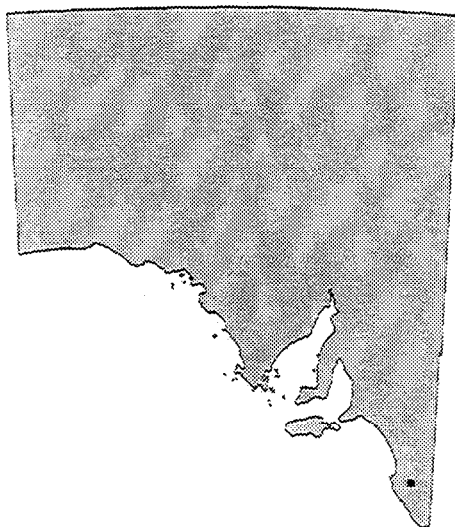


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# A BIOLOGICAL SURVEY OF DEEP SWAMP SOUTH AUSTRALIA IN JANUARY 1996

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**By H.J. Stewart**

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1996

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All geographical data from Statewide Map Library,  
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**Cover Photograph:**  
**A Redgum (*Eucalyptus camaldulensis*) open forest with an understorey of sedge (*Ghania filum*)**  
**on the verge of Deep Swamp. This habitat is typical of wetlands in the South East.**  
**Photo: H.J. Stewart**

# Abstract

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A one week survey of the vegetation and vertebrate fauna of Deep Swamp was undertaken in January 1996. This resulted in the recognition of

- Eleven plant communities with 174 plant species (20 introduced).
- Seventeen mammal species (5 introduced).
- Ninety two bird species (4 introduced).
- Fourteen species of reptile and three species of frogs.

In total, the Deep Swamp wetlands and vegetation complex contained fourteen species of threatened plants, and one regionally rare plant community, three mammal species of conservation significance, and ten bird species of conservation significance. The results of this survey suggest that the Deep Swamp wetlands and native vegetation remnant is of high conservation value.

This biological survey was undertaken specifically to determine the potential affects of constructing a drain through this area as part of the Upper South East Dryland Salinity and Flood Management Plan.

Although the exact location and design specifications were not known at the time of the survey, the results of this survey are based on the premise of a surface drain, following the route shown on the vegetation map in the back pocket of this report. Construction of the proposed drain would result in the clearance of approximately 17 hectares of native vegetation. This would result in the clearance of 10.8 ha of the regionally *rare* *Melaleuca halmaturorum* open scrub plant community, as well as 3 ha of the *rare* (state and regional level) Prostrate Blue Devil (*Eryngium vesiculosum*). Further, the present route of the drain would pass through the habitat of the nationally endangered Malleefowl (*Lepoia ocellata*), the Southern Emu-wren (*Stipiturus malachurus*), and may create a barrier to the dispersal of both small and large mammals and a number of small birds.

Given that both State and Federal Governments have conditionally supported the Upper South East Dryland Salinity and Flood Management Plan, any decision to place the drain route through this area should include a series of 'fauna crossings' to lessen the impact of the drain. Final drain location information confirmed after the completion of this survey will require several more sites to be surveyed in the vicinity of the altered drain route. A number of recommendations are proposed in the "Conclusion and Recommendations" section to help minimise the impact of the drain both during construction and operation.

# Contents

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	Page
ABSTRACT	III
LIST OF FIGURES	V
LIST OF TABLES	VI
LIST OF APPENDICES	VII
PEOPLE INVOLVED	IIX
INTRODUCTION	I
METHODS	4
RESULTS	7
CONCLUSIONS AND RECOMMENDATIONS	23
RESOURCE MATERIAL AND BIBLIOGRAPHY	26
APPENDICES	28

---

## Deep Swamp Biological Survey

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# Figures

		Page
Figure 1	The location of Deep Swamp in relation to NPWS reserves and heritage agreement areas.	2
Figure 2	The location of survey sites and proposed drain in Deep Swamp.	3
Figure 3	<i>Eucalyptus diversifolia</i> Dense Mallee at vegetation quadrat DS03.	8
Figure 4	<i>Eucalyptus fasciculosa</i> Low-open Forest at vegetation quadrat DS04.	8
Figure 5	<i>Melaleuca uncinata</i> Closed Scrub at vegetation quadrat DS01.	9
Figure 6	Co-dominant association of <i>Melaleuca halmaturorum</i> Open Scrub and Low Woodland and <i>Myriophyllum verrucosum</i> Herbland at vegetation quadrat DS02.	9
Figure 7	<i>Melaleuca halmaturorum</i> Open Scrub and Low Woodland at vegetation quadrat DS05.	10
Figure 8	<i>Eucalyptus camaldulensis</i> Open-forest at vegetation quadrat DS06.	10
Figure 9	<i>Eucalyptus camaldulensis</i> Open Forest with a dense understorey of <i>Gahnia filum</i> at vegetation quadrat DS07.	11
Figure 10	<i>Eucalyptus arenacea</i> Low Woodland at vegetation quadrat DS08.	11
Figure 11	Prostrate Blue Devil ( <i>Eryngium vesiculosum</i> ). A rare plant in the South East that is potentially threatened by the construction of the proposed drain.	12
Figure 12	Stoloniferous cane-grass ( <i>Eragrostis infecunda</i> ). This species presently has no conservation status but has been flagged as either rare or threatened.	12
Figure 13	Significant flora recorded at Deep Swamp.	16
Figure 14	Significant fauna recorded at Deep Swamp.	19

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## Deep Swamp Biological Survey

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# Tables

---

	Page
Table 1 Trapping and spotlighting effort during the Deep Swamp Biological Survey, January 1996.	5
Table 2 Number of individual observations of plants and vertebrates during the Deep Swamp Biological Survey, January 1996.	6
Table 3 Vegetation communities at Deep Swamp.	7

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## Deep Swamp Biological Survey

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# Appendices

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	Page
Appendix I      Plant species recorded from Deep Swamp	28
Appendix II     Mammal species recorded from Deep Swamp	38
Appendix III    Bird species recorded from Deep Swamp	40
Appendix IV     Reptile and Amphibian species recorded from Deep Swamp	44

## People Involved

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The data contained in this report was collected over a one week period of field work in response to the need by DENR (Department of Environment and Natural Resources) to acquire some biological information to enable the Department to better assess the potential conservation impact of a proposed drain through the area known as Deep Swamp, in the South East of South Australia. A small team of biologists were developed and supervised by Hafiz Stewart, the survey co-ordinator. All members made a notable contribution to the effectiveness of this short survey.

### Field work

#### Vegetation survey

The collection of all plant specimens was undertaken by Rick Davies and Lisien Loan.

#### Vertebrate survey

The vertebrate survey entailed obtaining records for all mammals (m), reptiles (r) and birds (b) present at the site during the survey. These records were obtained by Hafiz Stewart (m), Jason van Weenan (r) and Lynn Pedler (b).

Both groups were also assisted in a volunteer capacity by Scott Nichols and Scott Bemmer.

### Specimen Identification

Plants: All plant species were identified by R. Davies in the field. Collected specimens were also later verified by Rick Davies using the State Herbarium collection. Rick Davies also provided summary tables of the significant plant species found, and was responsible for interpreting and describing the floristic groups used to create the vegetation map.

Mammals: H. Stewart and L. Queale at the S.A. Museum.

Reptiles: J. van Weenan and M. Hutchinson from S.A. Museum.

Map production : Map production was under taken by members of the Geographical Analysis and Research branch (GAR) of the Department of Housing and Urban Development (DHUD) and South East Region, Department of Environment and Natural Resources.

I would also like to recognise the help given by Brenton Grear, Tim Dendy, Tony Robinson, Roger Ebsary (and others) for editing and providing useful feedback during the production of this report.

Lastly, I would like to thank all the land holders involved including John Del Fabro for accommodation and technical assistance before and during the survey, Gerry Rebbeck for access to his land and Len and Angas Vanderpeer for access to their land also.



# Introduction

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For some years now the South Australian National Parks and Wildlife Service and the South Australian Museum have been carrying out a series of systematic surveys of the vegetation and vertebrate fauna of large regions of South Australia. Previous surveys have been conducted or are currently in progress for the States Offshore Islands (excluding Kangaroo Island) (1971 - 1982), the South-East Coast (1982 - 1983), Cooper Creek (1983, 1991), the Nullarbor Plain (1984), the Gawler Ranges (1985), the Yellabinna area (1987), Kangaroo Island (1989 - 1990), Strzelecki Dunefields (1988 - 1992), Murray Mallee (1990 - 1991) Anangu Pitjantjatjara Lands (1991 - ), the South Olary Plains (1991 - 1992), Diamantina River Area (1994), Stony Deserts (1994 - ), and the North Olary Plains (1995 - ). With the exception of the Offshore Island surveys, the regional boundaries of these surveys have been based on the Environmental Regions and the Environmental Associations described and mapped for South Australia by Laut *et al.* (1977). In addition to these vegetation and vertebrate surveys, vegetation sampling analysis and mapping only has been completed or is in progress for the following areas:- South Mt Lofty Ranges (1986), Tallaringa Area (1988), Murray Mallee (1990), South-East (1991), Western Murray Flats (1991), Mid-North (1992), Burra Hills (1994), Yorke Peninsula (1994), and South Eyre Peninsula (1995 - ).

More recently, a number of more specific surveys have been undertaken in response to the need for detailed biological information for specific areas. These include the Biological Survey of Messent Conservation Park (Owens *et al.* 1995a) which assessed the likely biological impact of a proposed drain through the conservation park as part of the Upper South East Dryland Salinity and Flood Management Plan, The Biological Survey of Yumbarra Conservation Park (Owens *et al.* 1995b) which assessed the potential impact of mineral exploration proposed for the park, and the Box and Bulloke Biological Survey (Stokes: in press) that collected biological information required to develop management recommendations for the conservation of the remaining

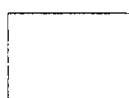
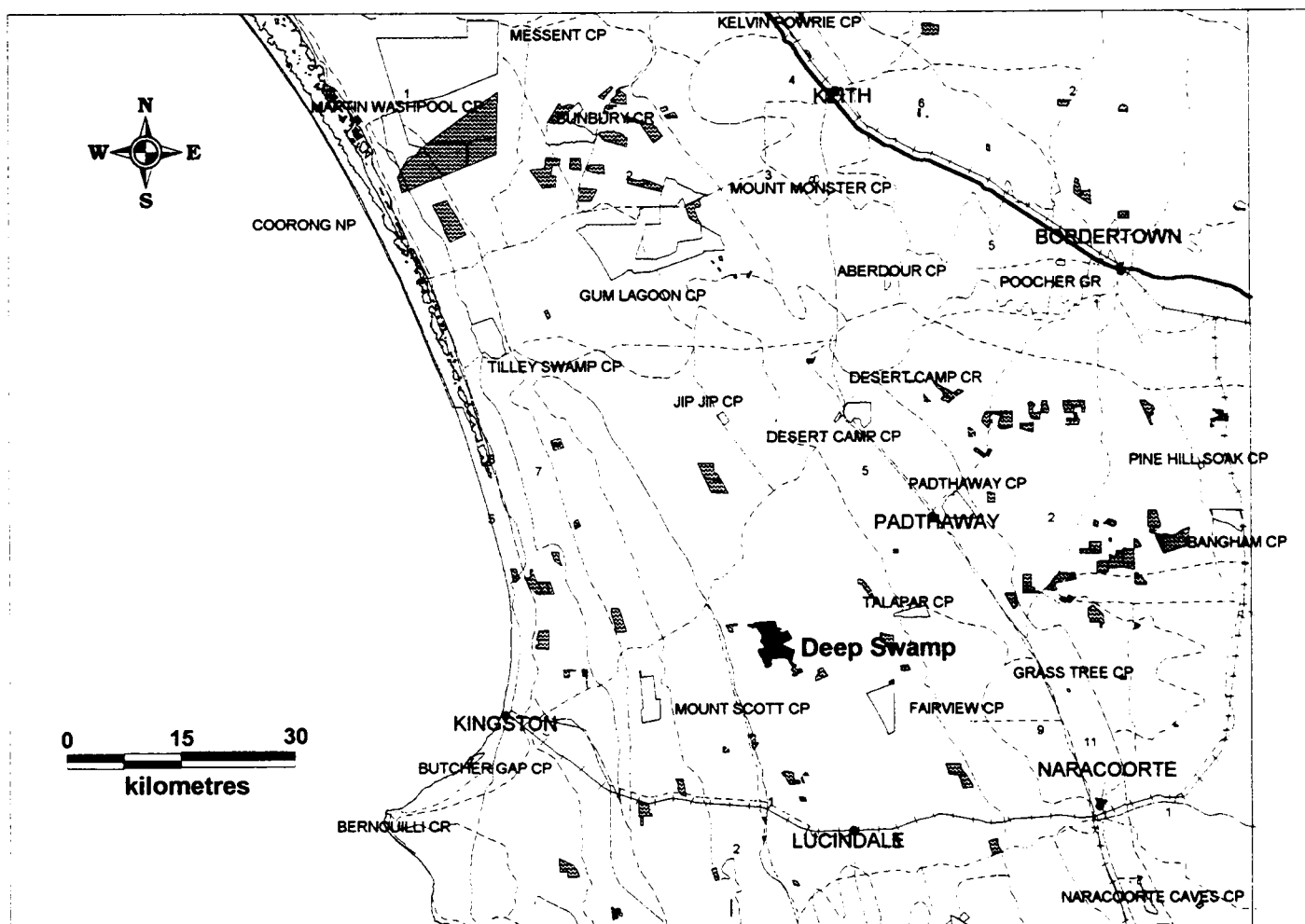
remnants of this vegetation association. As with the Biological Survey of Messent Conservation Park, the present survey was undertaken firstly, to identify the range of flora and fauna species present at Deep Swamp and secondly, to assess the potential biological impacts of a drain through this complex of wetlands and native vegetation.

