: S UFDCH[VMQV DVD FUMFDQ HQGDQJ HUHG HFRQJ IFDQFRP P XQVWVIVU/UFHRP P HQGHG DV &RQCMRQRI WHZ HMDQG WSHF QR VMDWEΘI QP IWRI FKDJH HFDQEH UHFRP P HQGHG DVS UHMQW &RQCFVWVWEHV HHQZ HMDQG UHP QDQWRUS RFNHW QR IXUWHURWRI GUDQG KDEMDVFRQCFVWQJ these should be allowed.		87
<b>ORXQVRIW Ranges GRXVHLQ (P X Z UHC</b>	It is not possible to establish the size of the population of this species or the Fleurieu Peninsula swamp habitats it relies upon (see preceding section) at or around the time the site was Ramsar-listed. Even today there are strong caveats placed on the estimated areal extent of the Fleurieu Peninsula swamp habitat currently (see preceding section). ) XUKHLZ RUNIVXUHG HGHG W FRQALP ERW VHS RS XDVVRQ VJH DQG H[VMQVRI the habitats required by this endangered species within the Ramsar site so that appropriate planning and management can be provided. From the perspective of setting limits of acceptable change there are four primary considerations: 3RS XDVVRQ VJH V H HMP DWIV <sup>2</sup> DQG QDVUDQDUDEMDVRI WIVZ IMIQ VHS RS XDVVRQ IVQRVQRZ QDW present. Until such time as a more precise population estimate is possible and natural variations are better understood, the precautionary approach suggests a 0% limit of acceptable change. In this context this is intended to mean that no actions should be permitted that may threaten this small population. S UFDCH[VMQVRI) ΘXUHX 3HQQXD VZ DP S KDEMDW VHI DERYH &RQCMRQRI VHI) ΘXUHX 3HQQXD VZ DP S KDEMDW VHI DERYH &RQCFVWVWEHV HHQZ HMDQG UHP QDQWRUS RFNHW QR IXUWHURWRI GUDQG KDEMDVFRQCFVWQJ VHHH should be allowed.		91
<b>2 UQJH bellied Parrot</b>	It is not possible to establish the size of the population of this species using the Coorong and Lakes Ramsar site at or around the time the site was Ramsar-listed. While there has been work done to estimate the extent of likely habitat (see above), the authors have not been able to gain authoritative advice on the veracity of this modeling, nor the size of the population that overwinters in the site today. Further work is needed to determine both the population size and extent of the habitats required by this endangered species within the Ramsar site so that appropriate planning and management can be provided. From the perspective of setting limits of acceptable change is appropriate: 3RS XDVVRQ VJH QR HMP DWRI VHS RS XDVVRQ XMQJ WH VM WGD\ IVDYDDEΘI. Until such time as a precise population estimate is possible and natural variations within that population are better understood, the precautionary approach suggests a 0% limit of acceptable change. In this context this is intended to mean that no actions should be permitted that may threaten this small population. S UFDCH[VMQVRI SUP DU KDEMDW QR DGYE H KDVEHHQ IRUWFRP IQJ RQ VHS UP DU KDEMDVUFDV 2 QFH this information is collected or provided, then this can be used to establish a robust limit of change. For an endangered species with a total national population estimated at 150 birds, a 0% limit of acceptable change is appropriate. &RQCMRQRI VHS UP DU KDEMDW QR VMDWEΘI QP IWRI DFFHS WEΘI FKDJH HFDQEH IQGIEDVWG XQMQXVH habitats are known. &RQCFVWVWEHV HHQZ HMDQ SUP DU KDEMDW VIVP D\ RUP D\ QRVEHD IDFVU No suitable limits of acceptable change can be indicated until these habitats are known.		95

