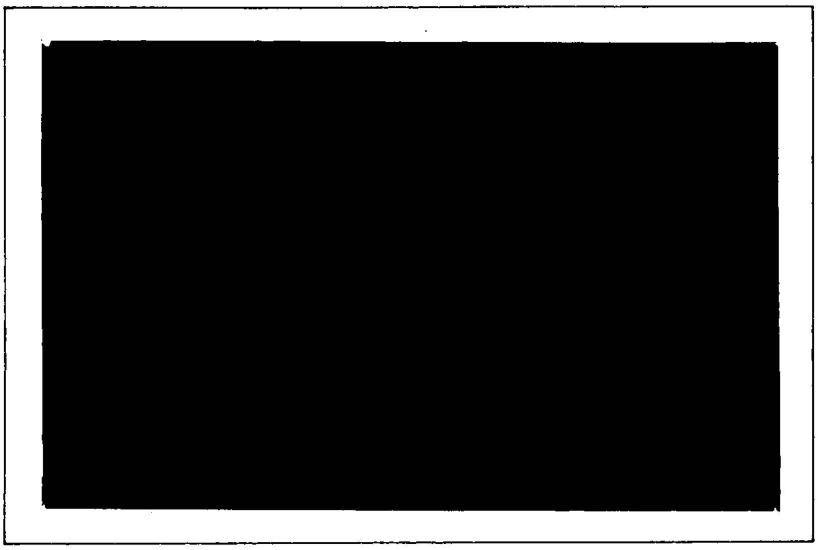

DEPARTMENT OF ENVIRONMENT AND PLANNING

~~Wildlife~~
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TONY ROBINSON

BIOLOGICAL SURVEY OF THE COOPER CREEK ENVIRONMENTAL ASSOCIATION (8.4.4), NORTH EASTERN SOUTH AUSTRALIA

by

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December, 1984

BIOLOGICAL SURVEY OF THE COOPER CREEK ENVIRONMENTAL ASSOCIATION (8.4.4) NORTH-EASTERN SOUTH AUSTRALIA

Prepared for the:
Survey and Research Section
National Parks and Wildlife Service Division
Department of Environment and Planning
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1984

PREFACE

This report is an early stage in the development of a systematic biological survey of South Australia based on the environmental subdivisions of the State derived by Laut et al (1977). The survey is built around a programme of standardised point related sampling of the vegetation and vertebrate fauna together with the compilation of all available biological inforamtion on the study area.

The Cooper Creek Environmental Association was chosen for study because of the areas great significance as one of Australia's major inland wetland regions. It is sufficiently large and complex to act as a good test for the development of techniques of data collection and analysis which will be equally applicable over the remaining arid areas of South Australia.

Field work was carried out between September and November 1983 and this report was submitted by the consultant team in December 1984. The survey to this point has been completely supported by a National Estate Grant to the Survey and Research Section, National Parks and Wildlife Service of South Australia.

Other pilot biological surveys in South Australia are being carried out in the South Coast Environmental Region (field work completed April 1983). The Nullarbor Plain Environmental Region (field work completed September 1984) and the Gawler Uplands Environmental Region (field work to commence September 1985). From these studies of four widely divergent parts of the state a series of standardised approaches to data collection, storage and analysis will be developed leading to a dramatic increase in the bilogical understanding of this State and providing a solid foundation on which to base decisions on the best methods of conserving large and truely representatative natural areas in South Australia.

The present report contains a large amount of raw data as it was the consultants main task to gather information in a systematic way representing a sample of the range of biological variation within the Cooper Creek Environmental Association. More raw data such as the base maps used on the survey, and the standard data sheets with information from the 27 sites surveyed are held by the Survey and Research Section N.P.W.S. and are available for examination by anyone interested in this information.

In addition to carrying out a large proportion of the field survey the consultants have produced the detailed land system classification of the Cooper Creek Environmental Association embodied in this report. While this may not necessarily be the final approach adopted for presentation of the results of the Biological Survey of South Australia it is the first detailed attempt to continue the heirachy proposed by Laut et al (1977) to the level of "habitats". Any comments on this or any other aspect of the following consultancy report would be welcome and should be addressed to:-

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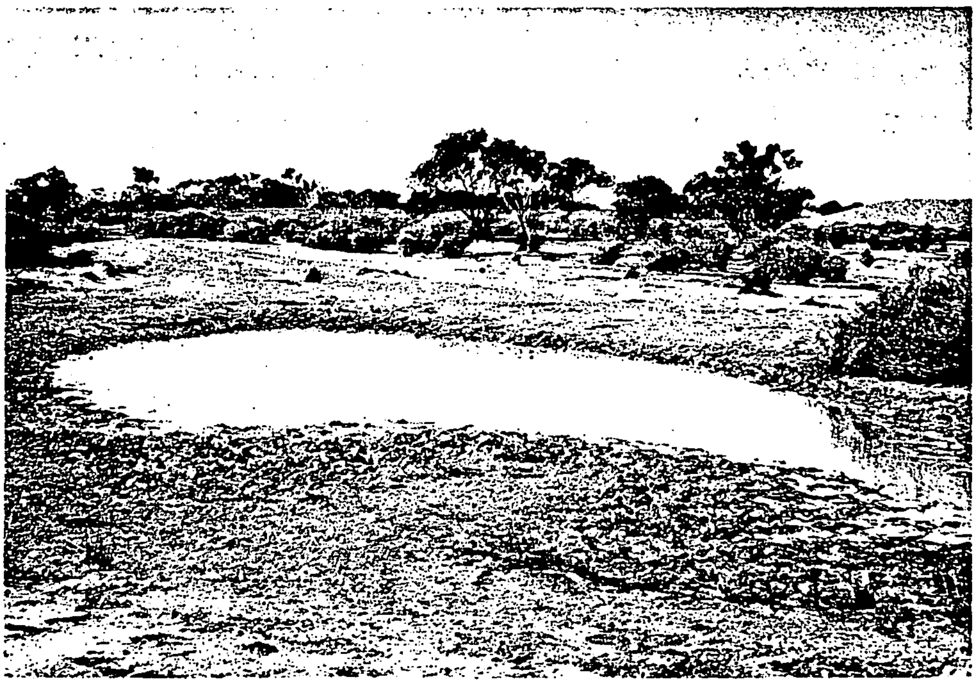
FRONTISPIECE

" Unfortunately the aspect of the country has been much changed since it has been taken up and stocked " (White, 1917b).



Cattle puddling 9 km north of Mundil Bore.