The present survey used a more intensive sampling program than the previously conducted regional surveys, it utilised the standard sampling, and presentation techniques developed as part of the overall Biological Survey of South Australia. All data was therefore collected in a systematic way which is completely compatible with existing biological survey information.

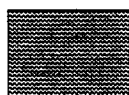
The location of Deep Swamp is shown in Figure 1. Although the exact location and nature of the drain were not known during the survey, the results of this survey were based on the assumption that the proposed drain would follow the route depicted in Figure 2 and on the vegetation map in back pocket. The Biological Survey was carried out between 15 to 19 January 1996. The location of all eight flora and fauna sampling sites, and opportunistic flora sites are depicted in Figure 2.

Deep Swamp is located in the middle of the Lucindale Southern Wetlands and Dune Ranges Environmental Region (1.4.1) of Laut *et al.* (1977). This environmental region is characterised by 'Low parallel calcarenite dune ridges trending north-northwest, separated by narrow interdunal plains with occasional swamps.' (Laut *et al.* 1977: 68).

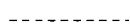
Prior to the present survey, very little research on the biology of Deep Swamp had been carried out. This survey therefore represents the first systematic study of the area, and as such will contribute to the greater understanding of the flora and fauna communities of the South East of South Australia.



National Parks & Wildlife Act reserve



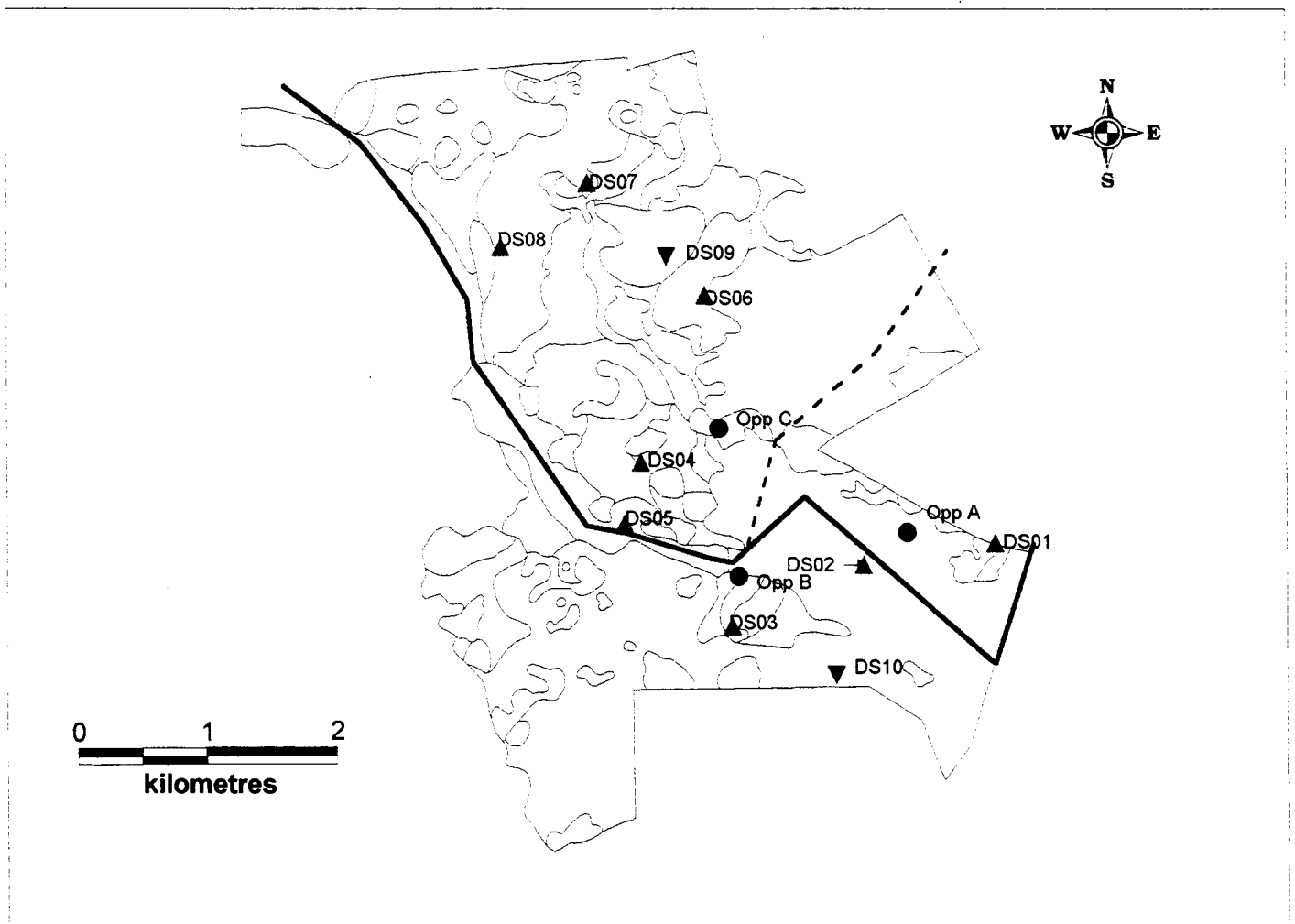
Native Vegetation Act - Heritage Agreement



Environmental Association boundary (Laut et al, 1977)

**Figure 1**

**The location of Deep Swamp in relation to NPWS reserves and heritage agreement areas**



- |           |  |   |                                    |
|-----------|--|---|------------------------------------|
| —————     | Proposed drain route (at time of survey) | ▲ | Flora and fauna survey site        |
| - - - - - | Altered drain route (as at June 1996)    | ▼ | Flora survey site                  |
|           |  | ● | Opportunistic flora sampling sites |

**Figure 2**  
**The location of survey sites and proposed drain in Deep Swamp**

## Methods

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The rationale behind these regional biological surveys has been explained in detail by Copley and Kemper (1992). The Deep Swamp Biological Survey was conducted in a patch of remnant vegetation in the agricultural district of South Australia, where much of the natural vegetation and its associated vertebrate fauna has been fragmented by clearance and undergone substantial habitat modification for agriculture. For this reason a number of alterations to the methods adopted in the extensive areas of natural vegetation covered by previous regional surveys were required. More recently, a number of specific biological surveys (Owens *et al.* 1995 a,b) have been undertaken which provided a methodology which ensured that the data collected in this survey were comparable to that collected in previous broad-scale surveys.

The biological survey of Deep Swamp was designed with the following aims;

- 1) To collate any previously existing information on the biota of Deep Swamp.
- 2) To undertake a biological survey of Deep Swamp to determine the presence of all resident flora and fauna, in a standard and comparable format. This includes providing both the S.A. Museum and State Herbarium with voucher specimens collected during the survey, and entering all the collected data onto the South Australian Survey Database.
- 3) To establish permanent sampling sites to collect baseline data, and monitor the potential effects of the proposed surface drain on the flora and fauna of Deep Swamp.
- 4) To prepare an accurate vegetation map of Deep Swamp at a scale of 1:25 000.
- 5) To obtain information to assist in planning the appropriate route for the proposed surface water drain.

### a) Site Selection and Nomenclature

The fundamental concept behind all the regional surveys conducted as part of the Biological Survey of South Australia to date has been that they are based on intensive sampling at a series of *sites* selected to represent the biological and geographical diversity of the study area. As the Deep Swamp survey was designed to assess the potential impact of a proposed surface water drain through a particular area, some changes were made to the site

selection process. Due to the small size, and more intensive nature of the survey, this survey considered the whole of Deep Swamp to be a single *site* designated with the code DS. Given the time available, the number of vegetation types and the relatively small size of the area a maximum of eight principle vegetation and vertebrate sampling quadrats was established. One sampling quadrat was placed in each of the eight major vegetation types.

However, a number of additional sites were established to sample vegetation types not already represented in the eight principal sites (Refer to Table 1 and Figure 2). As most vegetation patches in Deep Swamp were relatively small and in close association with other vegetation types, sampling quadrats were only placed in areas of greater than four hectares (200 m X 200 m) to minimise 'edge' effects. Where practical, sampling quadrats were placed in the centre of the vegetation patch. Five sampling quadrats were situated on the northern side of the proposed drain route and three quadrats were positioned on the south side of the proposed drain (Refer to Figure 2 and vegetation map).

### Data Collection

Each vegetation sampling site consisted of a 30 X 30 m quadrat, within which all vascular plants present were recorded and collected for later verification at the State Herbarium. All data on the specimens collected, including life stage, cover/abundance, vegetation association description were recorded on standard data sheets. Details on the overstory height, canopy depth and diameter, and canopy cover were also recorded, as well as a description of the location and physical environment of each quadrat.

Eight of the ten quadrats sampled for vegetation were also sampled for the presence of vertebrates. At each of the eight quadrats sampled for vertebrates, a 50 m long line of six fenced pitfall traps were established. Each pitfall trap consisted of a 455 mm x 380 mm sheet of white, high impact polystyrene sheet joined into a cylinder using a slotted H section plastic strip (HM12). The resultant pitfall traps had a diameter of 125 mm and a depth of 380 mm.

A separate line of 15 Elliott traps were set in association with each pitfall line sampling the same habitat within the quadrat, and two possum/cat size traps were placed at each end. A line of 6 micro-pitfalls consisting of plastic vials measuring 80 X 20 mm and filled with 70% alcohol were set adjacent to the main pitfall line. All traplines were run

for four nights. Reptiles and mammals were also sampled by searching each of the eight quadrats at least once during the sampling period.

Birds were recorded for each quadrat. An observer spent from one to several hours during the best bird observation times of early morning and evening and recorded all birds within or flying over the quadrat during the search period. An attempt was made to put the same amount of search effort into each quadrat during the best observation times.

A permanent photographic monitoring point was established at each of the eight vertebrate sampling quadrats using two 1.4 m long steel posts set 10m apart (Refer to Figures 3-10 (photos of sites)).

Observations of some plants and vertebrates encountered outside quadrats were recorded on special "opportunistic" data sheets. A single harp trap was set up at DS07.

At least the first specimen of each small mammal and reptile species recorded for the survey area was preserved as a museum specimen. Larger species (ie. *Varanus*

*rosenbergi*) which had been collected from the general region in the past and did not present any identification problems were not collected.

A small amount of vehicle and walking spotlight searching was carried out both on the quadrats and opportunistically but the demands of quadrat sampling and specimen processing did not allow this to be carried out systematically.

Samples of liver tissue were taken from all specimens collected and stored in liquid nitrogen. Tissue samples from all mammals and reptiles are permanently stored at the South Australian Museum (SAM).

Invertebrates were collected from the micro-pitfall and larger vertebrate pitfall traps or opportunistically around each quadrat. These samples were also lodged with SAM.

A summary of the sampling effort over the whole survey is given in Table 1. The number of individual observations during the survey is shown in Table 2.

**Table 1**

Trapping and spotlighting effort during the Deep Swamp biological survey, January 1996

SITE	Pit Trap Nights	Elliott Trap Nights	Cage Trap Nights	Vehicle Spotlight Hours	Harp Trap Nights
DS0101	24	60	8		
DS0201	24	60	8		
DS0301	24	60	8		
DS0401	24	60	8		
DS0501	24	60	8		
DS0601	24	60	8		
DS0701	24	60	8		
DS0801	24	60	8		
OPPORTUNISTIC				4	3
TOTALS	192	480	64	4	3

**Table 2**

Numbers of individual observations of plants and vertebrates during the Deep Swamp Biological Survey, January 1996.

	Quadrats		Opportunistic	Total
Plants	305	(10 sites)	44	349
Mammals	85	(8 sites)	39	129
Birds	240	(8 sites)	51	291
Reptiles	34	(8 sites)	5	39
Amphibians	3	(8 sites)	2	5

### **Data Management**

All collected specimens were lodged with the appropriate institutions for verification and were added to their collections if required. Whereas the State Herbarium received all collected plant specimens, the vertebrate specimens were lodged with SAM. Any corrections to specimen identification were transferred to the original data sheets and the data was entered on the Opportunistic and Survey databases administered by the Biological Survey and Research section of DENR.

### **Vegetation Mapping**

Due to the relatively small number of vegetation quadrats sampled in the current survey, PATN analysis could not be used to define floristic groups (which has been the case in most previous biological surveys).

Instead, a 1:25 000 vegetation map of the Deep Swamp vegetation was created from interpretation of current aerial photographs at a scale of 1:10 000 from data collected during the present survey and from previous information generated by the Regional Flora Survey undertaken by the Department of Housing and Urban Development (DHUD) in 1991 (this survey mapped the vegetation of Deep Swamp at a scale of 1:50 000). The vegetation boundaries were then traced from the 1:10,000 aerial photograph onto transparent overlays or 'mylars' at that scale. The mylars were corrected for topological inaccuracy, and the vegetation boundaries were then digitised by members of the Geographical Analysis and Research Group (GAR) of DHUD. The final map was produced using ESRI's ARC/INFO GIS software..

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## Deep Swamp Biological Survey

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# Results

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### VEGETATION

Some pre-existing information on the vegetation types found in Deep Swamp were available from assessments undertaken by the Native Vegetation Management Branch of DENR who assessed a section of Deep Swamp for adoption as a Heritage Agreement. A limited number of sampling sites were also positioned near Deep Swamp during the Regional Flora Survey undertaken by the Department of Housing and Urban Development (DHUD) in September 1991. Using aerial photographs and the data generated from this survey, the vegetation of Deep Swamp was mapped at a scale of 1:25 000 (Refer to Map).