7DEΘI & RQMRQEDVWG QP IWRI DFFHS WEΘI FKDJ H FRQMQXHG		
Element of ecological character	/IP IW RI S FFFHS WEΘI & KDQJ H UFFRP P HQGHG	Page in the Report
5DP VDU6U QIAP DQWIRQJ IFDQ&RP SRQHGW		
GRXWHIQ Bell Frog	<p>There is so little known about the distribution, abundance and habitat preferences of this species in the Ramsar-listed area, thus it is not possible to make any recommendations on Limits of Acceptable Change at this time. Once this information is available, there are four primary considerations as follows:</p> <p>3RS XQDVRQ VLP D S UHFHHS SRS XQDVRQ HMP DM IVQHFGHG DQG VRP H XQGHVWQDQJ RI VGH QDWDQO variations within that population.</p> <p>S UFDCH[ VQWRI SUP DÜ KDEMDW P DSSIQJ RI VHS UP DÜ KDEMDWUHDVIVQHFGHG V HXQXHS SRS URS UDVM management of these.</p> <p>&amp;RQGVIRQRI VHS UP DÜ KDEMDW P DQDQIQJ VHF RQGVIRQRI VHS UP DÜ KDEMDWVIVMDGRUS URMVQJ this species within the Ramsar site.</p> <p>&amp;RQHFVWVWEHW HHQS UP DÜ KDEMDW VIVP D\ RUP D\ QRVEHD IDFVU</p>	101
* DKQLE YHU HMDVRQ association	<p>It is not possible to establish the areal extent of this vegetation association (Type W) at or around the time the site was Ramsar-listed, and even today the area indicated (900ha) is considered an estimate until further detailed ground surveys are completed. From the perspective of setting Limits of Acceptable Change there are three primary considerations:</p> <p>S UFDCH[ VQW Z KID VHXODUFDCH[ VQWV\ HWV EH FRQALP HG VGH DWRFDVRQ IVS URYMRQDQ QVWG DV a vulnerable ecosystem within the agricultural district of South Australia. Given this, the precautionary approach indicates that a limit of acceptable change of 0% is appropriate until further information is obtained that may or may not alter this.</p> <p>&amp;RQGVIRQRI VGH YHU HMDVRQ DWRFDVRQ<sup>3</sup> QR VVWEΘI QP IWRI DFFHS WEΘI FKDJ H FDQEH recommended at present.</p> <p>&amp;RQHFVWVWEHW HHQS VGH YHU HMDVRQ DWRFDVRQ<sup>3</sup> VIVP D\ RUP D\ QRVEHD FRQMGHMDVRQ GHS HQGQJ RQ VGH AQGQJ VRI IXVUH UFDHFK V HWDEQK VHXOHFRQJ IFDQROV</p>	105
Breeding, ZHMDDG dependent birds	<p>At present there is no systematically collected information to indicate the size, distribution, annual or seasonal variations and success of these breeding populations within the Ramsar site, thus making it impossible to set meaningful limits of acceptable change across this range of species. Once more systematic surveys are conducted to map and assess the full extent of breeding areas it should be possible to set limits of acceptable change. Depending on the species this may set LAC of between 0 and 10%. For species such DV SXMDQDQ%VWMLQ DQG +RRGHG 3RYHUVDWUH VGHDMQHG VHFHIV HMKHUQDVRQDQ RUDVMDV QYHOMV expected the LAC would be 0%. An important element of these surveys will be to determine if species breed VHFHIV\ HDUWR RUKUH\ HDUVRXVRI AYH RURQO YHU RFFDVRQDQ. This will allow LAC to be developed that can indicate when managers need to be concerned should a certain species discontinue breeding activities at the site.</p> <p>Surveys will also identify the primary breeding habitats and allow LAC to be developed that consider, for example the areal extent and condition of inland shrublands, reedbeds, rushes, tussocks and grasslands etc. At present, LAC have been set for each wetland type found within the Ramsar site (in Section 4) and these will provide an interim indication for managers until more detailed breeding habitat data is collected.</p> <p>7KH GDV IURP 3DVRQ E VJ J HVVWDWRUHYHUCQK HDVQJ VHFHIV EUHGIQJ HIIRUVQ VGH GRXW Lagoon has declined considerably in recent years, apparently coincident with declines in the population RI KDUG\KHDG AK 7KIVQFQGHVS XMDQDQ 3HFDQ ) DIX 7HQ DQG +RDX KHDGHG * UFEH. Oral history DFFRXQWURP VGH 1J DULQGMLFRP P XQV DQG VUHHRI VGH RQJ VMLP AKIQJ IDP KHVDR UDVM FRQFHQV DERXVS HFDQV %DFNGZ DQV R\ VMFDVWKHVDQG GYHU* XQ On face value these may seem not to allow for the setting of robust limits of acceptable change. +RZ HYHUWH UHGXFVRQ DQG SRVMEΘI FHMVIRQRI pelican breeding in the South lagoon is notable in this context, as are Paton's (2005b) observations for ) DIX 7HQ DQG +RDX KHDGHG * UFEH IQGFDVH DVVH VHF V EHRI VGH RWRRI KDUG\KHDG AK IURP VIV part of the Coorong. Equally, the observed reduction in swan numbers and breeding success, linked to the documented decline in 'swan weed' (<i>SASSID WEHURLE</i>) (see Sections 5.4 and 6) is also strongly indicative of a major change in the ecological character of the South Lagoon.</p> <p>) RUKVH VHFHIV VGH QP IWRI DFFHS WEΘI FKDJ H QHGH V UHAFVD FRQMXDVRQRI VGHILEUHGQJ HIIRUV and success at or near that witnessed around the time the site was Ramsar-listed in 1985. It has not been possible for this project to source any such data and so it is recommended that this be part of the followup actions. At the very least it should be recognised that the decline or cessation of breeding activities by these species in the South Lagoon indicates the need for urgent remedial action to recover the former ecological character.</p>	108

