# A PRELIMINARY ASSESSMENT OF THE NATURAL VALUES OF THE SOUTH BUNBURY TO CAPEL COASTAL CORRIDOR

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# SUMMARY

## INTRODUCTION

The South Bunbury to Capel Coastal Corridor is formed by

- a large area of over 550ha of naturally vegetated (after Beeston *et al.* 2001) Quindalup Dunes and
- the contiguous eastern wetland chain

between the Maidens and Minninup Beach (Map 1).
The Coastal Corridor contains the largest most southern vegetated remnant of the Quindalup Dunes on the Swan Coastal Plain. The majority of the contiguous eastern wetland chain, around 250ha is naturally vegetated (after Beeston *et al.* 2001). An area open water in this chain is known as Muddy Lake. To the east the Coastal Corridor is contiguous with areas of naturally vegetated Spearwood Dunes.

The South Bunbury to Capel Coastal Corridor contains areas of privately owned land, some of which is proposed for Regional Open Space (DGBRS) and an area of reserved land. Both the currently reserved land, the Maidens and the land proposed for reservation, Muddy Lake ROS and Daleyellup ROS, have been recognised for reservation on the basis of their natural values (DCE 1983 and DBRS 1998 respectively). The natural values of the Coastal Corridor have been identified in a series of regional studies and several area specific studies. However, while these studies have identified that the Coastal Corridor has high natural value, the studies do not contain sufficient information to adequately assess the area specific values at a regional scale or to determine the most adequate boundaries of a reserved and/or protected area to conserve the area's substantial natural value. As a consequence

## NATURAL VALUES

### *INTRODUCTION*

This section considers published and unpublished regional and specific area information together with information from field survey. The survey work was performed over two days in June 2002 by BJ Keighery, GJ Keighery and S Santich. A series of transects were walked to observe the range of plant communities mapped by Tingay (1991) and compare these with current aerial photographs. Some plant voucher material was collected. The information from the various sources is discussed and preliminary conclusions made as to the regional significance of the particular attribute.

### *LANDFORM AND SOILS*

#### Description

The South Bunbury to Capel Coastal Corridor is located on the Swan Coastal Plain where the predominant landforms are

- a large area of over 550ha of naturally vegetated (after Beeston *et al.* 2001) Quindalup Dunes and

- the contiguous eastern wetland chain

between the Maidens and Minninup Beach (Map 1). bordered on the east by a contiguous wetland chain; the Dalyellup and Muddy Lakes (.

A series of other studies also map the soils and landforms of the Coastal Corridor. These are outlined below

- The most recent mapping for the area is that by the Department Agriculture land capability group (GIS dataset). That study describes the Coastal Corridor as lying within the Quindalup and Spearwood Dune Systems. The landforms and soils are described for each System, being:
    - Quindalup Dune landforms as being 'discrete long-walled parabolic dunes' (Qp2) and 'deflation basin' (Qd) with the soils of the dunes being deep pale cream calcareous and the basins moderate deep to deep alkaline calcareous sands over limestone pavement; and
    - Spearwood Dunes (the wetland area) landforms as being 'swales and depressions' (S3, S3b the unit actually mapped has no code given) with soils being acidic sand over loamy sand .

- The Urban Geology Series (Anon. 1981) map the area as being of Holocene age, the Quindalup Dunes being 'Safety Bay Sand' and the eastern wetlands 'swamp deposits mainly peaty sands'.

- Churchward and McArthur (1980) map Holocene sands in the Quindalup Dunes, but the large eastern wetland area is mapped in the Vasse System. That is the eastern wetland area is considered to be 'poorly drained plains with variable undifferentiated estuarine and marine deposits'.

- Semeniuk (1998) places the wetlands as an area of 'contact between Holocene Dunes and Pleistocene Dunes' being formally an 'estuarine basin now subject to groundwater hydrology and perching of direct precipitation' with the stratigraphy of the soils being 'friable ferricrete and peat overlying muddy sand (peat & clay) and estuarine'. Within the Quindalup Dunes three damplands (after Semeniuk 1987) the soils are peaty sands.