#### Floristic Vegetation Mapping

Eight floristic vegetation communities were recognised in this study. These included five communities associated with calcareous ridges (*Eucalyptus camaldulensis* open-forest (Fig. 8), *E. leucoxylon* woodland, *E. fasciculosa* low woodland (Figure 4), *E. diversifolia* dense mallee (Fig. 3) and *Melaleuca uncinata* closed scrub (Fig. 5), two communities associated with sandy rises (*E. arenacea* low woodland (Fig. 10), and *E. fasciculosa* low-open forest (Fig. 4) and four intergrading communities associated with areas subject to seasonal waterlogging or inundation (*Melaleuca brevifolia* open scrub, *M. halmaturorum* open-scrub and low woodland (Fig. 7), *Myriophyllum verrucosum*, *Lilaeopsis polyantha*, *Selleria radicans* herbland (Fig. 6), and *Eucalyptus camaldulensis* open-forest (Fig. 9) (Refer to Table 3, and veg map in back pocket).

**Table 3. Vegetation communities at Deep Swamp.**

Plant communities associated with calcareous ridges

1. <i>Eucalyptus camaldulensis</i> open-forest ( $\pm$ <i>Melaleuca lanceolata</i> & <i>Allocasuarina verticillata</i> ) OVER sparse <i>Acacia longifolia</i> var <i>sophorae</i> OVER mid dense to sparse <i>Danthonia geniculata</i> , <i>Vittadinia gracilis</i> (on better developed sandy loams on calcrete).
2. <i>Eucalyptus leucoxylon</i> woodland OVER very sparse <i>Lepidosperma congestum</i> (on better drained sandy loams on calcrete).
3. <i>Eucalyptus fasciculosa</i> low woodland OVER very sparse <i>Acacia longifolia</i> var <i>sophorae</i> ( $\pm$ <i>Xanthorrhoea caespitosa</i> , <i>Bursaria spinosa</i> , <i>Pteridium esculentum</i> ) (ecotone between vegetation on calcareous ridges and sandy rises).
4. <i>Eucalyptus diversifolia</i> dense mallee OVER very sparse <i>Xanthorrhoea caespitosa</i> , <i>Ajuga australis</i> , <i>Danthonia geniculata</i> (on heavy sheet limestone), (Community 3-DENR SE Regional Survey).
5. <i>Melaleuca uncinata</i> closed scrub OVER very sparse <i>Calytrix tetragona</i> , <i>Thomasia petalocalyx</i> , <i>Hibbertia riparia</i> (at the base of calcareous ridges adjoining swamp vegetation)

Plant communities associated with sandy rises

6. <i>Eucalyptus arenacea</i> low woodland ( $\pm$ <i>Eucalyptus viminalis</i> ssp. <i>cygnetensis</i> ) OVER mid dense <i>Banksia ornata</i> , <i>Xanthorrhoea caespitosa</i> , <i>Pteridium esculentum</i> , <i>Hypolaena fastigiata</i> , <i>Brachyloma ciliatum</i> (on deep sand), (Community 12-DENR SE Regional Survey).
7. <i>Eucalyptus</i> low open-forest OVER <i>Xanthorrhoea caespitosa</i> , <i>Brachyloma ciliatum</i> , <i>Hibbertia sericea</i> (on sandy loams) (Community 7-DENR SE Regional Survey).

Areas subject to seasonal waterlogging or inundation

8. <i>Melaleuca brevifolia</i> open-scrub ( $\pm$ <i>Melaleuca halmaturorum</i> ) OVER sparse <i>Leptocarpus brownii</i> , <i>Baumea juncea</i> ( $\pm$ <i>Agrostis avenaceus</i> , <i>Wilsonia rotundifolia</i> , <i>Angianthus preissianus</i> , <i>Eryngium vesiculosum</i> ) (less saline areas subject to less frequent and prolonged waterlogging) (Community 17-DENR SE Regional Survey)
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<p><b>9. <i>Melaleuca halmaturorum</i> open-scrub and low woodland</b> OVER very sparse <i>Baumea juncea</i>, <i>Juncus kraussii</i>, (<math>\pm</math> <i>Gahnia filum</i>, <i>Sarcocornia quinqueflora</i>, <i>Schoenus nitens</i>, <i>Sporobolus virginicus</i>) (more saline areas subject to more frequent and prolonged waterlogging, and infrequent inundation) (Community 22-DENR SE Regional Survey)</p>
<p><b>10. <i>Myriophyllum verrucosum</i>, <i>Lilaeopsis polyantha</i>, <i>Selliera radicans</i> herbland</b> (areas of shallow standing water)</p>
<p><b>11. <i>Eucalyptus camaldulensis</i> open-forest</b> OVER mid dense <i>Lepidosperma viscidum</i>, <i>Baumea juncea</i> (bordering areas of shallow standing water)</p>

Collectively these eleven communities supported 174 species of plants (20 introduced species), 14 species of which are considered threatened at either the state or regional level, and a regionally rare plant community (Refer to Figure 13).

Sampling was undertaken in early January, when most orchids were dying off. For this reason the following list of species may not represent all of the threatened plant species at Deep Swamp.





**Figure 3**  
*Eucalyptus diversifolia* Dense Mallee at vegetation quadrat DS03  
 Photo: H.J. Stewart



**Figure 4**  
*Eucalyptus fasciculosa* Low Open Forest at vegetation quadrat DS04  
 Photo: H.J. Stewart



**Figure 5**  
*Melaleuca uncinata* Closed Scrub at vegetation quadrat DS01  
 Photo: H.J. Stewart



**Figure 6**  
 Co-dominant association of *Melaleuca halmaturorum* Open Scrub and Low Woodland and *Myriophyllum verrucosum* Herbland at vegetation quadrat DS02  
 Photo: H.J. Stewart



**Figure 7**

*Melaleuca halmaturorum* Open Scrub and Low Woodland at vegetation quadrat DS05

Photo: H.J. Stewart



**Figure 8**

*Eucalyptus camaldulensis* Open Forest at vegetation quadrat DS06

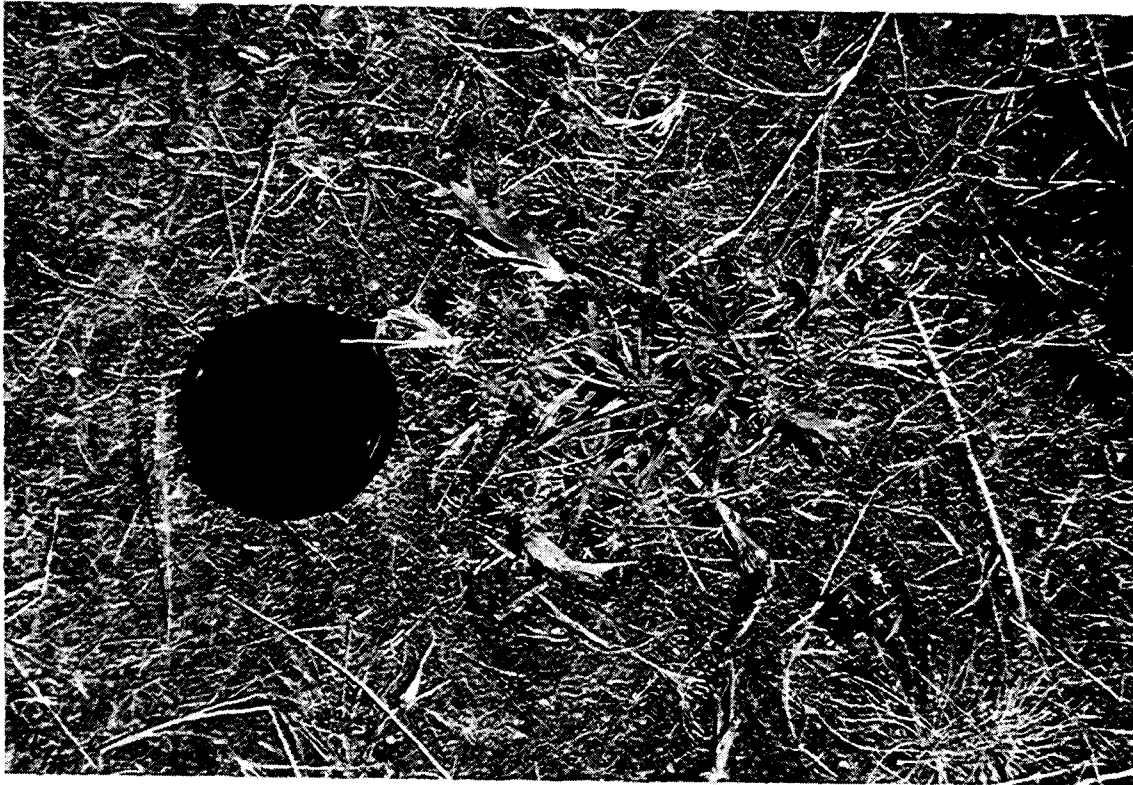
Photo: H.J. Stewart



**Figure 9**  
*Eucalyptus camaldulensis* Open Forest with a dense understorey of *Gahnia filum* at vegetation quadrat DS07  
 Photo: H.J. Stewart



**Figure 10**  
*Eucalyptus arenacea* Low Woodland at vegetation quadrat DS08  
 Photo: H.J. Stewart



**Figure 11**  
**Prostrate Blue Devil (*Eryngium vesiculosum*).** A rare plant in the South East that is potentially threatened by the proposed drain  
**Photo: H.J. Stewart**



**Figure 12**  
**Stoloniferous cane-grass (*Eragrostis infecunda*).** This species presently has no conservation status but has been flagged as either rare or threatened  
**Photo: H.J. Stewart**

## Species of Particular Interest

No plants of national significance were recorded in this survey, however, nine species of state significance and 12 species of regional significance were collected. As some species have different ratings at a state and regional level, both listings will be stated.

### Species of state and regional significance

#### Thin pondweed (*Potamogeton australiensis*)

A perennial submerged herb usually found in brackish, saline or hypersaline water (Jessop *et al.* 1986). This species is found in New South Wales, Victoria, Tasmania and in the south east of South Australia where it has been found in Piccaninnie Ponds Conservation Park, Bool Lagoon Game Reserve and Honans Scrub Native Forest Reserve. This wetland species is the most significant found during this survey, as it is considered to be **threatened** at the state and regional level (Lang and Kraehenbuehl 1994).

This species was recorded at DS09 (an opportunistic vegetation quadrat) in Deep Swamp itself (Refer to Figure 13 and Appendix 1). *P. australiensis* may have survived in Deep Swamp because the local farmer regulates the water flow out of Deep Swamp, maintaining water levels in the swamp for a longer period. Increases in water salinity and changes in the frequency, duration and timing of water flow may negatively affect this species.

#### Small milkwort (*Comesperma polygaloides*)

A small erect subshrub with a woody root stock from 100 to 200 mm tall (Jessop *et al.* 1986). This species has been found in Western Australia, Victoria and in the Murray area, southern Lofty Ranges and in the south east of South Australia. In South Australia this species is considered **rare** at the state and regional level (Lang and Kraehenbuehl 1994).

This species was found at site DS01 which is within 200m of the proposed drain route (Refer to Figure 13). Therefore any weed invasion associated with drain construction may adversely affect this species.

#### Prostrate blue devil (*Eryngium vesiculosum*)

A short-lived perennial herb with long prostrate branches to 30 cm long, leaves are 4-15 cm long with coarse spreading tiny teeth (Refer to Figure 13). The distribution of *Eryngium vesiculosum* includes New Zealand, most states of Australia (WA, QLD, NSW, VIC and TAS) including the southern Lofty Ranges, Kangaroo Island and the south east of South Australia, where it occurs mainly on sandy flats subject to waterlogging (Jessop *et al.* 1986).

Lang and Kraehenbuehl (1994) consider this species to be **rare** at both the state and regional level. In the south east, this species is only conserved in Mary Seymour CP. However, other populations have been located in a number of council reserves, Heritage Agreements and State Flora Native Forest Reserves.

Of all the threatened plant species described in this report, this species may be potentially most affected by the proposed drain as this species only occurs adjacent to the existing drain (at site DS02) feeding Deep Swamp (Refer to map 13). The species is locally common on the east side of the existing drain, but is very restricted on the west side, even though both sides have identical soils and would have originally had the same hydrological regime. This indicates the sensitivity of the species to such changes in hydrology.

Changes in the salinity of run-off water and the duration, timing and frequency of water flow are likely to adversely affect this species. Drain construction would also directly affect part of this population, the extent of this impact depending on the exact position of the drain (Refer to Figure 13), the extent of disturbance occurring adjacent to the drain during construction, and whether or not weed invasion occurs.

On the assumption of Best and Croft (1995) that one kilometre of drain requires four hectares of habitat to be cleared then, three hectares (from a 0.75km length of drain) of this vegetation type would be cleared.

#### Manila Grass (*Zoysia matrella*)

Manila grass is a short stemmed creeping perennial, which sprouts from an underground rhizome. The leaf blades are rigid and the inflorescence occurs as a dense terminal spike. This species is the only member of the *Zoysia* genus in South Australia, but is found in Queensland, Victoria, Tasmania, South Australia and through Asia (Jessop *et al.* 1986). In South

Australia *Z.matrella* is found only on Kangaroo Island and in the South East region. This species is considered to be **rare** in the South East region and at the state level (Lang and Kraehenbuehl 1994).

Present populations of this species are located in Comaum, Native Forest Reserve and may exist in Beachport CP (Lang and Kraehenbuehl 1994).