<sup>a</sup> FRQMQXHG RYHUQIDI <sup>a</sup>

Element of ecological character	/IP IW RI SFFHS VDEΘI &KDQJ H UHFRP P HQGHG	Page in the Report
5DP VDU6U QIÄFDQWIRQJ IFDO&RP SRQHGW		
<p><b>Wading birds, ICF ÖG IQJ P UJ UDVU species</b></p>	<p>For this assemblage of wading species within the wetland-dependent bird community of the Coorong and Lakes Ramsar site, there are a number of limits of acceptable change that need to be considered:</p> <p>3RSXDVRQ VJHF VLYH GDW V GDW FQEH XHG RQ V IQGFDVM VHQGVDCG IWRQVSRWEΘI V XH it to set robust limits of acceptable change. The data is also, in most cases, highly variable and this wide natural variation also hinders the setting of LAC. It is recommended that future surveys focus on VHI IRQZ IQJ Z DGHUS HFIEV GKDS VQDG EDQGS IS HU5HG QHFNHG GQW&amp;XQZ GDQGS IS HU%DQGHG GQW Greenshank, Red-necked Avocet and Red-capped Plover, to establish meaningful LAC. In the interim, the LAC should be to see these populations retained at or better than their 2000 levels as recorded in Paton (2005b). For these species, those population estimates for the Coorong were as shown below (see page 135). It is recognised that these are somewhat arbitrary but they are provided in the interest of providing an interim LAC until more systematic surveys can provide stronger data on which to base them.</p> <p>' IWEVXRQDQG EUFHGIQJ VFFHWRI FHUQI VSHFIEV VHG FHVQRQ +DEMDVRRG DYDDEIDV DQG FRQGMQRQ<sup>3</sup> 7KHU DUHD QXP EHURI ΘYHU FRP SRQHGWDCG SURFHWHVMDW impact on the availability and condition of habitat and food items for these species. These are considered in Section 6.</p>	120
<p><b>Cape Barren Goose</b></p>	<p>The species breeds away from the Coorong, on Kangaroo Island and other offshore islands further to the west. It is not possible to establish the size of the population of this species at or around the time the site was Ramsar-listed in 1985. In recent years, the population size of the Ramsar site and immediately adjacent areas has been estimated at approximately 4,000 (Tim Wilson, pers comm.). Further work is required to determine both the population size and extent of the habitats required by this rare species within the Ramsar site so that appropriate planning and management can be provided. From the perspective of setting limits of acceptable change, there are four primary considerations:</p> <p>3RSXDVRQ VJHF VHHMP DMIVDSSUR IP DVMO KRZ HYHUQDWDQYDUDEIDVRI VIVAJ XHIVQRWQRZ Q at present. Until such time as a more precise population estimate is possible and natural variations are better understood, the precautionary approach suggests a 5% limit of acceptable change, noting the generalist foraging behaviour of the species.</p> <ol style="list-style-type: none"> <li>2. Areal extent of primary habitats used by the species. Not known at present.</li> <li>3. Condition of the primary habitats used by the species. Not known at present, although see wetland type 4 in Section 4.1.4 (page 24).</li> <li>4. Connectivity between primary habitats used by the species assuming this is an important factor in sustaining the population. Not known at present.</li> </ol>	134
<p><b>Obligate IUFKZ DMUÄK species</b></p>	<p>It is not possible to establish the population sizes for these species either around the time the site was Ramsar-listed or today. Further survey work is needed to provide robust estimates of population sizes and the extent of the habitats each rely upon. From the perspective of setting limits of acceptable there are four primary considerations:</p> <p>3RSXDVRQ VJHF VHHV FQQRWEHGHMUP IQHG DVS UHHCQWQWRXJ K RI FRQFHQ DUH VHX J HMRQV E\ : HGGHEXIQDQG +DP P HU VQDQD QXP EHURI VHX V DQUS HFIEVHVMHUKDYHSDWV\ RUTXIM restricted distribution, making them potentially vulnerable. Until such time as a more precise population estimate is possible and natural variations are better understood, the precautionary approach suggests a 0% limit of acceptable change for those species with restricted or patchy distribution, and 5% for those are more widespread and less specialised in niche requirements.</p> <p>SUFDCH WQVRI SUP DÜ KDEMDV<sup>3</sup> VHG FHVQRQ Z KHU VHNH DUH IGHQWVHG E\ Z HMDQG VSHDQG /S &amp; indicated.</p> <p>: DMUTXDQV<sup>3</sup> VHG FHVQRQ DQG Z KHU /S &amp; DUH IGGFDVWG IQUHDVQRQ V VDCQWDCG VUEIGW respectively.</p> <p>&amp;RQHFVWVWEHWHHQSUP DÜ KDEMDV<sup>3</sup> DVQRVNG DERYH IRURP HRI VHNH VSHFIEV VHHH IVFRQFHQ that habitat patches are becoming isolated and some types are becoming less common due to the VPSQAFDVRQRI VHNH NHQYLRQF HQWFDXVHG IQDUHSDIWE\ VHFDFNRI ARZ DQG Z DMUDYHODUDVQRV This means that areas showing greater habitat diversity, such as the upper reaches of the Finniss River, the entrance to Waltowa Swamp, and drains entering Lake Alexandrina, are becoming more and more important for some species. In Section 4.1.4 (and see also Sections 6.3-6.5) this is noted under the relevant wetland types and LAC have been indicated.</p>	135

7DEΘI & RQMRQEDVWG QP IWRI DFFHS VDEΘI FKDJH FRQMQXHG		
Element of ecological character	/IP IW RI S FFFHS VDEΘI & KDQJ H UHFRP P HQGHG	Page in the Report
5DP VDUBU QIAF DQWIRQJ IFDQ&RP SRQHQW		
' IDGURP RXV AK VS HF IIA	<p>It is not possible to establish the population sizes for these species either around the time the site was Ramsar-listed or today. Further survey work is needed to provide robust estimates of population sizes and the extent of the habitats each rely upon. From the perspective of setting limits of acceptable change there are four primary considerations:</p> <p>3RS XDVRQ VJHP VHMFDQQRVEHGHMUP IQHG DVS UHFHQWOKRJK DVQRWNG DERYH VJ RI VHMVHYHQ species are being considered for inclusion on the South Australian list of species of conservation concern. Given this, the precautionary approach suggests a 0% limit of acceptable change for these species, P HDQJQJ VHA Z DUUDQWFRQNGHUVIRQIQ VHS HUDVIRQVRI VHEUUDJ HVDQG AKZ D\VVH HQXHS DWDJ H either upstream or down, when it is required.</p> <p>S UFDCH[ VQVRI SUP DU KDEMDWV WR QMHI VNRZ QRI VHKDEMDVQIHGVRI VHMV SFILV DVS UHFHQWR allow a LAC to be recommended.</p> <p>: DMUTXDQV<sup>8</sup> VHH GHFVRQV DQG Z KHUH /S &amp; DUHQGIE DVMG IQ UHDMRQVR VDOQW DQG VMEIGIV respectively.</p> <p>&amp;RQHFVWVEHWZHHQSUP DU KDEMDWV DVQRWNG DERYH VHSUP DU FRQNGHUVIRQIRUKHMV SFILVIVR be able to move through the barrages at certain times. 7KH AKZ D\ DQG EDUUDJ HRS HUDVQJ WDWVJ \ P DNH some allowance for these needs at present.</p>	149
(XUKDQJH RUHVWDUQJH species	<p>It is not possible to establish the population sizes for these species either around the time the site was Ramsar-listed or today. Further survey work is needed to provide robust estimates of population sizes and the extent of the habitats each rely upon. From the perspective of setting limits of acceptable change there are three primary considerations:</p> <p>3RS XDVRQ VJHP VHMFDQQRVEHGHMUP IQHG DVS UHFHQWOKRJK DVQRWNG DERYH VHYHUCRI VHMH species appear to have undergone considerable declines over the past 30–40 years and some, such DVVKH GP DQOP RXWVHG + DQ\KHDG P RUFUHFHQW * IYHQ VIV VHS UHFDMRQDU DSSURDFK VJ J HWD 0% limit of acceptable change for these species, meaning they warrant priority consideration in the management of this site and actions are needed to address apparent population reductions. The decline RI GP DQOP RXWVHG + DQ\KHDG IVRI SFIDQQRWJ IYHQ VVNH URΘ DVD IRRG IMP IRUZ DMVIEIGV 7KIVGHFQJ associated with the loss of the keystone 5XSSIL aquatic plant species is considered further in Sections 5.4 and 6.3.</p> <p>S UFDCH[ VQVRI SUP DU KDEMDWV WR QMHI VNRZ QRI VHKDEMDVQIHGVRI VHMV SFILV DVS UHFHQWR DQZ D /S &amp; VEHUFRP P HQGHG +RZ HYHUDVQRWNG DERYH VHGHFQJRI NHVRQH 5XSSIL aquatic plant species is likely to be a primary factor in the declines of these species, and so warrants immediate management intervention. LAC in relation to 5XSSIL have been provided in Section 6.3.</p> <p>: DMUTXDQV<sup>8</sup> VHH GHFVRQV DQG Z KHUH /S &amp; DUHQGIE DVMG IQ UHDMRQVR VDOQW DQG VMEIGIV respectively.</p>	155
Marine stragglers	<p>No limits of change are recommended due to knowledge gaps. As noted, the increased presence of these species in the system probably indicates a change in ecological character within the Coorong. SVVHV VVMP EHF RP HVP RUFVDOQJH Z IWK O XUD\ O RXW UFMVFRQVDQG UHGXFHG IUFKZ DMUIQ ARZ VRYHUWKH barrages, it may become more conducive to marine species visitation. There is anecdotal evidence that this is the case (see Section 7.2).</p>	163