**Table 1:** Landform and soils of the South Bunbury to Capel Coastal Corridor showing the relationship between geomorphological units, units identified in the Environmental Geology Maps and soils described on these maps. Column One can be used to cross-reference to groups shown in Table 1a Bush Forever Volume 2, Part B.

| **Major Geomorphological Systems after McArthur and Bettenay, (1960); *Detailed Geomorphological Units (after Churchward and McArthur, 1980)** | **Major Units in the Environmental Geology Maps (after various authors)** | **Soils associated with each unit** |
|---|---|---|
| Quindalup Dunes: Quindalup | Safety Bay Sands | white calcareous sands, sometimes limestone deposits |

| | | |
|---|---|---|
| Wetlands - Quindalup Dunes (not applicable) | Holocene lagoonal/swamp deposits | peats associated with clays, sands and silts in various proportions, dark grey and brown silts with shells and shell fragments and limestone (marl) |

**Discussion**

On the basis of the regional information and field observations the Coastal Corridor contains three significant landforms. These are:

- Quindalup Dunes - The take the form of a series of parabolic Quindalup Dunes with moderate relief and form the largest most southern band of such dunes on the Swan Coastal Plain.
- Wetlands. - Two types of wetlands are identified.

  Quindalup Dune Swale Damplands

  A series of damplands are found between the ridges of the Dunes and appear to be surface expressions of the ground water. A north-south gradient is apparent in these wetlands. To the north, in the Maidens, the damplands are relatively small in area, found in only several locations and are in the most inland dune swales (Ecoscape 2002) while those to south (west of Muddy Lake) are range from small in the near coastal swales to relatively large on the inland dune swales. and found in most swales (less common in the near coastal swales). These wetlands are much more extensive than previously mapped. The soils of these wetlands are variable being humus rich sands., peaty sands and sandy clays with calcareous fragments

  Quindalup/Spearwood Dune Interface Sumplands and Lakes

  The description from Semeniuk (1998) which places these wetlands as an area sumpland and lake in the area of 'contact between Holocene Dunes and Pleistocene Dunes' being formally an 'estuarine basin now subject to groundwater hydrology and perching of direct precipitation' with the stratigraphy of the soils being 'friable ferricrete and peat overlying muddy sand (peat & clay) and estuarine' is considered the most accurate description of these wetlands. The peat layer is substantial and in at least one location (east side of Daleyellup Lake area) is over 1m in thick.

This landscape appears to be unique on the Swan Coastal Plain. The only other location where there is sequence of dunes and wetlands associated with the Quindalup Dunes and their interface with the Spearwood Dunes is in the Rockingham area. However, the Rockingham sequence is associated with the Beach Ridge Plain rather than parabolic dunes.

***WETLANDS***

**Description**

***Wetland Types*** (Semeniuk 1998)

Dampland, sumpland and lake wetland types are mapped within the Coastal Corridor. The largest wetland is a sumpland containing a smaller area of lake (corresponds approximately with the area of open water called Muddy Lake). Five small damplands are located within the Quindalup Dunes.

***Consanguineous suite*** (Semeniuk 1998)

The sumpland and lakes in the Coastal Corridor are mapped as the Minninup Suite, the characteristics are described under wetland types and in the landforms and Soils section. Damplands within the Quindalup Dunes are from the XX Suite.

***Wetland Management Objective*** (Semeniuk 1998)
The area of sumpland north of the XX Drain (artificial channel for the XX Brook), except for Lot VV, is mapped as Conservation Category, the reminder of the sumpland and lake being Multiple Use. Damplands within the Quindalup Dunes are from the XX category.

***Lake's EPP*** (Government of WA 1992)
Two areas are mapped as Swan Coastal Plain Lakes under the EPP, a section of the sumpland near its northern extremely and a area of sumpland and lake around Muddy Lake to the south.

**Discussion**
This is covered under the vegetation section.

## *VEGETATION*

### Description

***Regional Vegetation Maps*** (1 250 000 scale)
Vegetation Types (Smith 1974) and Vegetation Complexes (Heddle *et al.* 1980) are mapped for the Coastal Corridor. Both studies map areas of wetland and upland in the Coastal Corridor. Smith identifies areas of woodland dominated by Tuart (*Eucalyptus gomphocephala*) or *Agonis flexuosa* and coastal shrublands. Heddle *et al.* (1980) maps two vegetation complexes in the area, the Quindalup Complex and the Vasse Complex (see Table 2). While these studies give an indication of what is the type of vegetation may be encountered in the corridor the mapping is only useful for broad comparisons.