AIM

The aim of this survey was to document the range of habitats and associated fauna in the Cooper Creek Environmental Association, 8.4.4, North-eastern South Australia.

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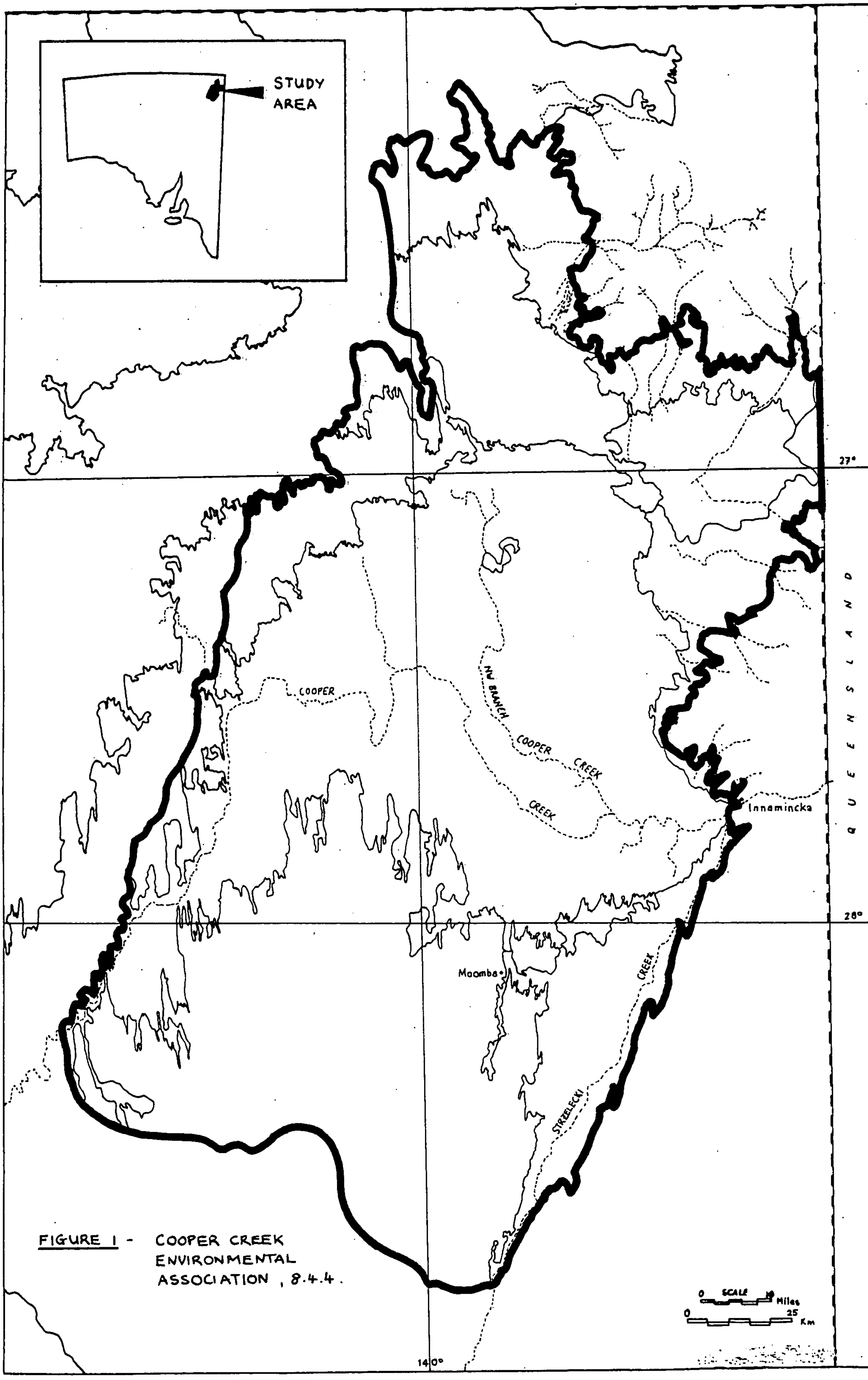


FIGURE 1 - COOPER CREEK ENVIRONMENTAL ASSOCIATION, 8.4.4.

1. INTRODUCTION

1.1 THE STUDY AREA

Cooper Creek Environmental Association, 8.4.4 (see Fig. 1), is centred on the Cooper Creek floodplain, lying west of Innamincka and east of the Birdsville Track. Containing areas of floodplain, dunefield and gibber plain, the Environmental Association has an area of 27 050 km^2 (Laut et al., 1977), about half the size of Tasmania.

In 1977, Laut et al., using Landsat remote sensing techniques as an aid, subdivided South Australia into various Environmental regions, associations and units based on landform criteria. Environmental associations such as 8.4.4 represent the combination of a limited number of Environmental units and are unique mapping areas (Laut et al., 1977).

Cooper Creek originates as the Barcoo and Thomson Rivers on the Great Divide in central Queensland and drains into Lake Eyre in north-eastern South Australia. Having a drainage area of 296 000 km^2, it is the largest of the seven river systems together which comprise the vast (1 170 000 km^2) and end-orheic Lake Eyre Drainage Basin (Australian Water Resources Council, 1976).

In South Australia the main channel of the creek carries water annually between April and July to about as far as Cuttapirie Corner Waterhole on the main channel and Coongie Lake on the North-West Branch. Its gradient averages 3-4 cm per kilometre to the east of Innamincka, but decreases to less than 0.5 cm per kilometre to the west in the broad floodout area of the Cooper Creek floodplain (Wopfner, 1970). Its course, which in some places e.g. Malagarga (Qld) spreads over a width of more than 50 km, consists of a wide expanse of braided, leveed channels (Wopfner, 1970), and is marked generally by a string of isolated waterholes. In times of extreme flow (a level 3 flood - see Section 2.4.2.6), which occur rarely at irregular intervals (Wopfner, 1970), with examples in recent times being in 1949/50 (Bonython, 1955) and 1974 (Douglas, 1980), the Cooper and its distributaries become inundated to a width of 30 km (Australian Water Resources Council, 1976) at which times large volumes of sediment are carried downstream and over the land surface.

The waters of the Cooper Creek are generally described as fresh (Australian Water Resources Council, 1976), but in some areas the channel passes through areas of saline groundwater or rock strata containing connate salts (Johnson, 1980); however, these sections have a negligible effect on the otherwise fresh-water.