7DEΘI & RQNRQEDVAG WDIAF ΘI KVDWHWP HQW

Element of ecological character		7DIAF light	5DVRQDDI J IYHQIRUWDIAF ΘI KVDWHWP HQW	Page in the Report
3UP DU GHMUP IQDQWR I HFRQJ I FDCF KDUDFWMU				
6DQIUV	Freshwater units	●	%RAK ONHVDUH DVU FVHQWRXVQHO DQG J UHDMW HJ FHHGIQJ recommended salinity levels and this is contributing to the loss of keystone species and other freshwater species as well as threatening ecosystem services (irrigation, stock and human drinking water supplies etc.) Increasing salinity levels in the tributaries threaten under-represented habitats and biota and must be arrested as soon as possible to ensure the full complement of ecosystem components and processes remains.	168
	Estuarine-saline units	●	More favourable salinities and more extensive areas of estuarine habitat need to be reinstated. Current conditions are leading to losses of species (including keystones), habitats and ecosystem processes and if salinities are not reduced urgently, the ecological character of the Coorong will change, possibly irreversibly. The Murray Mouth and Estuary and the northern end of the North Lagoon have become core refuge areas for the estuarine species, habitats and ecosystem processes.	171
7XIEIGIWDQG sedimentation	Freshwater units	●	Knowledge of turbidity and sedimentation processes is poor even though this appears to be a major factor in loss of keystone species and changes in species assemblages, nutrient cycling and food web dynamics. Priority management attention required.	177
	Estuarine-saline units	●	Knowledge of turbidity and sedimentation processes is poor even though this appears to be a major factor in loss of keystone species and changes in species assemblages, nutrient cycling and food web dynamics. Urgent management attention required.	179
. H WRQH species	Freshwater units	●	There is an urgent need to secure the core keystone species populations (whether they be in natural or human-made wetland types) and extend their range to ensure on-going provision of the environments needed to support freshwater ecosystem components and processes. The loss of, or severe decline in, keystone species population is considered a fundamental change in ecological character.	183
	Estuarine-saline units	●	There is an urgent need to secure the core keystone species populations around the Murray Mouth Estuary and the northern end of North Lagoon and extend their range to ensure on-going estuarine ecosystem functionality. The loss of, or severe decline in, keystone species populations is considered a fundamental change in ecological character. It is estimated that in these units keystone species coverage is less than 25% of original.	185
: DWUDBYHK	Freshwater units	●	Lake levels are a key determinant of all ecosystem components and processes. The current regime is counter-seasonal to the natural one and too static to support the full complement of the lakes' biota. Species reliant on variable water levels are under-represented and at risk of local extinction.	190
	Estuarine-saline units	●	The recent closure/restrictions of the Murray Mouth created adverse water levels in the Coorong which showed the vulnerability of the whole ecosystem to water levels. There is an urgent need to re-establish the ecosystem components and processes that were damaged by high water levels in the early 2000s.	194
Habitat FRQQHFVWIV	Freshwater and Estuarine-saline units	●	Restoration of habitat availability is required as a priority action. In particular, the full suite and extent of habitat types, needs to be restored and connections between habitats (particularly through the barrages and the lakes islands) need to be improved as soon as possible. Re-establishment of estuarine conditions in the Coorong lagoons is critical for restoration of ecological character.	198