**Table 2: Vegetation complexes (Heddle *et al.*, 1980) and area remaining as native vegetation (Beeston et al. 2001 GIS) on the Quindalup Dunes and wetlands**

| Vegetation Complex | Native Vegetation (ha) |
|---|---|
| **Quindalup Dunes** | |
| QUINDALUP COMPLEX: Coastal dune complex consisting mainly of two alliances - the strand and foredune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *Melaleuca lanceolata* - *Callitris preissii* and the closed scrub of *Acacia rostellifera.* | 555 |
| **Wetlands** | |
| VASSE COMPLEX : Mixture of the closed scrub of *Melaleuca* species fringing woodland of *E. rudis* - *Melaleuca* species and open forest of *E. gomphocephala* - *E. marginata* - *E. calophylla.* | 250 |

***Floristic Community Types*** (Gibson *et al.* 1994, DEP 1996)

**Table 3: Floristic Community Types in the Maidens and adjacent bushland and Hay Park (identified in Gibson *et al.*, 1994, and in the System 6 and Part 1 Update DEP, 1996)**

**Key**

**Column 1: Plot Codes**

**Column 2: Floristic Community Type Codes**
The numbers of the types additional to Gibson *et al.* (1994) are italicised if they are subsets of an existing group (in types 19, 20, 23 and 30) and italicised and preceded by an S if they are supplementary groups.

**Column 3: Source of plot data**

| | |
|---|---|
| SCP | Gibson *et al.* (1994) |
| SYS6ENV1/SYS6ENV2 | DEP (1996) |

## Column 4: Bushland Area

| | | | |
|---|---|---|---|
| **Supergroup 2 - Seasonal Wetlands** | | | |
| Hay01 | 08 | SYS6ENV2 | Hay Park, Bunbury |
| Hay02 | 17 | SYS6ENV2 | Hay Park, Bunbury |
| Hay05 | 18 | SYS6ENV2 | Hay Park, Bunbury |
| Hay03 | s05 | SYS6ENV2 | Hay Park, Bunbury |
| Hay04 | s05 | SYS6ENV2 | Hay Park, Bunbury |
| **Supergroup 4 - Uplands centred on Spearwood and Quindalup Dunes** | | | |
| **Spearwood Dunes** | | | |
| #Gmaid01 | 25 | SYS6ENV2 | C70 South Bunbury coastal land (The Maidens) and adj bushland |
| #Gmaid02 | 25 | SYS6ENV2 | C70 South Bunbury coastal land (The Maidens) and adj bushland |
| Gmaid03 | 25 | SYS6ENV2 | C70 South Bunbury coastal land (The Maidens) and adj bushland |
| Gmaid04 | 25 | SYS6ENV2 | C70 South Bunbury coastal land (The Maidens) and adj bushland |
| Nmaid05 | 25 | SYS6ENV2 | C70 South Bunbury coastal land (The Maidens) and adj bushland |
| **Quindalup Dunes** | | | |
| BMaid02 | 29a | SYS6ENV2 | C70 South Bunbury coastal land (The Maidens) and adj bushland |
| Nmaid01 | 29a | SYS6ENV2 | C70 South Bunbury coastal land (The Maidens) and adj bushland |
| Nmaid03 | 29a | SYS6ENV2 | C70 South Bunbury coastal land (The Maidens) and adj bushland |
| Nmaid04 | 30b | SYS6ENV2 | C70 South Bunbury coastal land (The Maidens) and adj bushland |

### *Specific Area Vegetation Maps*

Mapping of vegetation and/or descriptions of areas of the Coastal Corridor from aerial photography and ground truthing has been done by Tingay (1991), Hart Simpson and Asocs. (19XX), DEP (1996), Bischoff (1996), Ecoscape (2002) and this study.