The immediate area of the Cooper Creek Environmental Association was first visited by white man during the Sturt Expedition of 1844-46 (Black, 1917), at which time the first specimen of the Night Parrot *Geopsittacus occidentalis* was collected (by John McDouall Stuart near Lake Goyder on October 15 1845 - Forshaw, 1981). A.C.Gregory and the ill-fated Burke and Wills Expedition followed in 1858 and 1860, respectively, while one section of 8.4.4, the Strzelecki Track, was founded and became infamous when in 1871 Captain Starlight used it to bring stolen cattle from Queensland to the Adelaide markets (S.A. Govt. Tourist Bureau, 1983). Prior to these early European explorations, aboriginal man had occupied the area for a considerably longer period, as evidenced by the presence of shell middens, artefacts and extensive stone arrangements in some parts. Four tribes are known to have occupied the area (Tindale, 1974), and the Dieri and Jandruwanta tribesmen who were once plentiful along the Cooper declined rapidly after contact with white man, until only a handful of Jandruwanta people remained alive in 1930 (Elkin, 1931; and see White's description of their pitiful state in 1916 in White, 1917b).

Average annual rainfall of the study area is less than 150 mm (Australian Water Resources Council, 1976), and has a reliability of less than 30 per cent (Nix, 1981), while average annual evaporation at Birdsville is 3 958 mm (Bureau of Meteorology, 1975) and it is thought to be of this order in Environmental Association 8.4.4. Hence surface waters, derived directly by rainfall (the study region lies within the northern Eremaean zone of Burbidge (1960) in an area where summer rainfall is the dominant influence) or indirectly by river flow, dry up rapidly except for the deeper waterholes and lakes. At least one waterhole has a known depth of 27 m (Johnson, 1980). The most frequent direction of wind, based on records from Moomba, is north-west (SANTOS, 1981). Temperature shows considerable diurnal and seasonal variation (Laut *et al.*, 1977) with mean daily temperatures of the hottest week being 30-35°C and for the coldest week, 5-10°C (Nix, 1981). Mean daily temperatures are 20-25°C and mean daily solar radiation is 22-24 MJ/cm^2/day (Nix, 1981).

Soils of the study area are grey, self-mulching, cracking clays (Ug 5.24) on pans and floodplains, red siliceous sands (Uc 1.23) and white siliceous sands (Uc 1.21) on dunes, and red massive earths (Gn 2.13) in the interdune lows (Laut *et al.*, 1977). Those of gibber plains are crusty, red duplex soils (Dr 1.33) and the upper layer of salt lakes consists of salt of variable thickness.

1.2 THE BRIEF

The brief for this study consisted of seven sections, which are summarised below (a copy of the full brief appears in Appendix A).

- Establishment of representative, permanently marked sites to provide baseline data for assessment of ecological implications of flood events.
- Collection of data in a form suitable for computer analysis.
- Detailing of current and projected land-use within the study area.
- Consideration of the effect of grazing by feral animals and stock.
- Classification of wetlands with regard to areal extent, permanence, depth and associated flora and fauna.
- Production of an annotated bibliography relating to the ecology of the study area.
- Confidential recommendations pertaining to conservation priorities.

In order to comply with the requirements of the brief, two field trips, each of 16 days duration, were undertaken by the consultants, with a group of officers from the National Parks and Wildlife Service in the field for from 7-10 days at the time of the first of these.

Data in a form suitable for computer analysis (Section 2 of Brief) and the annotated bibliography relating to the ecology of the study area (Section 6 of Brief) are not included with this report. These form the basis of separate compilations, which have been submitted to the Survey and Research Section of the National Parks and Wildlife Service Division.

1.3 PREVIOUS BIOLOGICAL STUDIES

There have been few intensive studies of a biological nature in the Cooper Creek Environmental Association (Environmental Research and Planning Group, 1980; Foale, 1982; Social and Ecological Assessment Pty. Ltd., 1982), and the large area of the Association means that total coverage has been sparse. The focus has generally been on the Cooper Creek and its distributary channels (e.g. Waite, 1917; Foale, 1982). In the following sections the habitat and fauna components will be introduced, along with the principal land-uses.

1.4 HABITATS

Habitat has been defined as the natural home or dwelling place of an organism (Steen, 1971). The organisms (flora and fauna) of the study area may be found in one or more of the six major habitat types, which can be identified on the basis of the Environmental unit concept (refer to the glossary, Appendix B, for the definition of all terms used in this report) of Laut et al. (1977) i.e. claypans, salt lakes, floodplains, dunes, interdune lows and gibber plains, although it is noted that Laut et al. (1977) did not identify salt lakes (as distinct from (clay)pans) nor gibber plains in the section of their treatise relating to 8.4.4.

The major habitat types can be further subdivided into habitats, for example, dune crests and dune slopes as components of dunes. Habitats thus identified can be classified on the basis of the dominant plant community type(s) within that habitat. Plant community type is principally determined by the combined effects of hydrological conditions, edaphic conditions, aspect, hence microclimate, and macroclimatic conditions. Water is the major factor determining the distribution of vegetation in a large part of Environmental Association 8.4.4. However, in the wider context of Australia, edaphic conditions are generally more important.

In Association 8.4.4 three broad habitat zones, which are equivalent to the land zones of Dawson (1974), were identified by Laut et al. (1977) or from geological maps viz. dunefield , floodplain and gibber plain, and they contain one or more Environmental units.

Dawson and Boyland (1974), in their treatise on the Western Arid Region of Queensland, have used an entirely different approach. They started with an area greater than five times the size of the present study area about which relatively little was known and, in the absence of a broad-scale survey of Queensland as was carried out in South Australia by Laut et al. (1977), subdivided it as one entity. It appears from their report that the area is extremely complex, because of the numerous habitat types into which they subdivided the area (see Land System Map). However, McGreevy and Searle (1974) say that the area may be divided into just five habitat types viz. wetlands, open grassy plains, forested plains, stony ridges and sand-dunes. Hence it can be seen that this larger, adjacent region of Queensland is only slightly more complex than Association 8.4.4.

In the broad-scale survey of South Australia (Laut et al., 1977) conducted prior to the present study, the region of 8.4.4 was classified according to Environmental units , and it is now subdivided into smaller units to facilitate a greater understanding of the biology of the region.