7DEΘI & RQMRQEDVWG WDIAF QI KVDWHWP HQW FRQMQXHG				
Element of ecological character	7DIAF light	5DVRQDQI J IYHQ IRUMDIAF QI KVDWHWP HQW	Page in the Report	
3UP DÜ GHMUP IQDQWRI HF RQJ IF DCFKDUDFWU				
Water regime	.QARZ VIURP WK Eastern Mount Lofly Ranges (EMLR) tributaries of Lake Alexandrina	●	Assuming the cap on water resource development is implemented Z MLIQ AYH \HDUV ARZ VAKRXG UHP DIQ DWD QYHODSS URS UDVM VR VSS RUW WE XWUHV EIRW DQG EHQHAWDNH S QI DQGUQD E \ VSS QIP HQMQI 5YHUO XUUD IQARZ V ZKH QDP EHU QYHQB/UHFRP P HQGHG J IYHQ WK uncertainty about groundwater pumping limits, the observed recent increases in salinity to above keystone species thresholds, and the critical importance of these wetlands to future restoration of ecological character at a Ramsar site scale.	202
	.QARZ VIURP WK 5YHU Murray	●	The change in the ecological character of this Ramsar site is largely D FRQHTXHQFH RI UHGXFHG ARZ VIURP WK 5YHU XUUD. Delivery of the 500 GL First Step decision of the Living Murray Initiative is urgently QHGHG VR KHS VBZ WKH FKDQJ HV EXVDGGMRQDQZ VZ KDEH DÜ needed to keep the Murray Mouth open without dredges, to prevent H MQGHG SHURGVRI QR RUBZ ARZ VR DQZ IRUP RUH IUTXHQW P HGXP VJHG ÁRRG DQG IRUMDUW IF RQ VM Z DVUUP DQS XDVRQV	205
	%DUUDJ H 2 SHUDMQI Strategy	●	ZKHU IVFRQMGHDEGH VFRSH IRUMKH QHZ %DUUDJ H 2 SHUDMQI QMDWU \ to address ecological needs in a more extensive way than the current RQHGRHVZ IVKRXWU QAFDQW DIIHFQI WK FDSDFWVR VSS Q IUI DWUW with water during the irrigation season. Changes to barrage operation are urgently needed to prevent further losses of ecosystem components and processes.	212
	Murray Mouth Opening	●	In terms of maintaining the ecological character of this Ramsar site, the current situation with the mouth of the Murray being kept open with dredging is not considered optimal and is likely to lead to on-going degradation of the Ramsar site, albeit slower than if the mouth were closed. : KDI GUHG IQI P D\ EH HWHQMDQG XUQI FXUHQBZ UYHUARZ V it only mimics some of the ecological functions needed. Maintaining WK P RXW RS HQ Z IV QDWUDQZ VEUIJ VZ IV IWK IXQXDM RI ecological components and processes need to restore the ecological character of the site.	215
	.QARZ VIURP WK 8SSHU South East Drainage USED S Scheme	●	86 ' 6 IQARZ VKDYH WK FDSDFWVR P IV DVM VQDQW DQG VUEIGW QYHV IQ WK GRXW /DJ RRQH S HF IDQ DQG DQR EHQHAWKH NH VRQH 5XSIZ species, but care needs to be taken to ensure the quality of this water is DSS URS UDVM DQG VDWVWGHXHU P IP IFVP RUH QDWUDQZ UH IP HV	218
: HMDQG WSHV				
Freshwater V.VMP XQW	D - 5RFM P DUQH shores; includes rocky offshore islands, sea cliffs	●	The ecological roles of this wetland type are poorly understood, it has limited areal extent and the rocky shores are threatened by cattle grazing, therefore a precautionary approach of rating this type as under threat has been applied. If it is found that this habitat is critical KDEMDVURU5DP VDURURVHUMI QAFDQWEIRW IVKRXG EHFKDQI HG VR 'amber' unless habitat condition and threat assessment at the time shows otherwise.	42
	E - Sand, shingle or pebble shores; includes sand bars, spits and sandy islets; includes dune systems and humid dune slacks	●	Only 1 ha of this wetland type remains and thus this type is extremely vulnerable to loss from the Ramsar site. It is an important part of habitat variability and connectivity. Given its location on the lake shore near a major township, it is considered to be under immediate and extreme threat from a range of direct and indirect anthropogenic factors.	43

<sup>a</sup> FRQMQXHG RYHUQDI <sup>a</sup>

7DEΘI & RQMRQEDVWG WDIÁF QI KVDWHWP HQW FRQMQXHG

Element of ecological character	7DIÁF light	5DVRQDDI J IYHQIRUMDIÁF QI KVDWHWP HQW	Page in the Report	
: HMDQG WSHV				
<b>Freshwater</b> V VMP XQW (continued)	<b>M - Permanent</b> UYHV WFDP V FUFHN; includes waterfalls		This wetland type is considered to be under extreme threat and highly vulnerable. This rating is based on the combined factors of the high ecological value of this wetland type and immediate risks of damage from anthropogenic factors such as land and water resource development. The variable water regimes and habitats available in these wetland types support under-represented species assemblages DQG 5DP VDUU QAFDQWIRBU IEDQ&RP SRQHQW 56%V &RP EIQHG Z IW other island habitats and the Murray Mouth Estuary these wetlands are the 'jewel in the crown' of the modern Ramsar site.	44
	<b>N - 6HDVRQDO</b> IQANP IYHQWLIHU XDU UYHV WFDP V FUFHN		Similar to Type M above, Type N wetlands are also considered to be under immediate threat and extremely vulnerable to land and water resource development. These channels are critical connectors of various habitats and vital for maintaining the ecological functionality of the island habitats.	45
	<b>O - Permanent</b> IUFMKZ DVUONH (over 8 ha); includes large oxbow lakes		Type O wetlands are abundant in the Ramsar site but those with clear, cool water, as in the tributaries unit, are rare and under extreme threat from water resource development and increasing lake turbidity levels. Fringing lake habitats support species assemblages that once extended much further into the lake and thus are important and extremely vulnerable remnants. The turbidity of the main lake bodies needs to be below 90 NTU and the abundance and health of variable water regime dependent biota higher for the rating to be 'green'.	46
	<b>P - 6HDVRQDO</b> <b>intermittent freshwater</b> ONH (over 8 ha); IQFQGHVARRGS DIQ lakes		The wetlands are important remnants of the pre-European lower River O XUD\ V VMP VDWXS SRU56%VDQG RWKHUS HFIEHVRI QRW 7KH DUH considered to be under extreme threat and highly vulnerable because of relatively small area, location near areas of intensive human activities and capacity to support under-represented ecosystem components and processes.	47
	<b>Ss - 6HDVRQDO</b> IQANP IYHQWLIHU EUDFNK DODQH P DUKHV SRRQ		Important wetland type in the freshwater units assemblages that connect various other wetland types. They are under threat from grazing and altered water regime. These habitats are also considered extremely vulnerable because they occur at the top of the seasonal variations in groundwater levels and thus are vulnerable to reduced hydraulic pressure and also because of trampling of brittle vegetation and pugging of anoxic soils by cattle.	48
	<b>Ts - 6HDVRQDO</b> <b>intermittent freshwater</b> P DUKHV SRRQ on inorganic soils; includes sloughs, potholes, seasonally ARRGHG P HDGRZ V sedge marshes		Once the dominant type, these wetlands are considered to be under extreme threat because they are high elevation wetlands dependent RQYDUDEΘI ARZ VDQG ARRGV 7KH DUH DOR FRQMGHUG YXQHUDEΘI because they connect important habitats and support ecological processes and components that are dependent on variable water UHU IP HDQG ARRGQJ	50
	<b>Tp - Permanent</b> IUFMKZ DWUP DUKHV <b>pools:</b> ponds (below 8 ha), marshes and swamps on inorganic soils; with emergent vegetation water-logged for at least most of the growing season		8U HQMQHUG W UYHUXH VKH VP S QAFDVRQRI VKH HP HU HQWYHU HMDVRQ communities around the lake shore that has resulted from static regulated lake levels to ensure on-going provision of habitat for 56%VDQG RWKHUS HFIEHV ' IYHUXH HP HU HQMDQG VEP HU HG Z HMDQG vegetation are considered keystone assemblages for the freshwater units. Given the above, plus poor current condition and diversity, and high exposure to human activities, these wetland types are considered to be under threat and extremely vulnerable.	51