#### Stoloniferous cane-grass (*Eragrostis infecunda*)

This cane-grass grows to 70 cm high, but often occurs as long stolons growing inside bushes or small tussocks when grazed (Fig. 12). Unlike other species of *Eragrostis* in South Australia, this perennial grass does not produce fertile seeds, reproducing asexually by rooting at the nodes. Spikelets are generally 5-11.5 mm long and occur loosely in groups of 5-11 flowers (Jessop *et al.* 1986). This species has been recorded in both Victoria and South Australia. In South Australia *E.infecunda* is considered to be **uncommon** at a state level and has been recorded in Mount Lofty Ranges and in the south east. The regional status of this species is currently unknown because of a lack of data, however, Lang and Kraehenbuehl (1994) suggest that this species may be currently **rare** or **threatened**.

*E.infecunda* is conserved in the Murray River National Park, Bool Lagoon Game Reserve and Mundulla Council Reserve. In Deep Swamp this species was recorded opportunistically in the *Melaleuca brevifolia* / *M.halmaturorum* open-scrub and low woodland.

Changes in local hydrology (ie. decrease in the depth of the water table) and surface water flows (salinity levels, timing, duration and frequency of inundation) brought about by the drain may adversely affect this species.

#### Small mat-rush (*Lomandra sororia*)

A small perennial herb with leaves to 40 cm high and clusters of yellow flowers on a number of branched spikes. This species is found most often in heath and mallee vegetation types (Prescott 1988) in Victoria and in the Mt Lofty Ranges, Murray Mallee and in the south east of South Australia. This species is considered to be **uncommon** at the state level and **rare** in the South East (Lang and Kraehenbuehl 1994).

As this species was recorded at DS08 which is situated on a sandy rise some distance from the proposed drain route, the drain should not affect this species.

#### Pale mat-rush (*Lomandra glauca* ssp *nana*)

Pale mat-rush is a small perennial of the lily family to 50cm high. This species occurs in most states except the Northern Territory and Queensland. In South Australia Pale mat-rush has been found in most areas including the South East.

As this species was found at an opportunistic site situated some distance from the proposed drain route on high sandy rises, the proposed drain should not affect this species.

#### Salt pratia (*Pratia platycalyx*)

Salt pratia is a procumbent dioecious perennial herb. This species is found in Victoria, Tasmania, in the Murray area, on Kangaroo Island and in the South East of South Australia where it grows in salt marshes, near the coast in sandy soil and in association with limestone (Jessop *et al.* 1986).

*Pratia platycalyx* is considered **uncommon** both in the South East and at the state level (Lang and Kraehenbuehl 1994). Populations of this species are located in a number of Conservation Parks including Fairview CP, Big Heath CP and Piccaninnie Ponds CP. In the present survey *P.platycalyx* was recorded at a number of opportunistic and survey sampling sites (DS02, DS07), all of which were on the periphery of water courses or wetlands. Because of this, changes in water quality (ie. salinity) and flow management (duration, timing, and frequency) may negatively affect this plant.

#### Tiny Selaginella (*Selaginella gracillima*)

*Selaginella gracillima* is an herbaceous annual terrestrial sporophyte to 8 cm tall. This species grows in moist, shaded environments near creeks and swamps and is found in Western Australia, New South Wales, Queensland, Tasmania and South Australia. In South Australia this species has been recorded in the South East and southern Mount Lofty Ranges (Jessop *et al.* 1986). Presently, populations of *S.gracillima* are conserved in Big Heath CP, Desert Camp CP, Piccaninnie Ponds CP and Penola CP. At the state level, and in the South East this species is considered **uncommon** (Lang and Kraehenbuehl 1994).

Due to the close association of this species to wetland environments, any changes to water quality (ie. salinity) and the flow regime (ie. increases in salinity and changes to flow duration, frequency and timing) may adversely affect this species. Some populations of this species may be destroyed during drain construction, and later with the potential for weed infestation.

#### Slender daisy (*Brachycome exilis*)

An annual herb to 18 cm high. Leaves are broad, thick and hairless forming a rosette at the base of the herb and also growing along the stem (Jessop *et al.* 1986, Prescott 1988).

The distribution of this species includes Western Australia, New South Wales, Victoria and many regions of South Australia. This species has been found in the mid north, Flinders Ranges, both Eyre and York Peninsulas, the Murray, Southern Mt Lofty Ranges and the south east of South Australia. Although *B.exilis* has no state significance it is considered to be **rare** in the South East.

This species was recorded at site DS02 (Refer to Map 13), which is immediately adjacent to the present drain feeding Deep Swamp. Drain construction, and any associated weed invasion may therefore adversely affect this species. Presently, no known population of *B.exilis* are conserved in Conservation Parks in the South East. Careful management of this population is therefore required.

#### Red water-milfoil (*Myriophyllum verrucosum*)

A perennial aquatic herb with submerged leaves to 12 mm long. These plants are monoecious and flower all through the year. This species is found in Western Australia, Northern Territory, Queensland, New South Wales and Victoria and in most areas of South Australia except Yorke Peninsula and Kangaroo Island (Jessop *et al.* 1986). In the South East of South Australia this species is considered **rare**, but is not threatened at the state level. No known populations of this species are conserved in Conservation Parks in the South East but populations have been found in Bool Lagoon Game Reserve, Poochera Swamp Game Reserve and in Topperwein Native Forest Reserve.

This species was recorded in Deep Swamp itself. In common with the previously mentioned wetland plants, changes in water quality (ie. salinity) and flow regime (timing, frequency and duration of inundation) would adversely affect this species.

#### Austral bugle (*Ajuga australis* form A)

*Ajuga australis* form A is a small herb with quadrangular shaped branches to 30 cm long. Although members of this genus are distributed throughout Europe, this species is found only in South Australia where it occurs in the Flinders Ranges, Eyre and Yorke Peninsulas, Mount Lofty ranges, Kangaroo Island and in the South East. Lang and Kraehenbuehl (1994) consider this species to be **uncommon** in the South East, but is conserved in a number of Conservation Parks including Padthaway CP and Mount Scott CP

Austral bugle was recorded at both DS03 (limestone rise) and DS06 (sand on limestone) (Refer to Figure 13 and Appendix I), which are situated some distance from the proposed drain route. For this reason the proposed drain should have minimal or no impact on this species.

#### Australian lilaeopsis (*Lilaeopsis polyantha*)

The Australian lilaeopsis is a small perennial, with creeping rhizomes. This species is distributed from Queensland to New South Wales, Victoria, Tasmania and South Australia where it grows in waterlogged soils on the periphery of swamps and lakes, or submerged under water (Jessop *et al.* 1986). In South Australia *L.polyantha* has been recorded on the Eyre Peninsula, in the Murray, southern Mt Lofty Ranges, Kangaroo Island and the South East. As yet, the conservation status of this species has not been assigned, however, Lang and Kraehenbuehl (1994) recognise that this species may be of conservation significance, both at a state level and in the South East.

#### Arrowgrass (*Triglochin* affin. *trichophorum*)

*Triglochin trichophorum* belongs to a complex which is in need of taxonomic revision. Although four species are presently recognised in the complex, the characters used to distinguish between these taxa are observed to breakdown in individuals intermediate between species (Jessop *et al.* 1986).

Specimens collected from Deep Swamp were intermediate between *Triglochin trichophorum* and *T.minutissimum*. Both species are small annual herbs which occur mostly in areas subject to periodic flooding by fresh or brackish water.



*Triglochin trichophorum* is found in Western Australia and on both Eyre and Yorke Peninsulas, in the Murray area, the southern Mount Lofty Ranges and the south east. The conservation status of *T. trichophorum* has not been assessed but has been flagged as a species of likely conservation significance (Lang and Kraehenbuehl 1994).

This species was recorded at DS05, in the *Melaleuca halmaturorum* drainage line, adjacent to the planned drainage route. Drain construction and changes to flow regime (salinity increases, duration and timing of flooding) would almost certainly negatively affect this species.

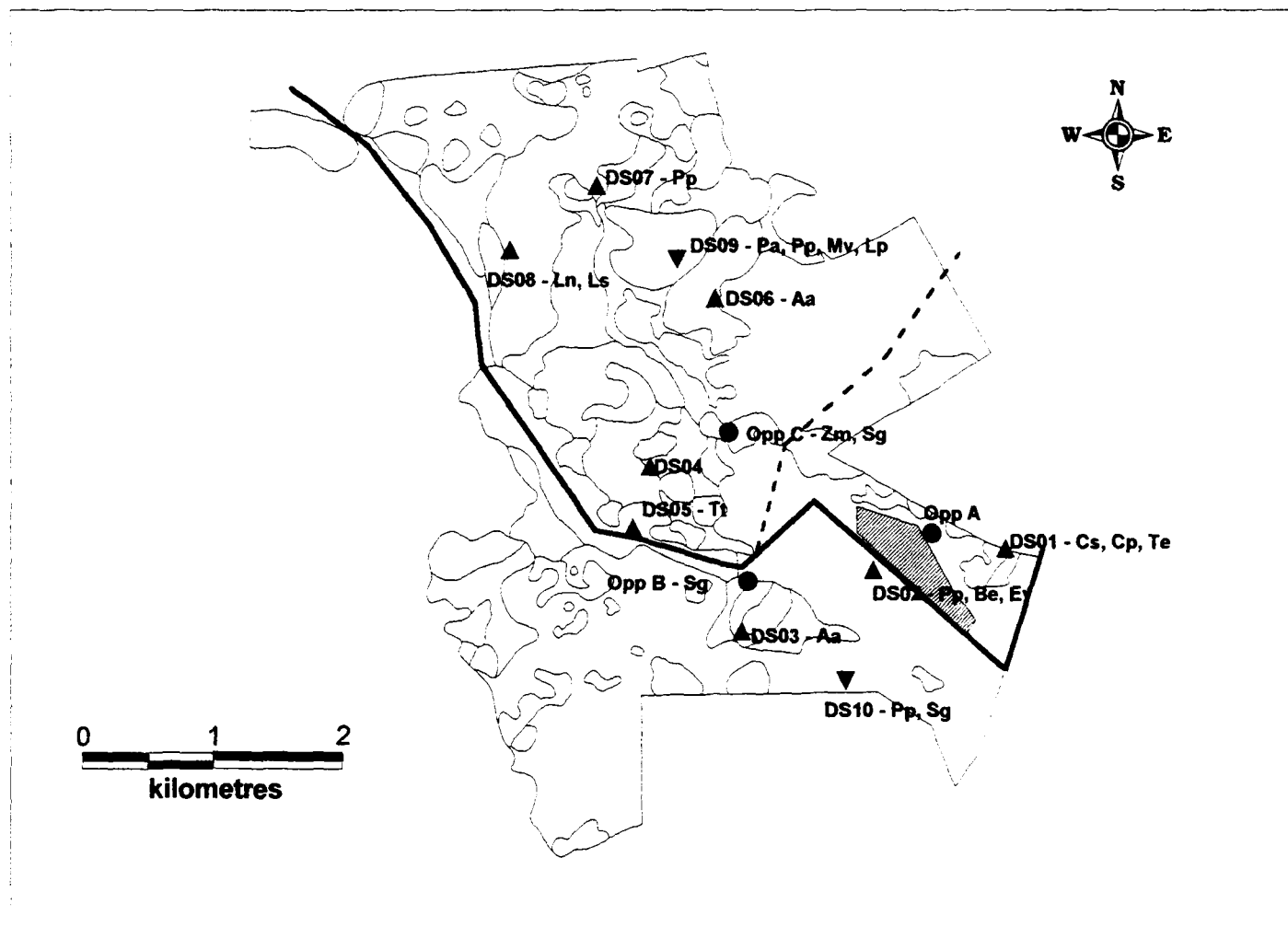
#### Potential Presence of Other Threatened Species

While undertaking the biological survey, suitable habitat for the nationally **endangered** Metallic Sun-orchid (*Thelymitra epipactoides*) was identified at site DS01. Davies (1995) stated that populations of this species occurring on the boundary of Messent CP may have disappeared because of weed invasion or fire break construction. If this species were located at DS01, then any potential weed invasion associated with drain construction would threaten the population. Further research should be undertaken in spring to determine whether this species occurs at Deep Swamp.

#### Rare Plant Communities

Of the eleven vegetation communities defined in this report, only one is of conservation significance. Croft and Carpenter (1996) recognise *Melaleuca halmaturorum* open - scrub (community 9- refer to Table 3) as **rare** in the South East.


The currently proposed drainage route cuts through the middle of this vegetation community for a length of approximately 2.7 km (Refer to Figure 13). On the assumption that four hectares of scrub would be cleared per kilometre of drain (*sensu* Best and Croft 1995), then construction of the drain would result in the clearance of 10.8 ha of this regionally **rare** vegetation type.



### SPECIES CODE

Aa - *Ajuga australis* form A  
 Be - *Brachycome exilis*  
 Cp - *Comosperma polygaloides*  
 Cs - *Cladonia* affin. *squamosula*  
 Ei - *Eragrostis infecunda*  
 Ev - *Eryngium vesiculosum*  
 Ln - *Lomandra nana*  
 Lp - *Lilaeopsis polyantha*

Ls - *Lomandra sororia*  
 Mv - *Myriophyllum verrucosum*  
 Pa - *Potamogeton australiensis*  
 Pp - *Pratia platyclayx*  
 Sg - *Selaginella gracillima*  
 Tt - *Triglochin* affin. *trichophorum*  
 Zm - *Zoysia matrella*

 Area of *Eryngium vesiculosum*

**Figure 13**  
**Significant flora recorded at Deep Swamp**

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## Deep Swamp Biological Survey

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### MAMMALS

This survey represents the first systematic sampling of the mammal fauna of Deep Swamp.

In total 17 species of mammal (five introduced species) were either observed, trapped or their presence was recorded (Appendix 2).

Of the 12 species of native mammal recorded in the area, three of these are of conservation significance.