Cost has been a limiting factor in the present study, yet every effort has been made to ensure that this survey is compatible with other, similar surveys. The desirability of achieving the aims of integration and compatibility of surveys has been pointed out in the Workshop on Survey Methods for Nature Conservation held in Adelaide in late August 1983. Because only South Australia has been divided into Environmental areas in the manner of Laut et al. (1977), the integration of surveys without a similar or compatible starting point is impeded, as is the case with the Queensland survey of Dawson and Boyland (1974). However, the hierarchial subdivision at the state level, as achieved by Laut et al. (9177), has proven to be a very useful basis from which the present survey could be started. It is unfortunate that similar broad-scale surveys will not be carried out in other Australian States and Territories.

The land zone, land system, land unit subdivision of Dawson (1974), are not directly compatible with the scheme of Laut et al. (1977), which by the requirements of the brief we are compelled to follow. However, in this report an attempt has been made to integrate the land zone, land system, land unit subdivisions into a hierarchy based on Laut et al.'s (1977) classification. Further subdivision has also been required. The subdivisions of the Environmental Association are Environmental Subassociation, Land Zone, Land System, Environmental unit, Environmental subunit and Habitat (≑ Land unit). These subdivisions fit into a hierarchial framework and are defined in the glossary.

Vegetation, the components of the three broad habitat zones and wetlands will now be considered.

1.4.1 Vegetation

General descriptions of the vegetation of Australia tend only to resemble catalogues of plant groupings (Carnahan, 1976; Specht, 1981; Pipelines Authority of South Australia, 1981; Williams, 1982), and serve only to introduce regional vegetations at a scale which in terms of habitat assessment is inadequate. Australia's vegetation, which in geologically recent times at least, has had to withstand some extreme changes in climatic and (as a result) edaphic conditions (Crocker, 1959; Wood, 1959; Bowler, 1982; Buckley, 1982), is in fact a mosaic of plant communities made up of species with varying tolerances to environmental change. Only detailed surveys can hope to elucidate the pattern of plant communities, which have developed in response to such changes.

Some detailed studies have been undertaken in the Cooper Creek Environmental Association and adjacent regions, and help to define the habitats of the region (e.g. Dawson and Boyland, 1974; Environmental Research and Planning Group, 1980; Bolton and Specht, 1981). In the habitat component of this study, it was intended to expand on the work of previous authors and detail the habitats of a smaller area (27 050 km^2) than covered by most of these studies (e.g. Dawson and Boyland, 1974 - 145 200 km^2; Environmental Research and Planning Group, 1980 - 32 000 km^2), and in greater detail in most respects.

While vegetation of the arid zone has been reported to undergo natural change extremely slowly in a historical sense (Correl and Lange, 1966), changes in the study region and the wider arid zone may have been more rapid under the influence of present and past land-uses. The role of aboriginal man in vegetation change, by his use of fire over the last 35 000 years or so, is now being discussed widely (e.g. Kershaw, 1981; Nix, 1981; Roxby Management Services Pty. Ltd., 1982). Furthermore the decreased frequency and greater intensity of wildfires since European settlement of the arid zone (Hodgkinson and Griffin, 1982; Roxby Management Services Pty. Ltd., 1982) may have resulted in change. Pastoralism, petroleum exploration and extraction, feral animals and to a lesser extent, tourism have also had an effect on the vegetation. Hence the vegetation of the study area and its borders may be somewhat different today than was seen by earlier workers (e.g Cleland, Black and Reese, 1925).

It is probable that changes in habitat have resulted in changes to faunal components. Fauna will be looked at in Section 1.5.

1.4.2 Dunefield

The majority of dunefields in the study area are the typical NNW trending parallel dunes which characterise the Strzelecki and Simpson Deserts. They are part of a regional system , and the source of their sediment supply and method of formation has been recently documented by Twidale (1982).

Two other fairly distinct types of dunefield are found within the study area, along with areas more akin to sand plain.

The dunefields may contain claypans or salt lakes, the latter forming where the process of deflation has reached the water table.

1.4.3 Floodplain

1.4.3.1 General

Many of the landforms of the study area and the North-East in general are present due to the work of rivers past and present, both directly and indirectly (Twidale, 1982). Floodplains of the study region are made up of channels, swamps, floodouts and terminal lakes; channels often follow a complex braided pattern. Pans and large areas of the floodplains have comparatively smooth floors. In all major floodplain environments, pans generally have clay rather than salt bases.

1.4.3.2 Wetlands

Wetlands form a significant habitat component of the study area, particularly for birds, with numerous waterholes and also lakes that carry water for long periods after rain or floods. They are generally classified on the basis of permanence of water, shape of basin, depth and quality of water, with finer classification on the basis of vegetation (e.g. Corrick and Norman, 1980). A recent treatise on wetland vegetation having particular relevance to the study area (Briggs, 1981) is useful in this latter regard. The need for management of wetlands in general and including those of the North-East has been dealt with recently (Delroy, 1981). This need is certainly highlighted in the study area where a lot of wetlands have been disturbed or modified by stock use and to a lesser degree by activities relating to petroleum exploration and extraction.

1.4.4 Gibber Plain

Only small areas of gibber plain occur within the northern part of the study region. They are characterised by angular silcrete fragments with polished coats of iron and manganese oxides (Twidale, 1982).

The gibber areas of Environmental Association 8.4.4 are not the typical gibber plains that characterise the Cordillo Surface (seen as the extensive plains north of Cordillo Downs - Ludbrook, 1980). In the study area they form a complex association with dune and floodplain elements, and therefore also form a relatively unique landform complex not common elsewhere in South Australia.

1.5 FAUNA

The main aspects of the fauna studied during the survey were mammals, birds, reptiles, frogs and fish. Aquatic invertbrates are looked at in much less detail.

1.5.1 Mammals

There have been few surveys of an intensive nature of the mammals of Environmental Association 8.4.4 (James, 1982) and the relatively large area of the study region means that total coverage of these surveys has been sparse, especially considering that previous surveys of the North-East (e.g. Waite, 1917; Watts and Aslin, 1974; Forrest, 1982) have not been confined to 8.4.4. In addition the collecting techniques of all surveys have varied, as has time allotted to some techniques (Waite, 1917; James, 1982).

This survey was designed to sample, using standard techniques, the small mammal fauna of all habitat types found in Environmental Association 8.4.4. To this were added incidental collecting records so that the distribution and habitat preferences of the mammals of the region could be determined.

1.5.2 Birds

Over the past ten years many ornithologists have visited the north-east portion of the State (that part of South Sustralia lying to the north and east of Lyndhurst) e.g. Cox and Pedler (1977) and Badman (1979), so the birdlist that has been compiled (see Appendix S) is thought to be a virtually complete checklist of the birds that regularly inhabit Association 8.4.4.