7DEΘI & RQVRQEDVWG WDIAF QI KVDWHWP HQW FRQMQXHG				
Element of ecological character	7DI AF light	5DVRQDDI J DYHQ IRU WDIAF QI KVDWHWP HQW	Page in the Report	
: HMDQG WSHV				
Freshwater V VMP XQI W (continued)	W - 6KUXE GRP IQD WNG wetlands; shrub swamps, shrub-dominated freshwater marshes, shrub carr, alder thicket on inorganic soils		Samphire communities cover relatively large areas of both the fresh and estuarine-saline units. They are however under threat from activities such as cattle grazing and alterations to groundwater and surface water dynamics. Although abundant, these wetlands are not given a 'green' rating primarily because of threats from land and water resource development to habitat connectivity between wetlands of this type and types Tp, O, Xf and Ss.	54
	Xf - ) UHVKZ D WU WFI dominated wetlands; includes freshwater swamp forests, VHDVRQDD ARRGHG forests, wooded swamps on inorganic soils		These trees are under extreme threat of local extinction due to their poor current condition at most freshwater remnant sites supported E\ 5IYHUO XUDD\ ARZ \. Once a dominant wetland type, the trees, and the species dependent on them (e.g. birds of prey), are considered extremely vulnerable, based on the lack of regular recruitment and their very small areal coverage. Local replanting efforts require additional resources to be truly effective at arresting the decline.	55
	4 - 6HDVRQDD ARRGHG DJ UFXWUDQDQG (including intensively managed or grazed wet meadow or pasture)		A 'green' rating has been given to this wetland type because it is not under threat but rather promoted by human activities, particularly by the active management of 'Wyndgate' to provide wetland habitats of VDVASHIRU&DSH %DUHQ* HHH VHI GHFVRQ	56
	6 - Water storage areas; reservoirs/barrages/dams/impoundments (generally over 8ha)		Dams of this nature are common in the landscape surrounding the Ramsar site, and as are Type 4 wetlands (see above), they are promoted by human activities rather than threatened.	57
	9 - Canals and drainage channels, ditches		Although constructed, these channels are valued for providing fresh, ARZ IQI FΘIDUFRRCKDEIMWVKD VDUH QRZ XCGHUHS UHHCQMG DWKIV Ramsar site. 7KH\ VMVXS RVV58&V S DUFXDU VP DQD WFI AKHV (see Section 5.6.1). 7KH\ DUH VUHDWQHG E\ GHGJ IQI IQAQI DQG WFI VXXWQI GRZ QRI SXP SVGXUQI FUMFDORZ SHURGV	58
( WDUQH VDUH XQI W	A - Permanent shallow marine waters in most cases less than six metres deep at low tide; includes sea bays and straits F - ( WDUQH Z D WLV permanent water of estuaries and estuarine systems of deltas		Estuarine waters once dominated the whole Coorong, Murray Mouth and Estuary area and are now restricted to just those times and places Z KHU IUFNKZ D WUQARZ VDUH J UHDWQRXJ K V UHGXFH VDUH V W QAFDQW EHRZ VKDRI VHD Z D WU Consequently, this wetland type now acts as refuge for estuarine species and is considered extremely vulnerable. It is also considered to be under extreme threat from RQJRIQI QZ ARZ VIURP WFI 5IYHUO XUDD\ FDXWQI IQFHDMQI VDUW and turbidity and effective loss of estuarine conditions.	66
	D - 5RFN\ P DUQH shores; includes rocky offshore islands, sea cliffs		This wetland type is ecologically important. The rocky, intertidal pools and shores are under threat from smothering due to the high rates of sedimentation occurring in the Coorong. Vulnerability is considered high because of the relatively thin tidal band occupied by this type and the relatively low areal extent.	67
	E - Sand, shingle or pebble shores; includes sand bars, spits and sandy islets; includes dune systems and humid dune slacks		This wetland type is considered to be under threat from wind and water erosion, exotic plant domination and recreation impacts. They are also vulnerable systems because of their dynamic morphology.	68