#### Species of particular interest

##### Red-necked Wallaby (*Macropus rufogresius*)

The Red-necked Wallaby has a wide distribution from southern Queensland through the temperate east coast of Australia to the south east of south Australia and Tasmania. At a national level this species is considered to be **common** with a distribution that has remained largely unchanged since European settlement (Calaby 1983). However, this species now exists in the larger remnants of native scrub left uncleared for agriculture, and at a state level and in the South East *M. rufogresius* is considered to be **rare** (Kemper and Queale 1990, Croft and Carpenter 1996). The Red-necked Wallaby was recorded in Fairview CP in January 1975, and at Kingston in 1994. Owens *et al* (1995a) reported the existence of a population at the "Deepwater" property south of Messent Conservation Park. Considering the relatively large size and intactness of the Deep Swamp fragment, and the status of the Red-necked Wallaby consideration must be given to ensure that the Deep Swamp population is not further fragmented. The presence of a drain may present a barrier to movement, depending on drain width and depth.

##### Koala (*Phascolarctos cinereus*)

Although the Koala has a wide distribution over much of eastern Australia, the distribution of this species has been declining due to a number of factors including habitat clearance and fragmentation and previously because of hunting. In South Australia, this species occurred naturally in the South East. However, this population became extinct in the 1930's, and Koalas have since been re-introduced to a number of locations including the South East, where in 1969 six Koalas were released at "Viviganie", north west of Lucindale (Robinson 1978). Presumably, the single Koala recorded during this survey, was an offspring of those released animals. The Koala is considered to be **potentially vulnerable** or **uncommon** at the national

level (Croft and Carpenter 1996) and **rare** in South Australia and the South East (Kemper and Queale 1990). As Koalas are regularly, but infrequently sighted in the South East, this record is of significance.

Koalas feed on the fresh leaves of a select number of Eucalypt species which are distributed patchily in Deep Swamp (eg. *Eucalyptus viminalis*). Koalas therefore must be locally mobile to exploit those resources. Although the Koala was recorded at DS03 (*E. diversifolia* dense mallee), which is considered uncharacteristic, this observation may be of an animal moving between feeding patches. Construction of a drain may negatively affect this species if it impedes their movement between feeding patches, and the dispersal of young. Patches of *E. viminalis* have currently been located on both sides of the proposed drain. The potential impediment of movement caused by the drain will depend on drain design.

##### Common wombat (*Vombatus ursinus*)

The Common Wombat is a nocturnal burrowing herbivore distributed from the northern border of New South Wales, south along the temperate coast to Salt Creek in South Australia. Although, this species has been undergoing a reduction in distribution since the Pleistocene, European settlement has exacerbated this decrease (Mc Ilroy 1983). Presently, in the south east of South Australia the Common Wombat exists in isolated populations on the eastern sides of dunes where sufficient cover, and perennial native grasses exist (Croft and Carpenter 1994, Owens *et al.* 1995a). Although the Common Wombat is considered to be **common** at the national level, it is considered **rare** in South Australia and in the South East (Kemper and Queale 1990, Croft and Carpenter 1996).

Evidence of Wombats were observed on both sides of the proposed drain route (refer to Figure 14). Drain construction should not directly affect any Wombats or their burrows, however, drain design must allow for the free movement of this species across the drain to ensure that the Deep Swamp population is not fragmented any further. Common Wombats have been known to investigate and turnover disturbed soil. Drain design and maintenance will need to take into consideration the potential for the Common Wombat to dig/burrow any disturbed soil associated with drain construction.

#### Other potential species

Despite application of the appropriate methodology to capture the suite of small mammals present at Deep Swamp, the resultant fauna list may not represent all of the fauna present. The following list of species has been compiled from museum records of specimens collected from around Deep Swamp and may exist at Deep Swamp but were not recorded during the survey.

##### Little Pygmy-possum (*Cercartetus lepidus*)

The Little Pygmy-possum is a small nocturnal inhabitant of open heath, open scrub and low woodland with a dense understorey. This species has a wide but disjunct distribution including Tasmania, Kangaroo Island and in a small area in the south east of South Australia. This species has been recorded at Messent CP (Owens *et al.* 1995), and both Fairview and Mt Scott CP which are less than 20km from Deep Swamp (refer to Site Map). Although this species is considered to be nationally **common**, the Little Pygmy-possum is considered to be **uncommon** (Watts 1990) or **rare** in the south east (Croft and Carpenter 1996).

##### Western Pygmy-possum (*Cercartetus concinnus*).

In both Fairview, and Mt Scott CP the Little Pygmy-possum co-occurs with the Western Pygmy-possum (*C. concinnus*). As a single specimen of a *C. concinnus* was found in a swimming pool (by a local land holder) on the periphery of Deep Swamp vegetation during the present survey, it is reasonable to expect the Western Pygmy-possum to occur in Deep Swamp also. The Western pygmy-possum is considered to be nationally **common**, and **common** in South Australia.

##### Eastern pygmy possum (*Cercartetus nanus*)

The Eastern Pygmy-possum (*C. nanus*) has a coastal distribution from southern Queensland to the south east of South Australia. In 1995 an Eastern Pygmy-possum was positively identified from Reedy Creek in South Australia, approximately 20 km south east of Deep Swamp. This record represents the western most edge of this species distribution and is therefore significant. The Eastern Pygmy-possum is considered to be **common** over Australia, and South Australia, but **rare** in the South East. Although, Croft and Carpenter (1996) suggest that their status should be reassigned to **endangered**. This species may potentially occur in Deep Swamp, and in other remnant blocks in the south east.

##### Sugar Glider (*Petaurus breviceps*)

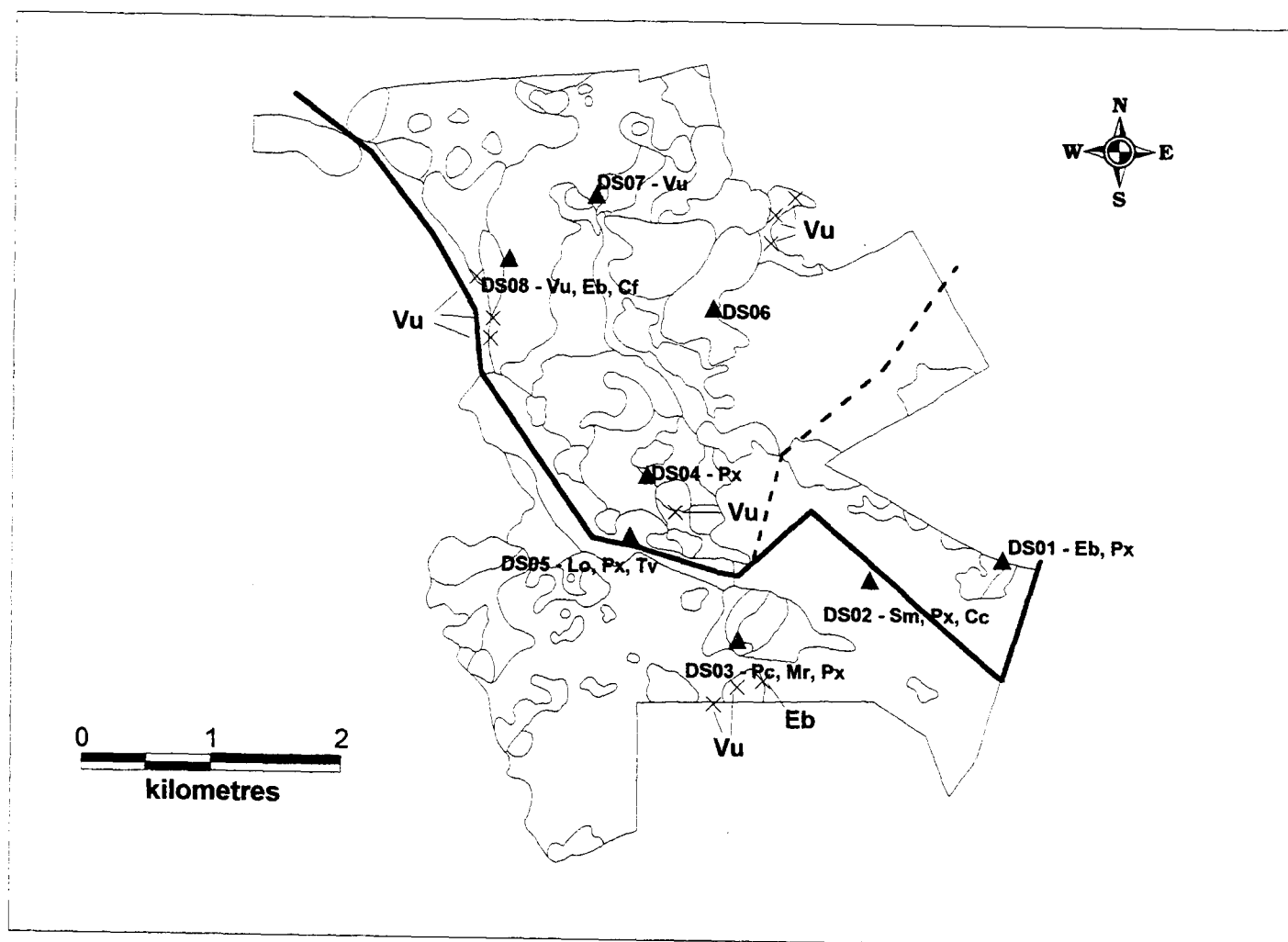
Although the Sugar Glider is considered **common** nationally, having a very wide distribution from northern Western Australia, through the eastern sea board, Tasmania and south eastern South Australia,

this species is considered to be **endangered** in South Australia and the South East region of South Australia (Kemper and Queale 1990, Croft and Carpenter 1996).

The closest known positive record for the Sugar Glider was from Padthaway in August 1931. However, the owner of "Alaman" (ten kilometres NE of Deep Swamp) recalls how approximately a decade previously, his cat brought home a Sugar Glider. Although, this record is dated, this species may still potentially exist in Deep Swamp but at levels too low to detect with the present methodology.

##### Silky Mouse (*Pseudomys apodemoides*)

The Silky-mouse is an inhabitant of the dry mallee-heath lands of north western Victoria, and eastern South Australia. The presence of this species is usually conspicuous because of the large spoil heaps created from burrow construction. Although this species has been recorded in Mt Scott CP and Fairview CP, no signs of this species were observed at Deep Swamp.



× areas where species have been observed opportunistically

### SPECIES CODE

#### **Birds**

<i>Cc</i> - <i>Calamanthus campestris</i>	(Western fieldwren)
<i>Cf</i> - <i>Calyptorhynchus funereus xanth.</i>	(Yellow tailed black cockatoo)
<i>Eb</i> - <i>Emblema bellum</i>	(Beautiful firetail)
<i>Lo</i> - <i>Lepoia ocellata</i>	(Mallee fowl)
<i>Px</i> - <i>Pardalotus xanthopygus</i>	(Yellow-rumped pardalote)
<i>Sm</i> - <i>Stipiturus malachurus</i>	(Southern emu-wren)
<i>Tv</i> - <i>Turnix varia</i>	(Painted button quail)

#### **Mammals**

<i>Mr</i> - <i>Macropus rufogresius</i>	(Red-necked wallaby)
<i>Pc</i> - <i>Phascogale carolinensis</i>	(Koala)
<i>Vu</i> - <i>Vombatus ursinus</i>	(Common wombat)

**Figure 14**  
**Significant fauna recorded at Deep Swamp**

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## Deep Swamp Biological Survey

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### BIRDS

A total of 92 species (4 introduced) were recorded either opportunistically or at the eight fauna sampling quadrats in Deep Swamp (Appendix 3). Ten species of birds of state conservation significance were recorded (Parker Horton and 1990). Of these, one species is currently Endangered, five species are Vulnerable and four are considered Uncommon.

#### Species of Significance Recorded Within Deep Swamp

##### Endangered Species

###### Mallee Fowl (*Leipoa ocellata*)

Mallee Fowl are a sedentary and territorial ground dwelling bird who build large conspicuous nests (approximately two metres in diameter and a metre tall) in which they incubate their eggs. This species inhabits mallee and eucalypt woodlands discontinuously from Western Australia to western New South Wales, and is declining throughout its range due to a number of factors including habitat clearance, fragmentation and introduced predators.

Although no individual birds or their mounds were observed during the survey, a relatively new feather was found at DS05 indicating the recent presence of the bird in the area. DS05 is situated in the *Melaleuca halmaturorum* Open Scrub on the periphery of the natural water course. As the route of the proposed drain has been suggested to follow this water course and pass through this area (Refer to Veg map), drain construction can be expected to negatively affect this species.

##### Vulnerable Species

###### Beautiful Firetail (*Emblema bellum*)

This species inhabits Eucalypt forest, heaths, swamps and farmland and has a coastal distribution from mid New South Wales to Yorke Peninsula, South Australia. The Beautiful Firetail forages for grass seeds and Casuarina seeds on the ground and is thought to be declining in numbers due to the effects of predation by cats, changes to fire regimes and habitat clearance (Blakers *et al.* 1984).

Individuals were recorded at both DS01 in the *Melaleuca uncinata* closed scrub and at DS08 in the *Eucalyptus arenacea* low woodland, both of which are on the northern side of the drain. As both of these sites

are away from the proposed drain route, this species should not be directly affected by drain construction. However, the cleared area created by the drain may prevent this species from crossing. This may be important considering that potential habitat exists for this species on the southern side of the drain as well.