On the basis of these studies the vegetation of the Coastal Corridor can be initially divided according to the landform elements described in the previous section. The vegetation of these units is described below.

Uplands - Quindalup Dunes

A series of vegetation associations are distinguished on the parabolic dunes. These are summarised Table 3 and Map 2a and 2b. Broad descriptions of the units derived form the tallest stratum are given in the studies and it is expected that a larger number of upland units could be identified if all strata were considered and/or units with limited distribution were also mapped. For example Tingay discusses but does not map the following units:

- the stable low foredune community dominated by *Spinifex longifolius*; *and*
- areas with stunted Peppermint and Tuart.

**Table 3: Upland vegetation associations**

Column 1 Description of vegetation unit
Column 2 Symbols from Map 2a after Ecoscape (1991)
Column 3 Symbol of unit mapped by Tingay (1991) and this study. Letters are from Tingay. The letters are annotated (d) and/or (w) to indicate that the units occur in upland areas and/or wetlands respectively. Letters with no annotation do not have a wet and dry unit.
Column 4 Units not mapped by either study in need of mapping.

| | | | |
|---|---|---|---|
| *E. gomphocephala*/*A. flexuosa* Forest | | **E (d)** | |
| *Acacia cochlearis*/*Jacksonia furcellata* Heath | | **J** | |
| *Acacia cochlearis*/*Jacksonia furcellata* Heath with *Scaevola paludosa* common | | **K** | |
| *Scaevola crassifolia*/*Diplolaena dampieri*/*Hemiandra pungens* Heath | | **L** | |
| *Agonis flexuosa* Scrub | | **M (d)** | |
| *E. gomphocephala* Mallee | | | # |
| *Agonis flexuosa* Mallee | | | # |
| *Olearia axillaris*/*Scaevola crassifolia* Health | | **R** | |
| *Spinifex/Olearia* | | | # |
| Bare to unstable sand dunes | | **U** | |
| Cleared | | **X** | |

Wetlands

*Quindalup Dune Swale Damplands*

Significantly more wetlands of this wetland group have been located than those mapped by in the landform and soils mapping (Anon 1981, ), the wetland mapping (Semeniuk 1998) and the regional and specific area mapping (see Table 4 and Maps 2a and 2b). It appears that wetland units, damplands, have developed in many of the swales, particularly those to the east and south. These wetlands are dominated by a series of species. Some of these species occur on both the ridges and slopes of the dunes as well as in the wet swales. These species include:

Understorey wetland species

Shrubs *Xanthorrhoea preissii, Acacia saligna, Calycopeplus* oligandrus

Herbs/Ferns: *Pteridium esculentum, Dichondra repens*
Sedges: *Baumea juncea, Gahnia trifida, Lepidosperma* aff. *squamatum* (BJK&GJK XX), *Isolepis nodosus, Lepidosperma angustatum*
Overstorey wetland species
Trees: *Eucalyptus gomphocephala, Agonis flexuosa, Acacia saligna, Banksia littoralis*
Overstorey wetland and/or upland species
Trees/shrubs: *Eucalyptus gomphocephala, Agonis flexuosa*

*Quindalup/Spearwood Dune Interface Sumplands and Lakes*
This wetland area has been mapped by all previous studies in the area. However these studies and the only known specific area mapping for these wetlands (Tingay 1991) have
(i) underestimated the extent of the wetland as there are significant unmapped areas of the western wetland 'tongues' of that are bordered on two sides by steep Quindalup Dunes; and
(ii) inadequately described the variety of vegetation units in the sumpland there being a variety of trees, shrubs and sedges within the area mapped as *Typha orientalis*/*Juncus pallidus* Sedgeland (Unit Tingay 1991).
As a consequence the vegetation of the sumpland is more complex than previously mapped. Table 4 lists the original units mapped as well as additional identified in this study. The species observed in these units included the following:

- Trees/shrubs: *Acacia saligna, Banksia littoralis, Melaleuca rhaphiophylla*, ?*Melaleuca preissiana, Rhabdinothamnus anceps, Calycopeplus oligandrus*
- Sedges: *Baumea articulata, B.* ?*juncea, *Typha orientalis, T. domingensis, Juncus pallidus, Lepidosperma* ?*effusum, L. gladiatum , Carex appressa, Carex fasciculata, C. tereticaulis, Schoenoplectus* pungens, *Schoenoplectus* validus, *Gahnia trifida*
- Herbs: *Centella asiatica, Sonchus hydrophilus*

*Typha* is present but there appears to be both *Typha orientalis* and *T. domingensis* in the sedgeland area. in patches but *Juncus* is uncommon, many other species in a mosaic.