Species known to occur in the North-East are now reasonably well documented, although little has been written on their patterns , habitat preferences and status (abundance, seasonality and "conservation status") within the region - such an analysis is attempted in this report. A standard bird censusing technique has been used, along with incidental observations and collections made during the survey.

Much of the information drawn upon for this analysis is as yet unpublished. Two long term surveys of the birds of the upper and lower portions of the Cooper are to be published shortly by Messrs. I.A. May and F.J. Badman, respectively. The conclusions that these authors reach concerning the dynamics of the birds of the Cooper Creek system will be the first to be drawn from a sound data base i.e. year round periods of observation spanning several years. It is strongly recommended that their papers (when published) be read in conjunction with this document.

1.5.3 Reptiles

Although there has been some interest in some species of reptiles in the North-East of South Australia in recent years (e.g. *Oxyuranus microlepidotus* - Blood *et al.*, 1979; *Emydura spp.* - Thompson, 1983), little comprehensive collecting has been done. Some surveys have made limited collections (e.g. Waite, 1917; Foale, 1982) in Environmental Association 8.4.4 and the S. A. Museum made a collection along the Cooper Creek to Coongie Lake in 1981.

Despite the few systematic surveys of reptiles of 8.4.4 most of the species known fron the area have been collected and lodged with the S. A. Museum since 1980. However, these occasional collections, usually incidental to some other activity, have not been published. Apart from texts and papers discussing various taxa of lizards over broad geographic areas, including 8.4.4 (e.g. Smyth, 1972 - *Morethia*; Kluge, 1974 - Pygopodidae; Houston, 1978 - Agamidae and Varanidae) there is little published information on most species of reptile within the study area.

The survey design for reptiles was essentially similar to that used for mammals, except that more active collecting was done.

1.5.4 Frogs

Seven species of frog are known from the North-East of South Australia (Tyler, 1978; Brooks, 1980). There are two basic, ecological groups - those species that are tied to permanent water such as occurs along the Cooper Creek, and those that are truely desert adapted. Desert adapted species usually emerge from their subterranean retreats only after significant rainfall. There have been no thorough systematic surveys of frogs in Environmental Association 8.4.4.

Although a significant effort was made to locate frogs in this survey, most collections were fortuitous and the coverage of the study region patchy.

1.5.5 Fish

The fish fauna of the North-East has been extensively surveyed and is well known (Glover and Sim, 1978a,b; Glover, 1979). Sixteen species, some undescribed, have been recorded from the Cooper Creek system, none of which are restricted to that waterway (Glover and Sim, 1978a; Glover, 1979). Extensive dispersal of fishes occurs in central Australia during floods. This has resulted in the wide distribution within the Lake Eyre drainage basin of the species found in the Cooper Creek (Glover and Sim, 1978a).

Survey design involved the sampling of suitable wetlands with nets of various types to identify the diversity of species present. A small but significant amount of time was devoted to this activity.

1.5.6 Aquatic Invertebrates

The Engineering and Water Supply Department is preparing a checklist of freshwater invertebrates of South Australia and it is known that specimens are lacking from the Cooper Creek (Suter, pers. comm.).

Active collection by netting, and use of a light trap (for adults) were employed to sample aquatic invertebrates.

1.6 GEOLOGY AND ECONOMIC GEOLOGY

Surficial geology of the study region is generally of Quaternary age, and consists of a dunefield unit (Qrs), a floodplain unit (Qra), a claypan and salt lake unit (Qrl), and a broken gibber and boulder duricrust unit (Qrt) (Strzelecki, 1:250 000 Geological Sheet G54-2, preliminary edition, 1970; Gason, 1:250 000 Geological Sheet SG54-13, 1973; Kopperamanna, 1:250 000 Geological Sheet SH54-1, 1974; Innamincka, 1:250 000 Geological Sheet SG54-14, 1975; Cordillo, 1:250 000 Geological Sheet SG54-10, preliminary edition, 1977 - all by the S. A. Department of Mines and Energy and hereafter referred to as STRZELECKI, GASON, KOPPERAMANNA, INNAMINCKA and CORDILLO, respectively).

While heavy mineral sands have been reported from Lake Hope in the extreme south-west of the study area (Wopfner and Townend, 1968), the petroleum resources of the study region, which overlies the south-west half of the Cooper Basin, are its most economically significant asset. The majority of petroleum accumulations known in the Cooper Basin are gas in Permian Formations (of porous sandstone layers approximately 2000-3000 m subsurface - SANTOS, 1981), whereas those known in the overlying Eromanga Basin (the Cooper Basin is a deeper infrabasin of the Eromanga Basin - formerly Great Artesian Basin - SANTOS, 1981) are mainly oil (SANTOS pamphlet). Most productive fields are in the central south-eastern part of the study area. The search for and extraction of petroleum constitutes one of the major land-uses in the study area.

1.7 PASTORALISM

The two main station properties in the study area are Innamincka and Gidgealpa. Smaller areas are occupied by the properties - Pandie Pandie, Cordillo Downs, Clifton Hills, Kanowana, Waukatana, Lake Hope, Merty Merty and Tinga Tingana (=White Catch) (see Appendix H). The remainder of the study region in the south-west consists of crown lands. All other things being equal, Innamincka Station , because it includes much of the Cooper Floodplain and in particular the Coongie system, has the capacity to provide double the returns of the other stations (Mr. G. Drewin, pers. comm.), and thus is one of the most significant cattle properties in South Australia.

Since 1979 and until the end of 1983, most properties have been gradually destocked in a programme to rid cattle herds of Brucellosis and Tuberculosis. This Brucellosis/Tuberculosis Eradication Programme (BTB Programme), organised by the S.A. Department of Agriculture, is aimed at improving the quality of meat sold on the export market, and the provision of new fences has been a significant consequence of the programme. Cattle have now been moved back onto some properties.

Pastoralists and their herds of cattle (and sheep in the past) have been in the area for over 100 years, and the study region includes areas showing the effects of obvious grazing pressure, particularly in the well watered portion of the Cooper Floodplain west of Innamincka (see LANDSAT image 104-79). However, cattle are not the only component of the grazing pressure. Feral rabbits are at least an equally significant contributor to the problem. Their individual and combined effects will be dealt with in Chapter 6. It has been pointed out (Mr. G. Drewin, pers. comm.) that the subdivision of properties by fencing of paddocks during the BTB Programme should allow for greater control over stocking pressure, as prior to the BTB Programme, properties were essentially managed on an open-range basis.