###### Southern Emu-wren (*Stipiturus malachurus*)

This sub-species of Emu-wren is a sedentary inhabitant of swamps and dry heaths along the south eastern coast of Australia from southern Queensland to the south east of South Australia (Shodde 1983, Blakers *et al.* 1984). This species has been declining in numbers due to the effects of loss of habitat through clearing, grazing, fires and drainage of swamps (Tay 1992). Fragmentation of remaining habitat may cause further declines of the Southern Emu-wren. At present the south eastern sub-species of the Southern Emu-wren (*Stipiturus malachurus*) has been recorded at a number of Conservation Parks in the south east including, Messent CP, Gum Lagoon CP, Mt Scott CP, Big Heath CP, Mary Seymour CP and Piccaninnie Ponds CP

Although little is known of the ecology of the Southern Emu-wren, this species is thought to be territorial, have poor dispersal powers, and rely on the cover of a dense understorey (Schodde 1983, Tay 1992). Birds predominantly remain in cover and are unlikely to travel distances of greater than 20m in the open (pers comm. T. Little, J. Cutten).

The Southern Emu-wren was only recorded at site DS02 on the southern side of the existing shallow drain feeding Deep Swamp (which is also part of the proposed drain route: refer to Figure 14) in the *Melaleuca brevifolia* / *M. halmaturorum* Open Scrub and Low Woodland. It is not known whether the Southern Emu-wren occurs on both sides of the existing drain and whether or not this species currently crosses the drain. The width of the proposed drain would influence the movement of this species. Wider drains may inhibit the movement of individuals. However, cross-drain movements may be facilitated by revegetating any drain crossings.

###### Painted Button Quail (*Turnix varia*)

The Painted Button-quail is an inhabitant of Eucalypt forest, woodlands and heaths in the temperate areas of south eastern and south western Australia. In South Australia this species is largely confined to areas of native vegetation where leaf litter provides suitable

feeding habitat. The Painted Button-quail has been decreasing in abundance due to habitat clearance and the effects of introduced predators.

Although no individuals were observed, their conspicuous feeding scrapes were recorded at site DS05 in the *Melaleuca halmaturorum* open scrub and low woodland. The population of Painted Button-quail in Deep Swamp may be adversely affected by drain construction as the proposed drain route passes through this habitat for approximately two kilometres, separating the habitat in two.

**Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus xanthanotus*)**

This species is distributed from southern Queensland to the Eyre Peninsula in South Australia, and includes Tasmania also. This species undertakes local and seasonal movements (Blakers *et al.* 1984). In South Australia, the Yellow-tailed Black Cockatoo is thought to move between the Mount Lofty Ranges and the South East, where large numbers congregate to feed on Pine seeds and *Banksia* cones in the winter. This species is thought to be declining in numbers due to lack of breeding sites.

**Hylacola sp. (*Heathwren*)**

Two species of Hylacola occur in the vicinity of Deep Swamp, namely the Shy Heathwren (*Hylacola cauta*) and the Chestnut-rumped Hylacola (*Hylacola pyrrhopygia*) both of which are considered **Vulnerable**

at the state level. Positive identification of the species was not possible from the single call heard while sampling for birds at site DS01.

**Little Lorikeet (*Glossopsitta pusilla*)**

The Little Lorikeet is a nectivore who's distribution follows the flowering of Eucalypts. The south east of South Australia represents the most western distribution of this species. Once common in South Australia, this species is now rarely reported, and breeding has not been reported in recent years. Croft and Carpenter (1996) classify this species as **Vulnerable** at the state level and in the south east of South Australia.

**Peregrine falcon (*Falco peregrinus*)**

This species is distributed discontinuously over all of Australia where there is abundant bird life available for prey. This species was recorded at DS06 which is near Deep Swamp itself, which supports a range of prey species.

**Uncommon Species**

A number of bird species classified as **uncommon** in the South East where recorded including the Eastern Fieldwren (*Calamanthus fuliginosus*), the Golden Whistler (*Pachycephala pectoralis youngi*), the Peaceful Dove (*Geopelia placida*) and the Eastern Yellow Robin (*Eopsaltria australis*).

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## Deep Swamp Biological Survey

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### REPTILES AND AMPHIBIANS

A total of fourteen species of reptile and three species of frogs were recorded during the present survey (Appendix IV). Prior to the current survey, no research had been undertaken on the herpetofauna of Deep Swamp. However, museum records exist for both reptiles and frogs from Mt Scott and Fairview CP which are both within 20 km of Deep Swamp.

Although the suite of reptiles and amphibians recorded at Deep Swamp were very similar to those recorded from Mt Scott and Fairview CP, a further four species of reptiles and frogs were recorded in the Conservation Parks, and may therefore also occur in Deep Swamp but were not recorded. These species include the Bearded Dragon (*Pogona barbata*), the Lined Worm Lizard (*Aprasia striolata*), the Garden Skink (*Lampropholis guichenoti*), the Mallee Snake-eye (*Morethia obscura*), the Brown Tree Frog (*Litoria ewingi*), the Eastern Banjo Frog (*Limnodynastes dumerilli*), the

Burrowing Frog (*Neobatrachus sudelli*) and the Marbled Toadlet (*Pseudophryne semimarmorata*) (Refer to Appendix IV).

No conservation ratings have as yet been assigned to South Australian Reptiles or Amphibians (Edwards and Tyler 1990).

#### Species of particular interest in Deep Swamp

Rosenberg's Goanna (*Varanus rosenbergi*)

Rosenberg's Goanna occurs both on Kangaroo Island where it is abundant and in the south east of South Australia where the population is declining (Pers comm. M.Hutchinson). Owens *et al.* (1995) recorded the presence of this species at Messent CP

Addition of a shallow, slow flowing drain should not significantly affect this species as Goannas are capable of swimming.



## Conclusions and Recommendations

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The Deep Swamp wetlands and surrounding vegetation provide a diversity of habitats that support fourteen species of threatened plants (of state and regional significance), three species of mammal of conservation significance (national, state and regional level), ten species of birds of conservation significance (national, state and regional level) and one species of reptile considered to be declining in the south east.

Further, this area provides potential habitat for the nationally threatened Metallic Sun-orchid (*Thelymitra epipactoides*) as well as the Sugar Glider (*Petaurus breviceps*) which is endangered in South Australia, and the regionally uncommon Little Pygmy-possum (*Cercartetus lepidus*). The Deep Swamp vegetation complex therefore is of considerable conservation importance. These results are not surprising considering the relative size (550 ha) and intact nature of the swamp and surrounding vegetation.

Similarly to the conclusions reached by Best and Croft (1994) and the Biological Survey of Messent Conservation Park (Owens *et al.* 1995a) the proposed drain would potentially negatively affect a range of threatened flora and fauna species during drain construction and because the drain may create an effective barrier to the free movement of a number of mammals and small birds.

The following conclusions emanate from the results of the Biological Survey and are based on the assumption that the route shown on Figure 2 is followed :

### Potential Effects on the Flora Communities

1). The proposed drain route traverses 5.4 linear kilometres through the Deep Swamp area of which 3.4 km is vegetated. This would result in the clearance of approximately 13.8 ha (10.8 ha of the regionally rare *Melaleuca halmaturorum* open scrub) and 3 ha of the

rare (state and regional level) Prostrate Blue Devil (*Eryngium vesiculosum*)

2). It has been established that the present hydrological regime of the Deep Swamp wetlands is supporting a relatively healthy ecosystem. Any changes to the hydrology of the wetlands and fringe vegetation may negatively affect at least eight species of threatened plants.

3). Invasion of weeds associated with drain construction could negatively affect at least two species of threatened plants.

### Potential Effects on the Fauna Communities

4). Drain construction would result in the clearance of habitat for the nationally endangered Malleefowl, the Southern Emu Wren, and the Painted Button Quail.

5). Depending on drain design, the proposed drain may present an effective barrier to the free movement (including local movements and dispersal) of a range of small and large mammals (ie. Koala, Common Wombat, Red-necked Wallaby, Western Pygmy-possum) and a number of small birds (ie. Beautiful Firetail, Southern Emu-wren, Hylacola sp., Eastern Fieldwren, Painted Button Quail, Golden Whistler, and Eastern Yellow Robin).

6). Drain construction and presence should not significantly impact on the reptile community present at Deep Swamp.

7). The presence of a drain will create openings in the vegetation which will facilitate the movement of introduced predators (ie. Foxes and Cats) into the Deep Swamp vegetation. Increased access of introduced predators will negatively affect most fauna, especially small, sedentary, and ground dwelling species.

From the above it can be seen that the Deep Swamp wetlands and native vegetation are of high conservation value. The construction of a

drain through Deep Swamp will clearly have a negative impact on a number of threatened flora and fauna species, as well as a regionally rare vegetation type.

From a conservation standpoint, it would be preferable not to position the drain in this largely intact patch of remnant wetlands and native vegetation. However, if the decision is made to position the drain as depicted in Figure 2, then measures need to be taken to minimise environmental damage. Further, as this survey provides baseline data for an area where drains will be placed then the opportunity should be seized to study and monitor the impacts of the drain on the terrestrial and aquatic communities. This information will be invaluable in the planning and design of further drains which are proposed as part of the Upper South East Dryland Salinity and Flood Management Plan.

#### **Drain, Design and Construction**

Determining the affects of a ground water drain on the flora and fauna of an area was very difficult without first knowing the design and specifications (ie. width, depth, flow rate) of the proposed drain. The results of this Biological Survey should be included in the design phase to ensure that the drain does not fragment the remaining flora and fauna populations any further.

As suggested by Owens *et al* (1995a) sections of the proposed drain should be piped to allow fauna crossings. These fauna crossings are envisaged to consist of buried lengths of PVC tubing or concrete pipes. To be biologically effective, these sections should be as wide as practical and should be re-planted with vegetation to mimic the local habitat that had been cleared for drain construction. Owens *et al.* (1995a) recommended that at least ten percent of the proposed Messent CP drain would ensure biologically effective fauna crossings. On this assumption at least 540m of the proposed drain through Deep Swamp should be piped.

Location of these sections were not recommended in this report as the final position of the drain has not been decided. Consultation between members of DENR and the South Eastern Water Conservation and Drainage Board would therefore be required, if the piped sections were used in drain construction.

To minimise the impacts during drain construction, all excavated soil should be removed immediately and stockpiled. The removal of the spoil heap will discourage the invasion of weeds. Where practical all heavy machinery should be washed down before entrance to Deep Swamp to remove weed seeds and any soil potentially infected with the root pathogen *Phytophthora* sp.

Cleared areas would then require immediate revegetation to further decrease the risk of weed infestation and ameliorate the disturbance caused by clearance.

#### **Wetlands Management**

Transportation of saline ground water through the Deep Swamp area has the potential to destroy the wetlands environment if the water regime is not properly managed. To ensure that the Deep Swamp wetlands are maintained and possibly improved, the intercepted saline groundwater must not be allowed to enter the Deep Swamp wetlands complex. In addition, the "natural" water regime of the Deep Swamp wetlands needs to be maintained (ie. maintaining the appropriate frequency, duration and timing of water flows). This will facilitate the natural flow of surface waters north along the complex of wetlands of the Bakers Range Watercourse. Monitoring of the water quality, quantity and flow regimes would be required.

#### **Monitoring of the Biological Impact of the Proposed Drain**

The biological surveys of Messent CP (1995), Gum Lagoon CP (1995) and more recently Deep Swamp (1996) represent the first of many Biological Surveys to be undertaken as part of the "Upper South East Dryland Salinity and Flood Management Plan". These Surveys were undertaken using a modified version of the methodology used in the regional Biological Surveys, and therefore did not contain methodology for sampling or monitoring wetland environments.

To ensure that the maximum information is collected on the effects of the proposed drains on the biota of the South East, a standard, relatively simple but effective wetlands and surrounding habitat monitoring program needs to be developed. This methodology could then be included as an integral component of the proposed biological surveys of the South East.

The most appropriate body to develop this methodology should be interdisciplinary, including expertise in terrestrial and fresh water ecology, and hydrology.

In conjunction with the general monitoring proposed above, more specific monitoring of the affect of the proposed drain on the distribution and abundance of select indicator species of threatened flora and fauna present in Deep Swamp must be undertaken. This would entail mapping and/or permanently marking populations of threatened species and following their fate through time. This report recommends the permanent monitoring of the following species :

- Thin Pond Weed (*Potamogeton australiensis*)
- Malleefowl (*Lepoia ocellata*)
- Southern Emu Wren (*Stipiturus malachurus*)

Similarly, use of the fauna crossings should be monitored, comparing the movement of larger species to smaller species. The results of these studies would assist in the design of future fauna crossings. This type of monitoring may take the form of trapping and marking small mammals and birds, and larger mammals on both sides of the drain to determine any movements. Remotely triggered cameras have been successfully used to record animal movements (Carthew 1993b) and therefore may be used to establish whether animals were using the crossings.

Finally, as the present methodology may not have turned up all of the species present in Deep Swamp, caution should be exercised in all stages of drain location, design and construction. The Deep Swamp wetlands and native vegetation remnant is of high conservation significance, and it is therefore our responsibility to maintain this integrity.

## Resource Material and Bibliography

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### MAPS

1: 250 000 Topographic

Naracoorte	SJ 54 - 2	1988
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1: 50 000 Topographic

Marcollat	6924 - I	1982
Lucindale	6924 - II	1981
Minecrow	6924 - III	1982
Gyp Gyp	6924 - IV	1983

1: 50 000 Floristic Map

Floristic Vegetation Communities of the Southern  
Drainage Catchment

Produced by Department of Urban Development (DHUD),  
Geographic Analysis and Research Unit (GAR).

Produced using ESRI ARC/INFO

Geographic Information System, October 1995.

### AERIAL PHOTOGRAPHS

Photo composite covering Deep Swamp ST9 No :24477

1: 10,000

Svy: 4480      Date: 31/1/92

Photo numbers : 219, 262.