<sup>a</sup> FRQMQXHG RYHUΘIDI <sup>a</sup>

Element of ecological character	7DIAF lights	5DVIRQDΘI J IYHQIRUWDIAF ΘI KVDWHWP HQW	Page in the Report	
3UP DUX GHVUP IQDQWRI HFRQJ IEDCFKDUDFWU				
(VWDUQH VDCQH XQVW (continued))	G - QNVWGDOP XG VDCG RUMDQADW		This wetland type is vital for waders and is considered to be under extreme threat from increased sedimentation and changes to the RU DQF FDUERQDQG VHGP HQVS URADIV 7KHV WMMVDUH DOR H[ WHP HQ YXQHUDEΘI EHF DXHRI VKH VKRUVH F\FΘVDCG VS HFIHVVS HFIAF VDCQW tolerances of the decomposers and the macroinvertebrates that utilise these habitats and provide feed to waders (see Sections 5.4 and 6.3).	69
	+ <b>Intertidal marshes</b> ; includes salt marshes, salt meadows, saltings, raised salt marshes; includes tidal brackish and freshwater marshes		7KIVZ HMDQG WSHRQFH GRP IQDVG VKH VGDQAXHQFHG XQVDCG IVQRZ under-represented. As such it represents an extremely threatened and vulnerable refuge area for ecosystem processes and components that will be relied upon to expand into other areas of the Ramsar site once estuarine conditions are restored.	70
	I - <b>Intertidal forested wetlands</b> ; includes mangrove swamps, nipah swamps and tidal freshwater swamp forests		These critical remnants are considered threatened by altered water regime and increased salinities and vulnerable due to low rates of recruitment and relatively old age and poor condition of many trees. There is an urgent need to rehabilitate this wetland type and provide missing habitats for colonial birds and birds of prey.	71
	J - & RDVCEUDFNK <b>saline lagoons</b> ; brackish to saline lagoons with at least one relatively narrow connection to the sea		The miniature 'coves' described in the Murray Mouth and Estuary unit are unique, poorly described and considered highly important habitats that are vulnerable because of their morphology and dependence on localised recharge-discharge rates. The coastal saline waters that form the North and South Lagoons may cover a vast area but they are in such poor condition as to be likely to undergo an irreversible shift in HFRQJ IEDCFKDUDFWULZ IMLQ VKH QH WHZ \ HDVXQGW VKHUH IVU QAFDQW management intervention in the near future. Immediate reductions in salinity and turbidity levels and re-establishment of <i>SASSIL</i> spp. beds are required to prevent this occurring (see Sections 6 and 8).	72
	K - <b>Coastal freshwater lagoons</b> ; includes freshwater delta lagoons		These wetlands are the only source of freshwater for many terrestrial species as well as being important habitats per se. The remaining springs are considered extremely vulnerable because of their dependence on undisturbed recharge-discharge processes and their declining quantity and water quality. They are also considered under extreme threat from land and water resource development and altered surface-groundwater interactions.	74
	M - <b>Permanent</b> UYHV WHDP V FUVHNV; includes waterfalls		Salt Creek is undergoing another period of change in water regime GXH VU FH XDMRQRI ARZ VIURP O RUHQ %DVQDQG IVFRQDQVU QAFDQW stands of <i>Gahnia</i> VS VHH GHFMRQ %DVHG RQ WIV VVFRQMGHUG extremely vulnerable and under extreme threat.	75
	R - GHDVRQDO IQAMP IWWQVDCQH EUDFNK DODQCH QNHVDCG ADW		Although covering a large area, this wetland type is still considered vulnerable because of dependence on close connections with other habitats, and the need for high lagoon levels and/or winter rainfalls for inundation.	76
	Ss - GHDVRQDO IQAMP IWWQVDCQH EUDFNK DODQCH P DUXHV SRRQ		This type of wetland is well represented in area but is still considered to be vulnerable. This is based primarily on threats to the maintenance of habitat connectivity between these wetlands and Types G, W, R and Xf at high elevations around the South Lagoon. This rating takes into account that this type is partly found within Coorong National Park, and that these areas receive management attention.	77