1.8 TOURISM

Tourism has a largely unknown effect on the study region. Records of tourist activity in the study area are unavailable, as excursions are largely of a private nature or are occasionally made by pastoral property employees or SANTOS workers. At present no tourist operator includes the study area as a main destination (Mr. W. King, pers. comm.), although Rex Ellis does conduct one camel trip per year for 8-10 people from Cordillo Downs via Coongie to Mungeranie. It was reported in the News (26 June 1983) that 10 000 people visit the area each year, but this cannot be substantiated. During 1982, SANTOS flew 32 876 people in and out of Moomba for work on the Liquids Project (SANTOS, 1983). This number increased to 66 000 in 1983 and is expected to be about 44 000 in 1984 (Mr. M. Dodwell, pers. comm.), as stages of work on the current expansion of the Liquids Project are completed. The component of these visitors that can be classed as tourists cannot be ascertained, as some will tour around during breaks from work while others will not.

2. PHYSIOGRAPHY AND BACKGROUND

2.1 APPLICATION OF THE HIERARCHY OF LAUT *ET AL.* (1977)

2.1.1 Province 8

Within the context of South Australia the Cooper Creek Environmental Association 8.4.4 lies within the Northern Arid Province (Province 8 - Fig. 2a), a set of four contiguous environmental regions (Laut *et al.*, 1977).

The Northern Arid Province (8), extends across northern South Australia with its southern limits an irregular line from the northern margin of the Nullarbor Plain in the west and over the northern extreme of the Flinders Ranges in the east. The province contains dunefields, sandplains, silcrete plateau's and associated gibber plains, and easterly striking Precambrian Ranges of igneous intrusions and associated metamorphics. Soils are diverse - sands, loams, cracking clays, earths, red duplex and salt lake classes predominate. For the most part vegetation consists of shrubland and grassland - hummock grasses associated with dunes and tussock grasses associated with gibber plains, with woodland associated only with the more frequently inundated drainage lines. Forblands and herblands may be conspicuous in better seasons or in areas subject to flooding. Province 8 has a very hot dry desert climate with short cool to cold winters and extremely low and unreliable rainfall. Evaporation is high (Laut *et al.*, 1977).

2.1.2 Environmental Region 8.4

The environmental region of interest in the Northern Arid Province (8) is the Lake Eyre Environmental Region (Environmental Region 8.4 - Fig. 2b), a set of 11 environmental associations grouped on unifying geomorphic criteria (Laut *et al.*, 1977).

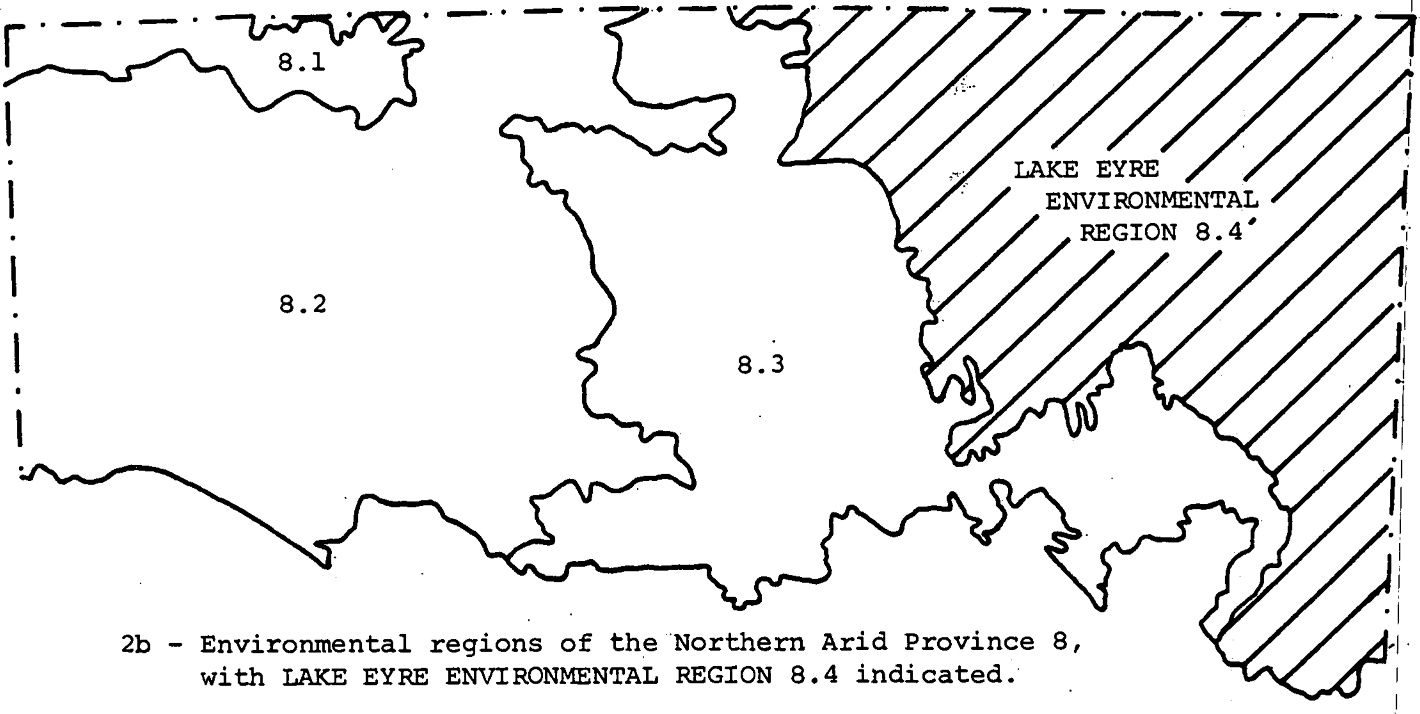
Lake Eyre Environmental Region (8.4), an area of 176 660 km^2, occupies the eastern part of the Northern Arid Province (8). Geology, soils, vegetation and climate are cnaracteristic of Province 8 (see description above), except for the absence of Precambrian Ranges of igneous intrusions and associated metamorphics. Unifying geomorphic criteria are based on the Diamantina and Cooper Creek drainage systems, as part of the Lake Eyre drainage basin, the integral association of these drainage systems with adjacent dunefields (the drainage systems are the source of supply for dunefield formation) and the relationship between silcrete of the Cordillo Surface (see Ludbrook, 1980), gibber and dunes.