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## **Deep Swamp Biological Survey**

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# **Appendices**

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## **Appendix I**

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### **PLANT SPECIES RECORDED FROM DEEP SWAMP**

Plant taxonomy and nomenclature is in accordance with Jessop (1993). All common names were derived from Jessop and Toelken (1986) and/or the SA Flora database. All species have been listed alphabetically in order of Family. Exotic species have been marked with an asterisk (\*).

Scientific Name	Common Name	Sites							
		DS01	DS02	DS03	DS04	DS05	DS06	DS07	DS08 Opport.
<b>ADIANTACEAE</b> <i>Cheilanthes austrotenuifolia</i>							+		
<b>BORAGINACEAE</b> <i>Cynoglossum australe</i> <i>Heliotropium curassavicum</i>	Australian hounds tongue smooth heliotrope			+	+		+		+
<b>CAMPANULACEAE</b> <i>Pratia platycalyx</i> <i>Wahlenbergia gracilentia</i>	annual bluebell	+	+		+			+	
<b>CARYOPHYLLACEAE</b> <i>*Spergularia media</i>	coast sand-spurry		+				+		
<b>CASUARINACEAE</b> <i>Allocasuarina muelleriana</i> <i>ssp. muelleriana</i>	common oak-bush	+							
<b>CENTROLEPIDACEAE</b> <i>Centrolepis aristata</i> <i>Centrolepis polygyna</i> <i>Centrolepis strigosa</i>	pointed centrolepis wiry centrolepis hairy centrolepis	+	+				+		
<b>CHENOPODIACEAE</b> <i>*Atriplex prostrata</i> <i>Enchyllaena tomentosa</i> <i>var. tomentosa</i> <i>Sarcocornia quinqueflora</i>	mat saltbush ruby saltbush beaded samphire		+					+	
<b>COMPOSITAE</b> <i>Angianthus preissianus</i> <i>*Aster subulatus</i> <i>Brachycome exilis</i> <i>*Carduus tenuiflorus</i> <i>*Cirsium vulgare</i> <i>Cotula vulgaris var. australasica</i> <i>Diitrichia graveolens</i> <i>Euchiton gymnocephalus</i>	salt cup-flower wild aster slender daisy slender thistle spear thistle stinkwort creeping cudweed		+				+		
			+	+			+	+	+
			+		+			+	

Scientific Name	Common Name	DS01	DS02	DS03	DS04	DS05	DS06	DS07	DS08	Opport.
<i>Helichrysum scorpioides</i>	button everlasting								+	
<i>Hypochoeris glabra</i>	smooth catsear	+			+	+	+		+	
* <i>Leontodon taraxacoides</i>										
<i>ssp. taraxacoides</i>	lesser hawkbit						+			
<i>Senecio glomeratus</i>	swamp groundsel	+	+					+		
<i>Senecio picridioides</i>	purple-leaf groundsel			+						
<i>Senecio tenuiflorus</i>	woodland groundsel								+	
* <i>Sonchus oleraceus</i>	common sow-thistle			+				+		
<i>Vittadinia gracilis</i>	wooly New Holland daisy						+			
CONVOLVULACEAE										
<i>Dichondra repens</i>	kidney weed			+			+			
<i>Wilsonia rotundifolia</i>	round-leaved wilsonia		+							
CYPERACEAE										
<i>Baumea arthropophylla</i>	bare twig-rush									+
<i>Baumea juncea</i>	black bristle-rush				+			+		
<i>Chorizandra enodis</i>	smooth cutting-grass	+			+					
<i>Gahnia filum</i>			+							+
<i>Isolepis cernua</i>	coarse club-rush		+							
<i>Isolepis marginata</i>	knobby club-rush				+			+		
<i>Isolepis nodosa</i>	black rapier-sedge								+	
<i>Lepidosperma carphoides</i>	spreading sword-sedge	+		+						
<i>Lepidosperma concavum</i>	sticky sword-sedge	+						+		
<i>Lepidosperma viscidum</i>	matted bog-rush									
<i>Schoenus breviculmis</i>	shiny bog-rush	+				+				
<i>Schoenus nilens</i>										
DENNSTAEDTIACEAE										
* <i>Pteridium esculentum</i>	bracken fern				+				+	
DILLENIACEAE										
<i>Hibbertia riparia (glabriuscula)</i>	guinea-flower	+			+					
<i>Hibbertia sericea</i>	silky guinea-flower			+					+	
<i>Hibbertia sericea</i>										
<i>var. scabrifolia</i>	rough-leaf guinea-flower				+					



Scientific Name	Common Name	DS01	DS02	DS03	DS04	DS05	DS06	DS07	DS08	Opport.
<b>DROSERACEAE</b> <i>Drosera peltata</i>	pale sundew	+				+				
<b>EPACRIDACEAE</b> <i>Astroloma humifusum</i> <i>Brachyloma ciliatum</i> <i>Brachyloma ericoides</i> <i>ssp. ericoides</i> <i>Leucopogon clelandii</i> <i>Leucopogon ericoides</i> <i>Leucopogon virgatus</i> <i>Monotoca scoparia</i>	native cranberry fringed brachyloma brush heath Cleland's beard-heath pink beard-heath common beard-heath broom heath	+			+			+		
<b>EUPHORBIACEAE</b> <i>Poranthera microphylla</i>	small poranthera		+							
<b>GENTIANACEAE</b> <i>*Centaurium spicatum</i> <i>*Centaurium tenuiflorum</i>	spike centuary branched centaury		+			+				
<b>GERANIACEAE</b> <i>Pelargonium rodneyanum</i>	magenta pelargonium					+			+	
<b>GOODENIACEAE</b> <i>Goodenia blackiana</i> <i>Selliera radicans</i>	native primrose shiny swamp-mat	+	+							
<b>GRAMINEAE</b> <i>Agrostis avenacea</i> <i>var. avenacea</i> <i>Agrostis aemula</i> <i>Aira caryophyllea</i> <i>Aira elegantissima</i> <i>ssp. elegantissima</i>	fairy grass blown grass silvery hair-grass delicate hair-grass		+				+			+



# LAURACEAE

*Cassytha melantha*

large dodder-laurel

+

## Scientific Name

## Common Name

DS01 DS02 DS03 DS04 DS05 DS06 DS07 DS08 Opport.

# LEGUMINOSAE

*Acacia longifolia* var. *sophorae*

coastal wattle

+

+

+

+

*Acacia pycnantha*

golden wattle

+

*Acacia spinescens*

spiny wattle

+

*Acacia verticillata*

prickly Moses

+

*Bossiaea prostrata*

creeping bossiaea

+

*Pultenaea tenuifolia*

narrow-leaf bush-pea

+

# LILIACEAE

*Arthropodium fimbriatum*

nodding vanilla-lily

+

*Arthropodium strictum*

commom vanilla-lily

+

*Burchardia umbellata*

milkmaids

+

*Chamaescilla corymbosa*

blue squill

+

var. *corymbosa*

black-anther flax-lily

+

*Dianella revoluta* var.

small mat-rush

+

*Lomandra nana*

sword mat-rush

+

*Lomandra sororia*

bridle creeper

+

\**Myrsiphyllum asparagoides*

rush fringe-lily

+

*Thysanotus juncifolius*

twining fringe-lily

+

*Thysanotus patersonii*

heath yacca

+

*Xanthorrhoea caespitosasand-*

+

# LOGANIACEAE

*Mitrasacme paradoxa*

wiry mitrewort

+

# LORANTHACEAE

*Amyema melaleucae*

tea-tree mistletoe

+

*Amyema miquelii*

box mistletoe

+

# LYTHRACEAE

<i>Lythrum hyssopifolia</i>	lesser loosestrife	+								+
<b>MENYANTHACEAE</b>										
<i>Villarsia reniformis</i>	running marsh-flower									+
<b>MYRTACEAE</b>										
<i>Calytrix tetragona</i>	common fringe-myrtle	+								+
<b>Scientific Name</b>	<b>Common Name</b>	<b>DS01</b>	<b>DS02</b>	<b>DS03</b>	<b>DS04</b>	<b>DS05</b>	<b>DS06</b>	<b>DS07</b>	<b>DS08</b>	<b>Opport.</b>
<i>Darwinia micropetala</i>	small darwinia	+							+	
<i>Eucalyptus arenacea</i>	sand stringybark									
<i>Eucalyptus camaldulensis</i>	red gum					+	+			
var. <i>camaldulensis</i>	coastal white mallee	+	+							
<i>Eucalyptus diversifolia</i>	pink gum	+	+		+					
<i>Eucalyptus fasciculosa</i>	blue gum			+	+					
<i>Eucalyptus leucoxylon</i> ssp.	manna gum									+
<i>Eucalyptus viminalis</i>	muntries				+					
<i>Kunzea pomifera</i>	prickly tea-tree							+		
<i>Leptospermum continentale</i>	heath tea-tree				+					
<i>Leptospermum myrsinoides</i>	short-leaf honey-myrtle	+	+							
<i>Melaleuca brevifolia</i>	slender honey-myrtle									+
<i>Melaleuca gibbosa</i>	swamp paper-bark		+							
<i>Melaleuca halmaturorum</i>	dryland tea-tree					+	+			
<i>Melaleuca lanceolata</i>	broombush	+								
<i>Melaleuca uncinata</i>										
<b>ONAGRACEAE</b>										
<i>Epilobium billardierianum</i>	smooth willow-herb							+		
ssp. <i>billardierianum</i>										
<i>Epilobium billardierianum</i>	variable willow-herb		+							
ssp. <i>cinereum</i>										
<b>ORCHIDACEAE</b>										
<i>Caladenia</i> sp.		+				+				
<i>Prasophyllum</i> sp.		+						+		+
<i>Thelymitra</i> sp.		+			+					





## Weeds Found on Existing Shallow Spoil Heap

Scientific Name	Common Name
<b>COMPOSITAE</b>	
<i>Arctotheca calendula</i>	Capeweed
<i>Cirsium vulgare</i>	spear thistle
<i>Dittrichia graveolens</i>	stinkwort
<i>Hypochaeris glabra</i>	smooth catsear
<i>Sonchus asper</i>	prickly sow-thistle
<i>Sonchus tenerrimus</i>	clammy sow-thistle
<b>GRAMINEAE</b>	
<i>Avena</i> sp.	
<i>Bromus hordeaceus</i>	soft brome
<i>Critesion maritimum</i>	sea barley
<i>Pennisetum clandestinum</i>	kikuyu
<i>Phalaris paradoxa</i>	paradoxa canary-grass
<i>Polypogon</i>	annual beard-grass
<i>Vulpia</i> sp.	
<b>LABIATAE</b>	
<i>Mentha pulegium</i>	pennyroyal
<b>LEGUMINOSAE</b>	
<i>Melilotus indica</i>	King Island melilot
<i>Trifolium campestre</i>	hop clover
<i>Trifolium fragiferum</i>	strawberry clover
<b>POLYGONACEAE</b>	
<i>Rumex crispus</i>	curled dock
<b>SCROPHULARIACEAE</b>	
<i>Verbascum virgatum</i>	twiggy mullein

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## Deep Swamp Biological Survey

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# Appendices

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### Appendix II

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#### MAMMAL SPECIES RECORDED FROM DEEP SWAMP

Mammal taxonomy follows Kemper and Queale (1990).

Introduced species are indicated with an asterisk (\*).

Comments on particular species are indicated in the annotations to the list.

Only state conservation ratings are shown in bold following the scientific name, regional ratings were only given in the results section. State conservation ratings have been taken from Kemper and Queale (1990).

The definition for the status codes are as follows:

**E** Endangered: taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating.

**V** Vulnerable: taxa believed likely to move into endangered category in the near future if the causal factors continue operating.

**R** Rare: taxa with small populations in South Australia that are not at present endangered or vulnerable, but are at risk.

In addition Watts (1990) also used the categories Uncommon for species not considered at risk. The definition for this category follows:

**U** Uncommon: taxa occurring in relatively low numbers in South Australia, but not rare.

All species considered common, and therefore not at immediate risk have not been labelled



Scientific Name	Common Name	1	2	3	4	5	6	7	8	Opport
<b>BOVIDAE</b>										
<i>Bos taurus</i> (1)	Cattle					+				+
<b>BURRAMYIDAE</b>										
<i>Cercartetus concinnus</i> (2)	Western Pygmy-possum									+
<b>CANIDAE</b>										
* <i>Vulpes vulpes</i> (3,4)	Fox				+	+		+	+	+
<b>CERVIDAE</b>										
* <i>Cervus dama</i> (3)	Fallow Deer									+
<b>LEPORIDAE</b>										
* <i>Oryctolagus cuniculus</i> (1,3)	Rabbit	+	+	+	+	+	+	+	+	+
<b>MACROPODIDAE</b>										
<i>Macropus fuliginosus</i> (3)	Western Grey Kangaroo	+	+	+	+	+	+	+	+	+
<i>Macropus rufogriseus</i> (5) R	Red-necked Wallaby			+						+
<b>MURIDAE</b>										
* <i>Mus domesticus</i> (6)	House Mouse		+		+					
<b>PETAURIDAE</b>										
<i>Trichosurus vulpecula</i> (3)	Common Brushtail-possum									+
<b>PHASCOLARCTIDAE</b>										
<i>Phascolarctos cinereus</i> (5) R	Koala			+						
<b>TACHYGLOSSIDAE</b>										
<i>Tachyglossus aculeatus</i> (1,4)	Short-beaked Echidna	+			+		+	+	+	
<b>VESPERTILIONIDAE</b>										
<i>Chalinolobus gouldii</i> (7)	Gould's Wattled Bat							+		
<i>Chalinolobus morio</i> (7)	Chocolate Wattled Bat							+		
<i>Mormopterus planiceps</i> (7)	Little Mastiff Bat							+		
<i>Nyctophilus geoffroyi</i> (7)	Lesser Long-eared Bat							+		
<i>Vespadelus regulus</i> (7)	King River Eptesicus							+		
<b>VOMBATIDAE</b>										
<i>Vombatus ursinus</i> (1,8) V	Common Wombat							+	+	+

- (1) Recorded from scats found at sampling sites.  
(2) This specimen was found in a swimming pool, one week after the survey, approximately 800 m south west of DS08.  
(3) Observed during spotlighting

- (4) Recorded from tracks found.  
(5) Observed during the day.  
(6) Caught in Elliott traps at a sampling quadrat.  
(7) Caught in a Harp trap.  
(8) Burrows found.