7DEΘI & RQVRQEDVWG WDIAF QI KVDWHWP HQW FRQMQXHG				
Element of ecological character	7DIAF lights	5DVRQDDI J DYHQ IRUWDIAF QI KVDWHWP HQW	Page in the Report	
3UP DU GHMUP IQDQWRI HFRQJ IF DCFKDUDFWU				
(VWDUQH VDUQH XQJW (continued)	W - 6KUXE GRP IQDVG <b>wetlands</b> ; shrub swamps, shrub-dominated freshwater marshes, shrub carr, alder thicket on inorganic soils		The mosaic of <i>Gahnia</i> sp. (see Section 5.2.1) and <i>O. KDD DWURUXP</i> represents vital habitat that is considered to be under threat due to this Z HMDQG WSH VUHQDQFH RQ IUFKZ DMUQARZ VDQG VKH QHO FRQYHURQ IURP : V 6VIL IQARZ VUHGXFH. These wetlands are also considered vulnerable because the species assemblages are under-represented DW 6DVM QYHOKDYH YHU AQH VRQDUDQFHVRUZ DMUHU IP H DQG DUH GILAFXOWR UH HWDEQK IL QW	78.
	Xf - ) UFKZ DMU WPH <b>dominated wetlands</b> ; includes freshwater swamp forests, VHDVQDQ ARRGHG forests, wooded swamps on inorganic soils		Large areas of this wetland type remain around the South Lagoon but they are considered to be under threat from land and water resource development and vulnerable because they represent the only wetland tree in the bulk of the Ramsar site and as such perform a myriad ecosystem processes.	79
	Y - <b>Freshwater springs; oases</b>		7KHUH KDVEHQD P DUNG GHF QH IQ VKH QXP EHURI DFVH VRDN <sup>a</sup> see comments from the Ngarinjeri community and long-term WDNHQRQHUS <sup>a</sup> DQG VHXDQV DQG TXDQWRI Z DMUQ VKRH WDW remain. These soaks are considered to be under immediate and extreme threat of loss as a habitat type and vulnerable to changes in groundwater dynamics, reduced recharge in recent years and surface disconnection by animals digging for water. Their loss would be catastrophic to the terrestrial and aquatic fauna of the Youngusband Peninsula in particular.	80
5DP VDUU QI AF DQWIRQJ IF DQ:RP SRQHQW				
( QGDQJ HUHG DQG YXQHUDEΘI <b>plant species</b>			Despite the lack of comprehensive data, this rating is recommended taking into consideration the endangered and vulnerable status of the species concerned and applying the precautionary approach. Surveys are recommended as a high priority to clarify the situation and, if IQGIEDVWG V IQVRGXFH VSHFIAF P DQDJ HP HQVQMYHQMRQV	84
6Z DP SVRI VKH) QXUHX 3HQQXD			While there remain caveats on the estimated areal extent of this ecological community within the Ramsar site, this rating is given taking into consideration that the community is listed as critically endangered and that recovery actions are underway. Without the latter, the rating would be 'red'.	87
0 RXQWRIW 5DQJ HV6RXVHLQ (P X Z UHQ			While there remain caveats on the estimated population size and areal extent of its primary habitat within the Ramsar site, this rating is given taking into consideration that the species is listed as endangered and that recovery actions are underway. Without the latter, the rating would be 'red'.	91
2 UQJ H EHQHG 3DURY			While the population size and areal extent of its primary habitats within the Ramsar site remains unknown, this rating is given taking into consideration that the species is listed as endangered nationally and that recovery actions are underway. Without the latter, the rating would be 'red'.	95
6RXVHLQ %HQ) URJ			Despite the lack of comprehensive data, this rating is recommended taking into consideration the vulnerable status of the species concerned and applying the precautionary approach. 7KH WDIAF light assessment for many of the likely habitats of this species within the Ramsar site (see Section 4.1) is also a factor. Surveys are recommended as a high priority to clarify the situation and, if indicated, to introduce VSHFIAF P DQDJ HP HQVQMYHQMRQV	101

<sup>a</sup> FRQMQXHG RYHUQDI <sup>a</sup>

7DEΘI & RQMRQEDVWG WDIAF ΘI KVDWHWP HQW FRQMQXHG

Element of ecological character	7DIAF light	5DVQRQDΘI J IYHQIRUWDIAF ΘI KVDWHWP HQW	Page in the Report
5DP VDU6U QIADFQWIRQRJ IFDO&RP S RQHQW			
* DKQL YHI HMDVIRQ DWRFIDVRC		While the areal extent of this association is considered approximate, this rating is given taking into consideration that the Coorong and Lakes Ramsar site is thought to contain 96% of the remnant populations Z IMLQ VHI 6RXV S XVMDDQS RUVRQRI VHI O XUD\ ' DQQJ %DVQ ) XIWKI surveys and studies are needed as a priority to clarify the status and management needs of this association.	105
%UHHGLQI Z HMDDG GHS HQGHQVEILGV		Urgent action is needed to provide the ecological conditions that support waterbird breeding, in particular, to arrest the declines of the key food items 5XSSID VEHURV DQG 6P DOP RXVHG + DUG\KHDG (see Section 6).	108
: DGIQI EILGV IQFOXGIQI P LJ DVVU VSHFIV		8U HQMQMUYHQVRQIVZ DUDDQMG EDVHG RQ VLYH GDW DQG VHI AQGIQV V of Paton (2005a, b) and Geddes (2005) in particular. Their data clearly show how the ecological character of the North and South Lagoons have changed, and are continuing to change, in ways that are GHMP HQMDOR VHI Z DMUEIG DQG AK <sup>3</sup> VHI GHFVRQ FRP P XQMHV The loss of keystone aquatic plant species and key food items such DVKDUG\KHDG AK IQGIFDM VIVS DVVRI VHI 5DP VDUVM IVFUM DQ HQGDQI HUHG DQG Z DUDDQWDMQI DVVFK XQGHUMH (3% & SFW (see Section 8).	120
<b>Cape Barren Goose</b>		There are no indications at present that this species, despite being rare in South Australia, is facing any immediate threat, or that the population has declined over recent years. %HIQI D J HQHDDVWHHG HU@WUHQDQW on aquatic resources than other birds from this site, and breeding on off-shore islands may have insulated this species from some of the impacts noted for other bird species in the preceding sections. Further investigations are needed to set robust LAC for the aspects referred to above.	134
2 EΘI DM IUFMKZ DMUAK VSHFIV		3RS XDVRQ QXP EHVDFH QRVFRQALP HG DQVRXJ K VRP HRI VHI smaller species have restricted distributions and increasingly isolated habitats. 7KVDWHWP HQMDYHCV VHI HIRUH UHFRP P HQGHG VU UHAFVQD precautionary approach and that some of the important key habitat areas are known to face threats (see Section 4.1.4).	135
' IDGURP RXVAK VSHFIV		Population numbers are not known although six of these seven species are being considered for inclusion on the South Australian list of species of conservation concern. This assessment level is therefore UHFRP P HQGHG VU UHAFVQD S UHFDMVRQDU DSSURDFK DQG VDWVHIQI able to move through the barrages is a critical life history strategy for these species.	149
(XU KDQCH RUHWDDQCH VSHFIV		While population numbers are not known, oral history information, some FRP P HUFDAVKIQI GDW DQG VFIHQMF VHGHIQGIFDM VURXVGHF@HV in the populations of a number of these species over the past 30–40 years. 7KH GHF@HRI 6P DOP RXVHG + DUG\KHDG IVRI VSHFDQRVM J IYHQ its key role as a food item for waterbirds. This decline is considered to be associated with the loss of the keystone 5XSSID aquatic plant species (see Sections 5.4 and 6.3).	155
<b>Marine stragglers</b>		See page 163.	163