2.1.3 Environmental Association 8.4.4

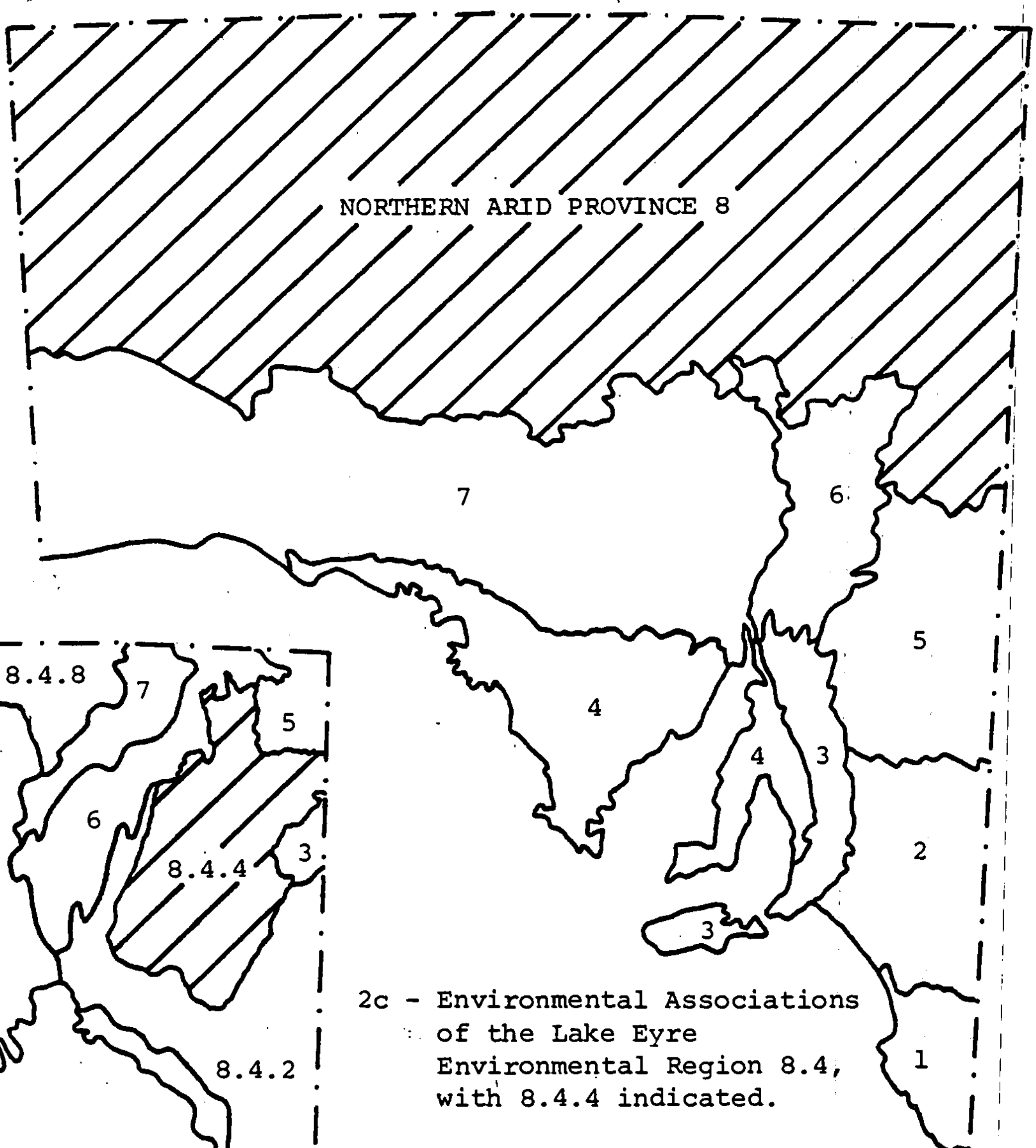
The environmental association of interest in the Lake Eyre Environmental Region (8.4), and the subject of this study, is the Cooper Creek Environmental Association (Environmental Association 8.4.4 - Fig. 1, 2c), a particular combination of a limited number of environmental units, and a unique mapping area (Laut *et al.*, 1977).

Cooper Creek Environmental Association (8.4.4), an area of 27 050 km^2, occupies the central north-eastern part of the Lake Eyre Environmental Region 8.4. Geology and vegetation are characteristic of Environmental Region 8.4, except for the absence of silcrete of the Cordillo Surface and associated vegetation. Dominant soils are a unique combination of deep well-drained sands and deep poorly drained cracking clays. Macroclimate is characteristic of Province 8, although microclimate is somewhat different; influenced by the presence of the Cooper Creek system. Environmental Association 8.4.4 is a unique mapping area based on the landforms of the Cooper Creek drainage system and associated

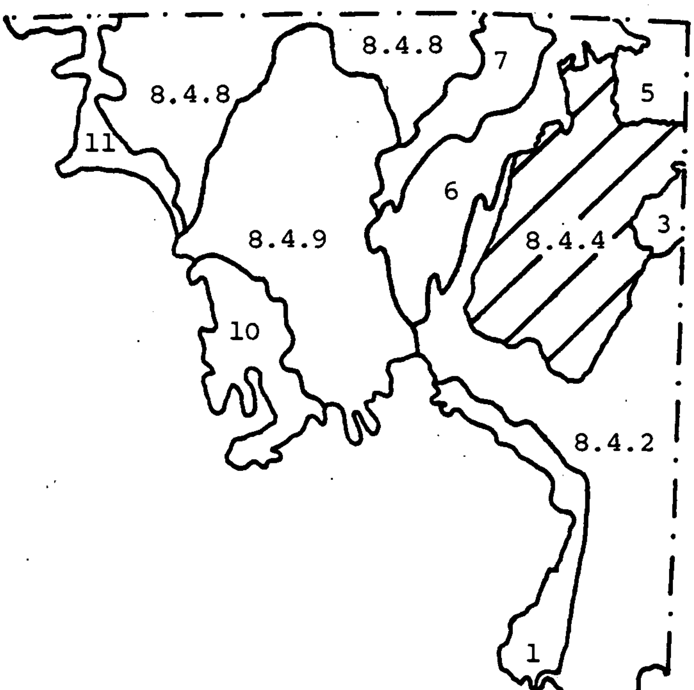
Figure 2 - Regional plans showing 8.4.4 in relation to other environmental areas.



2b - Environmental regions of the Northern Arid Province 8, with LAKE EYRE ENVIRONMENTAL REGION 8.4 indicated.