# Appendices

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## Appendix III

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### BIRD SPECIES RECORDED FROM DEEP SWAMP

Species are arranged in alphabetical order of Family using the taxonomy and nomenclature of Parker and Horton (1990). The following list includes all birds observed in the sampling quadrats as well as those recorded opportunistically. The presence of each bird species at the sampling sites is indicated by a cross at the site number. For convenience, the sampling sites have been abbreviated such that sampling site DS01 is represented in the table as site 1. Introduced species are preceded with an asterisk (\*). Only state conservation ratings are shown in bold following the scientific name, regional ratings were only given in the results section. State conservation ratings have been taken from Kemper and Queale (1990).

The definition for the status codes are as follows:

**E** Endangered: taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating.

**V** Vulnerable: taxa believed likely to move into endangered category in the near future if the causal factors continue operating.

**R** Rare: taxa with small populations in South Australia that are not at present endangered or vulnerable, but are at risk.

In addition Watts (1990) also used the category Uncommon for species not considered at risk. The definition for this category follows:

**U** Uncommon: taxa occurring in relatively low numbers in South Australia, but not rare.

All species considered common, and therefore not at immediate risk have not been labelled.

Scientific Name	Common Name	1	2	3	4	5	6	7	8	Opport.
<b>ACCIPITRIDAE</b>										
<i>Accipiter cirrhocephalus</i>	Collared Sparrow hawk						+			
<i>Accipiter fasciatus</i>	Brown Goshawk					+		+		+
<i>Aquila audax</i>	Wedge-tailed Eagle									+
<i>Circus approximans</i>	Swamp Harrier									+
<b>ANATIDAE</b>										
<i>Anas gracilis</i>	Australasian Grey Teal							+		
<i>Anas rhynchotis</i>	Blue-winged Shoveler							+		
<i>Anas superciliosa</i>	Pacific Black Duck							+		
<i>Cygnus atratus</i>	Black Swan									+
<i>Tadorna tadornoides</i>	Mountain Duck									+
<b>ARDEIDAE</b>										
<i>Ardea novaehollandiae</i>	White-faced Heron							+		
<b>CASUARIIDAE</b>										
<i>Dromaius novaehollandiae</i>	Emu	+	+		+	+		+	+	
<b>CHARADRIIDAE</b>										
<i>Elsyornis melanops</i>	Black-fronted Dotterel							+		
<i>Hoplopterus miles</i>	Masked Plover							+		
<b>CLIMACTERIDAE</b>										
<i>Cormobates leucophaea</i>	White-throated Treecreeper				+				+	
<b>COLUMBIDAE</b>										
<i>Geopelia placida</i>	Peaceful Dove (U)							+		
<i>Phaps chalcoptera</i>	Common Bronzewing			+			+	+	+	
<i>Phaps elegans</i>	Brush Bronzewing		+	+					+	
<b>CORVIDAE</b>										
<i>Artamus cyanopterus</i>	Dusky Woodswallow	+								
<i>Colluricincla harmonica</i>	Grey Shrikethrush	+					+	+	+	
<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike				+			+		
<i>Corvus mellori</i>	Little raven					+	+	+	+	
<i>Corvus tasmanicus</i>	Forest Raven		+			+	+	+	+	
<i>Cracticus torquatus</i>	Grey Butcherbird	+	+				+			
<i>Grallina cyanoleuca</i>	Magpie-lark						+			
<i>Gymnorhina tibicen</i>	Australian Magpie	+	+	+			+		+	
<i>Pachycephala pectoralis</i>	Golden Whistler (U)	+		+	+				+	
<i>Pachycephala rufiventris</i>	Rufous Whistler			+			+			
<i>Rhipidura fuliginosa</i>	Grey Fantail	+		+	+	+	+	+	+	
<i>Rhipidura leucophrys</i>	Willie Wagtail					+	+	+		
<i>Strepera versicolor</i>	Grey Currawong									
<b>DACELONIDAE</b>										
<i>Halcyon sancta</i>	Sacred Kingfisher									+
<b>EOPSALTRIIDAE</b>										
<i>Daphoenositta chrysoptera</i>	Sittella				+					
<i>Drymodes brunneopygia</i>	Southern Scrub-robin (check dist)	+				+	+	+		
<i>Eopsaltria australis</i>	Eastern Yellow-robin (U)	+		+	+	+	+		+	
<i>Petroica multicolor</i>	Scarlet Robin					+				

Scientific Name	Common Name	1	2	3	4	5	6	7	8	Opport
<b>FALCONIDAE</b>										
<i>Falco berigora</i>	Brown Falcon									+
<i>Falco longipennis</i>	Little Falcon									+
<i>Falco peregrinus</i>	Peregrine Falcon						+			
<b>FRINGILLIDAE</b>										
* <i>Carduelis carduelis</i>	Gold Finch			+	+			+		
<b>HIRUNDINIDAE</b>										
<i>Hirundo neoxena</i>	Welcome Swallow	+						+		
<i>Hirundo nigricans</i>	Tree Martin							+		
<b>MALURIDAE</b>										
<i>Malurus cyaneus</i>	Superb Blue Wren	+	+	+				+		
<i>Malurus lamberti</i>	Varigated Wren				+					
<i>Stipiturus malachurus</i>	Southern Emu Wren (V)		+							
<b>MEGAPODIIDAE</b>										
<i>Leipoa ocellata</i>	Malleefowl (E)					+				
<b>MELIPHAGIDAE</b>										
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	+					+			
<i>Anthochaera carunculata</i>	Red wattlebird	+		+	+		+	+	+	
<i>Anthochaera chrysoptera</i>	Little Wattlebird			+					+	
<i>Ephthianura albifrons</i>	White-fronted Chat	+								
<i>Gliciphila melanops</i>	Tawny-crowned Honeyeater		+		+	+				
<i>Meliphaga chrysops</i>	Yellow-faced Honeyeater			+						
<i>Meliphaga leucotis</i>	White-eared Honeyeater	+		+						
<i>Meliphaga penicillata</i>	White-plumed Honeyeater	+					+	+		
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	+			+					
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	+		+	+	+		+	+	
<b>MOTACILLINAE</b>										
<i>Anthus novaeseelandiae</i>	Richard's Pipit									+
<b>MUSCICAPIDAE</b>										
* <i>Turdus merula</i>	Blackbird							+		
<b>PARDALOTIDAE</b>										
<i>Acanthiza apicalis</i>	Inland Brown Thornbill						+			
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill									+
<i>Acanthiza lineata</i>	Striated Thornbill				+				+	
<i>Acanthiza pusilla</i>	Brown Thornbill	+	+		+	+	+		+	
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill			+	+					
<i>Calamanthus fuliginosus</i>	Eastern Fieldwren (U)		+							
<i>Hylacola sp.</i>	Heathwren species (V)	+								
<i>Pardalotus striatus</i>	Eastern Striated Pardalote								+	
<i>Pardalotus punctatus</i>	Spotted Pardalote									+
<i>Pardalotus xanthopygus</i>	Yellow-rumped Pardalote (V)	+		+	+	+				

Scientific Name	Common Name	1	2	3	4	5	6	7	8	Opport
<i>Sericornis frontalis</i>	Spotted Scubwren	+	+		+	+	+		+	
<i>Smicrornis brevirostris</i>	Brown Weebill				+				+	
PASSERIDAE										
<i>Emblema bellum</i>	Beautiful Firetail (V)	+							+	
<i>*Passer domesticus</i>	House Sparrow									+
PHASIANIDAE										
<i>Coturnix novaezealandiae</i> <i>pectoralis</i>	Stubble Quail									+
PODARGIDAE										
<i>Podargus strigoides</i> <i>strigoides</i>	Tawny Frogmouth	+				+				+
PODICIPEDIDAE										
<i>Tachybaptus</i> <i>novaezealandiae</i>	Black-throated Grebe				+				+	
POMATOSTOMIDAE										
<i>Pomatostomus superciliosus</i>	White-browed Babbler			+	+		+	+		
PSITTACIDAE										
<i>Barnardius zonarius</i> <i>barnardi</i>	Mallee Ring-neck				+					
<i>Calyptorhynchus funereus</i> <i>xanthanotus</i>	Yellow-tailed Black Cockatoo (V)								+	
<i>Eolophus roseicapillus</i>	Galah									+
<i>Glossopsitta concinna</i>	Musk Lorikeet				+	+	+	+	+	
<i>Glossopsitta</i> <i>porphyrocephala</i>	Purple-crowned Lorikeet	+	+		+		+	+	+	
<i>Glossopsitta pusilla</i>	Little Lorikeet						+	+		
<i>Platycercus elegans elegans</i>	Crimson Rosella (U) ??			+	+				+	
<i>Platycercus eximius</i>	Eastern Rosella								+	
<i>Psephotus haematonotus</i>	Red-rumped Parrot							+	+	+
SCOLOPACIDAE										
<i>Tringa nebularia</i>	Greenshank									+
STURNIDAE										
<i>*Sturnus vulgaris</i>	Starling		+					+		
THRESKIORNITHIDAE										
<i>Platalea regia</i>	Royal Spoonbill									+
<i>Threskiornis aethiopicus</i>	Sacred Ibis									+
<i>Threskiornis spinicollis</i>	Straw-necked Ibis									
TURNICIDAE										
<i>Turnix varia varia</i>	Painted Button-quail (V)					+				
ZOSTEROPIDAE										
<i>Zosterops lateralis</i>	Silvereye	+	+	+	+	+			+	

## Deep Swamp Biological Survey

# Appendices

### Appendix IV

#### REPTILE AND AMPHIBIAN SPECIES RECORDED FROM DEEP SWAMP

Reptile taxonomy follows Edwards and Tyler (1990), however all common names are those proposed by Hutchinson (in prep.). Species have been listed alphabetically in order of Family. The conservation

status of the following reptile species has not been listed as no formal conservation status for reptiles has been established.

Scientific Name	Common Name	Sites								Opport.
		1	2	3	4	5	6	7	8	
AGAMIDAE										
<i>Amphibolurus norrisi</i>	Mallee Tree-dragon									+
<i>Pogona vitticeps</i>	Central Bearded Dragon									+
CHELIDAE										
<i>Chellodina longicollis</i>	Common Long-necked Tortoise							+		
ELAPIDAE										
<i>Austrelaps superbus</i>	Copperhead		+							
<i>Notechis scutatus</i>	Tiger Snake			+						
<i>Pseudonaja textilis</i>	Eastern Brown Snake									+
LEPTODACTYLIDAE										
<i>Crinea signifera</i>	Brown Froglet						+		+	
<i>Lymnodynastes tasmaniensis</i>	Marbled Frog									+
<i>Neobatrachus pictus</i>	Burrowing Frog							+		
SCINCIDAE										
<i>Bassiana duperreyi</i>	Eastern Three-lined Skink	+								
<i>Ctenotus robustus</i>	Eastern Striped Skink			+	+		+		+	
<i>Hemiergis peronii</i>	Four-toed Earless Skink	+	+	+	+	+				
<i>Lampropholis delicata</i>	Delicate Skink			+	+				+	
<i>Lerista bougainvillii</i>	Bougainville Skink				+				+	
<i>Tiliqua rugosa</i>	Shingle-back	+								+
<i>Tiliqua scincoides</i>	Eastern Blue Tongue	+	+							
VARANIDAE										
<i>Varanus rosenberg</i>	Rosenberg's Goanna	+								+

# VEGETATION COMMUNITIES - DEEP SWAMP



Note : Selection of base colour for primary and secondary units does not indicate dominance of any of the component vegetation types.






## Plant Communities associated with calcareous ridges

Primary Units	Secondary Units	
		<i>Eucalyptus camaldulensis</i> Open forest
		<i>Eucalyptus leucosylon</i> Woodland
		<i>Eucalyptus fasciculosa</i> Low woodland
		<i>Eucalyptus diversifolia</i> Dense mallee
		<i>Melaleuca uncinata</i> Closed scrub

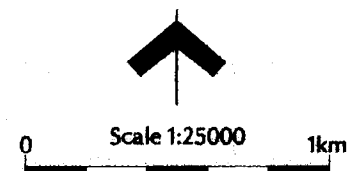
## Plant communities associated with sandy rises

		<i>Eucalyptus arenacea</i> Low woodland
		<i>Eucalyptus fasciculosa</i> Low open-forest

## Areas subject to seasonal waterlogging or inundation

	<i>Melaleuca brevifolia</i> Open-scrub	
		<i>Melaleuca halmaturorum</i> Open-scrub and Low woodland
		<i>Myriophyllum verrucosum</i> , <i>Lilaeopsis polyantha</i> , <i>Selliera radicans</i> Herbland
		<i>Eucalyptus camaldulensis</i> Open-forest

	Sites
	Vegetation community boundaries
	Proposed drainage route
	Unsealed road, two lanes
	Unsealed road, one lane
	Vehicle track
	Non access linear feature drains, powerlines
	Cadastre



Produced by : INFORMATION AND DATA ANALYSIS BRANCH  
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Department of Housing and Urban Development  
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Data Analysis : ESRI Arc/Info Geographic Information System  
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ENVIRONMENTAL &  
SOCIO-ECONOMIC  
DATABASES