**Table 4: Wetland vegetation associations**

| | |
|---|---|
| Column 1 | Description of vegetation unit |
| Column 2 | Symbols from Map 2a after Ecoscape (1991) |
| Column 3 | Symbol of unit mapped by Tingay (1991) and this study. Letters are from Tingay. The letters are annotated (d) and/or (w) to indicate that the units occur in upland areas and/or wetlands respectively. Letters with no annotation do not have a wet and dry unit. |
| Column 4 | Units not mapped by either study in need of mapping. |

| **Wetland** | | | |
|---|---|---|---|
| *E. rudis*/*Melaleuca preissiana* Woodland | | **G** | |
| *E. rudis*/*E. calophylla*/*A. flexuosa*/*M. preissiana* Woodland | | **H** | |
| *Banksia littoralis*/*Xanthorrhoea preissii* Shrubland | | **L** | |
| *Agonis flexuosa* Scrub | | **M** | |
| *Melaleuca rhaphiophylla* Scrub | | **N** | |
| *Typha orientalis*/*Juncus pallidus* Sedgeland | | **O** | |
| *Acacia saligna* Scrub | | **Q** | |
| *Isolepis nodosus*/*Lepidosperma angustatum* Sedgeland | | **T** | |
| Tuart over *Lepidosperma angustatum* and *Gahnia trifida* | * | | |

| | | | |
|---|---|---|---|
| Sedgeland | | | |
| | | | |
| *Melaleuca rhaphiophylla* Low Forest | | | # |
| Wetland Rises dominated by *Acacia saligna, Banksia littoralis, Melaleuca rhaphiophylla,* ?*Melaleuca preissiana, Rhabdinothamnus anceps, Calycopepalus oligandrus* and/or combinations of these over sedges | | | # |
| Cleared wetland | | P | |
| | | | |
| **Wetland and/or upland** | | | |
| *E. gomphocephala*/*A. flexuosa* Forest | | **E** | |
| *Agonis flexuosa* Scrub | | **M** | |
| *E. calophylla*/*Agonis flexuosa* Forest | | **V** | |

***Discussion***

Uplands

Tuart significant, largest Quindalup Tuart remnant left Plain and most southern. Both Tuart tree - forest and Woodland as well as mallee formation. Tingay emphasised value of Tuart area as well as condition. Not equivalent to Spearwood Tuart, f-different vegetation units.

Wetlands

and Very complex system, need to map , identify variation. At present the entire Corridor regionally significant and worthy of protection. . These wetlands are dominated by a series of species. Some of these species occur on both the ridges and slopes of the dunes as well as in the wet swales. The presence of stunted Peppermint and Tuart are also discussed by Tingay but these units are not mapped. Tuart of particular interest as this is most extensive area of Mallee Tuart known on the SCP.

*Threatened Ecological Communities* (after English and Blyth 1997 and as updated by CALM

None identified

***Threatened Species***

None identified.

**Background**

The existing known information for the Muddy Lake Proposed ROS has been considered to better identify the core natural values of the area.

**Specific Area Attributes**

***Broad Natural values***

- Contiguous linked vegetated areas of the Quindalup and Vasse Complexes (Heddle *et al.*, 1980).

- A diverse mosaic of vegetation units (see Map 1, after ATA 1991) in variable condition, from completely degraded to excellent (interpretation of ATA 1991).
- A diverse mosaic of wetland units (see Map 1, after ATA 1991), management categories varying from Conservation to Multiple Use (see Map 2, after Hill *et. al*, 1996),
- Wetland boundaries appear to go beyond those shown in the WRC database (see Maps 1 and 2), especially within the Quindalup Dunes, these wetlands are intact and would be Conservation Category.
- EPP Lake (goes beyond the boundaries in the ROS)

***Description of the Area***

**Structural Units**: limited survey (Map 1, after ATA 1991, DEP 2002 edge inspection)

Uplands – *Acacia cochlearis* / *Jacksonia furcellata* Heath; *Agonis flexuosa* Scrub. *Eucalyptus gomphocephala*/ *Agonis flexuosa* Forest with *E. marginata* and *Banksia attenuata* sub-dominant.

Wetlands – *Eucalyptus rudis* Woodland to Forest, *Acacia saligna* Scrub; *Banksia littoralis* / *Xanthorrhoea preissii* Shrubland; *Melaleuca rhaphiophylla* Scrub; *Melaleuca viminea* Scrub; *Typha orientalis* / *Juncus pallidus* Sedgelands.

**Vegetation Condition:** Natural Condition (trees and understorey largely intact) to Understorey Grazed (ATA 1991).

Vegetation Condition
should be mapped or recorded using standard terminology (Government of WA 2000b)

Total Flora
including total flora (level of survey should be indicated), significant flora (DRF, priority taxa, range extensions, species at geographic limits etc.)

***FAUNA***

The vertebrate species occurring in the region are relatively well known from general publications, and references therein, especially Storr (1991), Storr and Johnstone (1998) and Serventy and Whittell (1976) for birds and How *et al*. (1987) for ground vertebrates. However there is little specific information available on current assemblages in different remnant vegetation remaining in the region. Information on the fauna of some specific sites within the area is available in unpublished reports especially Bow (1999), Dell *et al*. (2002) and ATA (1998).
As indicated by Shortridge (1936) and How *et al*. (1987, 1993) there have been dramatic changes in the vertebrate assemblages in coastal parts of the South-west as a result of impacts from European colonisation. Little is known about the current status and conservation requirements of most faunal species in the region.

The current distribution of many bird species especially those that are listed in Table 15 in Bush Forever as habitat specialists with a reduced distribution on the Swan Coastal Plain or which are wide-ranging species with reduced populations on the Swan Coastal Plain is poorly known in the region. This is a significant issue in biodiversity conservation on this part of the Coastal Plain as there have been marked reductions in range and population levels of many sedentary bird species as a consequence of disturbance and land clearing

The role of different remnants in the region in facilitating seasonal movement of birds and the role of remnants in facilitating long-term genetic movement between populations is yet to be determined.

***Threatened Faunal Species***

A number of Threatened faunal species and Priority Faunal species are known from the south Bunbury to Capel coastal corridor but no detailed surveys have been conducted to determine their current distribution or conservation significance in different remnants in the study area.

The Bunbury Skink, *Glaphyromorphus ' koontoolasi'* is currently unnamed. It is listed as Priority 1 on CALM's Priority Fauna list. Priority 1 listed species need urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. The taxonomic status of the Bunbury Skink was assessed by Aplin and Dell (1998) who determined that it was specifically distinct from the Southern Mulch Skink, *G. gracilipes* . Despite recent searches in the Bunbury region (Aplin ) no extant population has been discovered. This species was known to previously occur in low-lying or swampy areas and it could occur at Muddy Lakes or similar areas.

The Quokka, *Setonix brachyurus,* is listed on Schedule 1 of the Wildlife Conservation Act 1950 as fauna that is rare or likely to become extinct and is currently ranked as Vulnerable by the Threatened Species Consultative Committee. It is known to occur at Muddy Lakes. Road kill specimens have been collected recently e.g. a skull was sent to the Western Australian Museum in 1975 and other specimens are recorded in the Museum observational database. Carcases have been brought into CALM in Bunbury sporadically up until about two years ago. ATA (1991) did not refer to the Museum database but referred to "persistent observation records from Muddy Lake by local people but which has not been positively confirmed in the area". The current status of the Quokka at Muddy Lakes and other sites in the study area is yet to be determined.

Other Threatened or Priority fauna Species that are currently still known from and could have significant populations in the study area include the Quenda, *Isoodon obesulus,* Western Ringtail Possum, *Pseudocheirus occidentalis,* Baudin's Cockatoo, *Calyptorhynchus baudinii,* Carpet Python, *Morelia spilota,* and Western Brush Wallaby, *Macropus irma.*

An assessment of the conservation values to fauna of remnant bushland in the south Bunbury to Capel coastal corridor needs to assess the total fauna present (level of survey should be indicated), faunal assemblages in different remnants, significant fauna (including Threatened Fauna, Specially Protected Fauna, Priority Fauna, range extensions, species at geographic limits, species with reduced distributions or species which are wide-ranging but with reduced populations). The role of ecological linkages between remnants and reserve areas and other adjacent bushland areas needs to be addressed.

**Discussion**

Some need to consider values as there is debate over the location of the ROS boundary and the need for protection for this area. preliminary assessment of background information for the Muddy lake area led to

- Part of a broad freshwater wetland chain from the Maidens to Wonnerup (Hill *et. al*, 1996).

-Regionally significant mosaic of upland and wetland units of the Quindalup Complex and freshwater wetland units of the Vasse Complexes.
-Wetlands in this geomorphic position are unusual (between Quindalup and Vasse Complexes and within Quindalup) on the Swan Coastal Plain.
- The wetland vegetation unit; *Banksia littoralis* / *Xanthorrhoea preissii* Shrubland, is of particular interest as a similar vegetation unit, Floristic Community Type 19 ( English and Blyth, 1997; Gibson *et. al* 1994) is a threatened ecological community of national significance (subject to the EPBC Act ). Other wetland units may be of similar significance.

values of the Maidens area has focussed on being part of the South Bunbury Bushland Corridor, a regionally significant corridor of landform/vegetation/flora from coast to the Preston River. values of part of the north south corridor not as appreciated as well as the wetland chain in the Coastal Corridor.

To better identify the regional and national significance of the wetland chain and associated uplands and identify appropriate protection the following is required:
- map/verify current vegetation type and condition from Maidens to Wonnerup
- identify wetland and upland floristic community types, particularly in the Quindalup complex, through north-south and east west transects of the vegetation.

**REFERENCES**
# The mapping information in these studies is available in a GIS format.

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**APPENDIX 1: Vegetation Associations or Formations Mapped in Tingay (1991).**

Tingay (1991) used 1 : 10 0000 aerial photography and ground survey to map 21 vegetation associations and two cleared units as listed below and shown in Map 1. Twelve of these vegetation units occur within the Coastal Corridor (bold units).

A. *Eucalyptus gomphocephala*/*Agonis flexuosa* Forest with *E. marginata and Banksia attenuata* sub-dominant
B. As above but with *E. calophylla* included
C. *E. gomphocephala* / *A flexuosa*/*Acacia saligna* Forest
D. *Banksia attenuata* Woodland
**F. *E. gomphocephala*/*A. flexuosa* Forest**
G. *E. marginata*/*E. calophylla*/*Banksia attenuata* Woodland
**H. *E. rudis*/*Melaleuca preissiana* Woodland**
**I. *E. rudis*/*E. calophylla*/*A. flexuosa*/*M. preissiana* Woodland**
**J. *Banksia littoralis*/*Xanthorrhoea preissii* Shrubland**
**K. *Acacia cochlearis*/*Jacksonia furcellata* Heath**
**L. As above with *Scaevola paludosa* common**
**M. *Scaevola crassifolia*/*Diplolaena dampieri*/*Hemiandra pungens* Heath**
**N. *Agonis flexuosa* Scrub**
**O. *Melaleuca rhaphiophylla* Scrub**
**P. *Typha orientalis*/*Juncus pallidus* Sedgeland**
**Q. Cleared wetland**
**R. *Acacia saligna* Scrub**
**S. *Olearia axillaris*/*Scaevola crassifolia* Health**
**T. *Isolepis nodosus*/*Lepidosperma angustatum* Sedgeland**
U. *Melaleuca viminea* Scrub
**V. Bare to unstable sand dunes**
**W. *E. calophylla*/*Agonis flexuosa* Forest**
**X. Cleared**

**MAP 2a: Vegetation of the Maidens area after Ecoscape 2002**

**MAP 2b: Vegetation of the Daleyellup Lakes to Minninup Road area after Tingay (1991) and this study.**