2a - Environmental provinces of South Australia, with NORTHERN ARID PROVINCE 8 indicated.



2c - Environmental Associations of the Lake Eyre Environmental Region 8.4, with 8.4.4 indicated.

(after Laut et al., 1977)

dunefields (Laut et al., 1977).

2.2 PRECISE LOCATIONS OF THE BOUNDARY OF 8.4.4

The Cooper Creek Environmental Association, 8.4.4, as defined by Laut et al. (1977), and redefined below, lies in the North-East of South Australia. It is named after the major river system, the Cooper Creek, whose floodplain environment spreads out through its centre and then returns to a channelled course in its flow to Lake Eyre. Also of importance are the Strzelecki Creek distributary branch of the Cooper Creek, which flows to Lake Callabonna via Lake Blanche in the south, the extensive dunefields in the south-west and north, and the gibber, dune and floodplain complex in the north. A small area of uncoordinated dunefield and sandplain in the north-east of the study region add a further aspect of diversity, which is in contrast to the more homogeneous nature of adjacent Environmental Associations.

Due to the scale (1 : 1 000 000) at which the original divisions of Laut et al. (1977) are mapped, it appears that they have arbitrarily placed the boundary in some parts, such as in the north where the dunefields edge onto the consolidated gibber duricrust of the Winton Formation on CORDILLO viz. the Cordillo Surface (see Ludbrook, 1980). A zone (or ecotone) of loose gibber, dune and floodplain up to a maximum width of 25 km is found between the gibber and dunefields proper, and the boundary of the Association has been placed about halfway through this system. On 1 : 250 000 normal colour LANDSAT imagery of the region, the basis of Laut et al.'s work, it is difficult to determine where the boundary may best be placed. However, the area has been mapped geologically at least to a preliminary stage of publication (CORDILLO), and on this map the true boundaries are clearly evident. Due to the homogeneous nature of adjacent associations and the "catch-all" nature of Association 8.4.4, it was decided to redefine this northern boundary basedon the available information, so that the boundary lies at the interface between the consolidated gibber and the dune/gibber/floodplain complex. Thus Association 8.4.4, which lies between 26° and 29°S and 139° and 141°E , is defined below (and see Fig. 1). For this definition reference will be made to the maps - STREZELECKI, GASON, KOPPERAMANNA, INNAMINCKA and CORDILLO. A set of the above geology maps showing the precise location of the boundary has been submitted to the Survey and Research Section, National Parks and Wildlife Service with this report.

The Cooper Creek Environmental Association 8.4.4 is bounded in the north by outcropping siltstones, sandstones and shales of the Cretaceous Winton Formation (Kuw and Qrt/Kuw - north-east corner of CORDILLO), Tertiary deposits covered by pebble and boulder conglomerate (Qrt/T - south-west corner of CORDILLO), and a small area of sandstones and conglomerates of the Tertiary Eyre Formation (Tee - CORDILLO : 26°45'S / 140°00'E), all relatively stable land areas in comparison with the strongly dunal nature of Association 8.4.4. These areas make up the consolidated "gibber" lands (more correctly referred to as silcrete or duricrust)and form the Cordillo Surface, which can be seen in the area north of Cordillo Downs Homestead (Ludbrook, 1980); as distinct from the loose gibber of the study area, which consists of the broken remnants of the duricrust (Ludbrook, 1980) that is found interspersed with sandhills and floodplains. This northern boundary, particularly in the eastern part of CORDILLO is strongly drainage defined.

The western boundary is placed to the west of the extensive floodplain and swamp complex of the Cooper Creek, as can be seen in the north-west corner of INNAMINCKA and the south-east corner of GASON.

In the east, the boundary of the Association lies along the western slope of the extensive Tertiary gibber plains (Qrt/T) and silcretes (Tsi) outcropping to the north-east and east around Innamincka town site on INNAMINCKA.

The boundary in this area ia also drainage defined. Strzelecki Creek defines the rest of the eastern boundary of the Association down to Coque Waterhole on STRZELECKI (28°47'S / 140°10'E).

The remainder of the boundary to the south and west of the Association on STRZELECKI and KOPPERAMANNA is defined by a change in soil character from deep well-drained sands on dunes in the study region to deep well-drained earths to the south and west of it (see Laut et al., 1977 - p.3, Fig. 4).

2.3 HIERARCHIAL CLASSIFICATION OF ENVIRONMENTAL ASSOCIATION 8.4.4

The larger subdivisions of Environmental Association 8.4.4 are Environmental Subassociations, and land zones (after Dawson, 1974). In the hierarchial classification used here, Environmental Subassociations can be considered equivalent to land zone complexes. These larger subdivisions are discussed below.

2.3.1 Environmental Divisions of 8.4.4 Based on Landform Criteria - Environmental Subassociations

Laut et al. identified four Environmental units - the lowest category in their hierarchial classification of South Australian environments - within 8.4.4. These units, representing the four main habitat types in the Environmental Association viz. pans, dunes, interdune lows and floodplains, are combined together in various ways to comprise the extensive dunefields of the south-west and north, and the floodplain and dunefield complex in the central and south-eastern parts of the study area.

In order to facilitate the best survey design for the effective study of the biology of the region, two additional Environmental units - salt lakes and gibber plains - were identified, based on geological information, and a new category - the Environmental Subassociation - was erected.

Agglomeration of the Environmental units of Laut et al. (1977) into Environmental Subassociations (as part of an hierarchial classification) has enabled the division of the study area into a number of more-or-less homogeneous regions, each having similar internal diversity of structure; the division is made solely on landform (geological) criteria. The Environmental Subassociation category has been of considerable value in selection of survey sites.

2.3.2 The Environmental Subassociations of 8.4.4

Prior to the first field trip Association 8.4.4 was divided into five Environmental Subassociations, which were thought to have been fairly homogeneous. They were named according to their predominant feature(s) thus -:

- 8.4.4.1 Cooper Creek Floodplain Environmental Subassociation
- 8.4.4.2 Strzelecki Creek Floodplain Environmental Subassociation
- 8.4.4.3 South-western Dunefields Environmental Subassociation
- 8.4.4.4 North-western Dunefields Environmental Subassociation
- 8.4.4.5 Northern and North-eastern Gibber and Floodplain Environmental Subassociation,

and their boundaries are shown in Fig. 3. The dunefields of 8.4.4.3 have already been referred to as the south-western dunefields by Environmental Research and Planning Group (1980 - see also SANTOS, 1981); the other Environmental Subassociations are named for obvious reasons in similar vein.

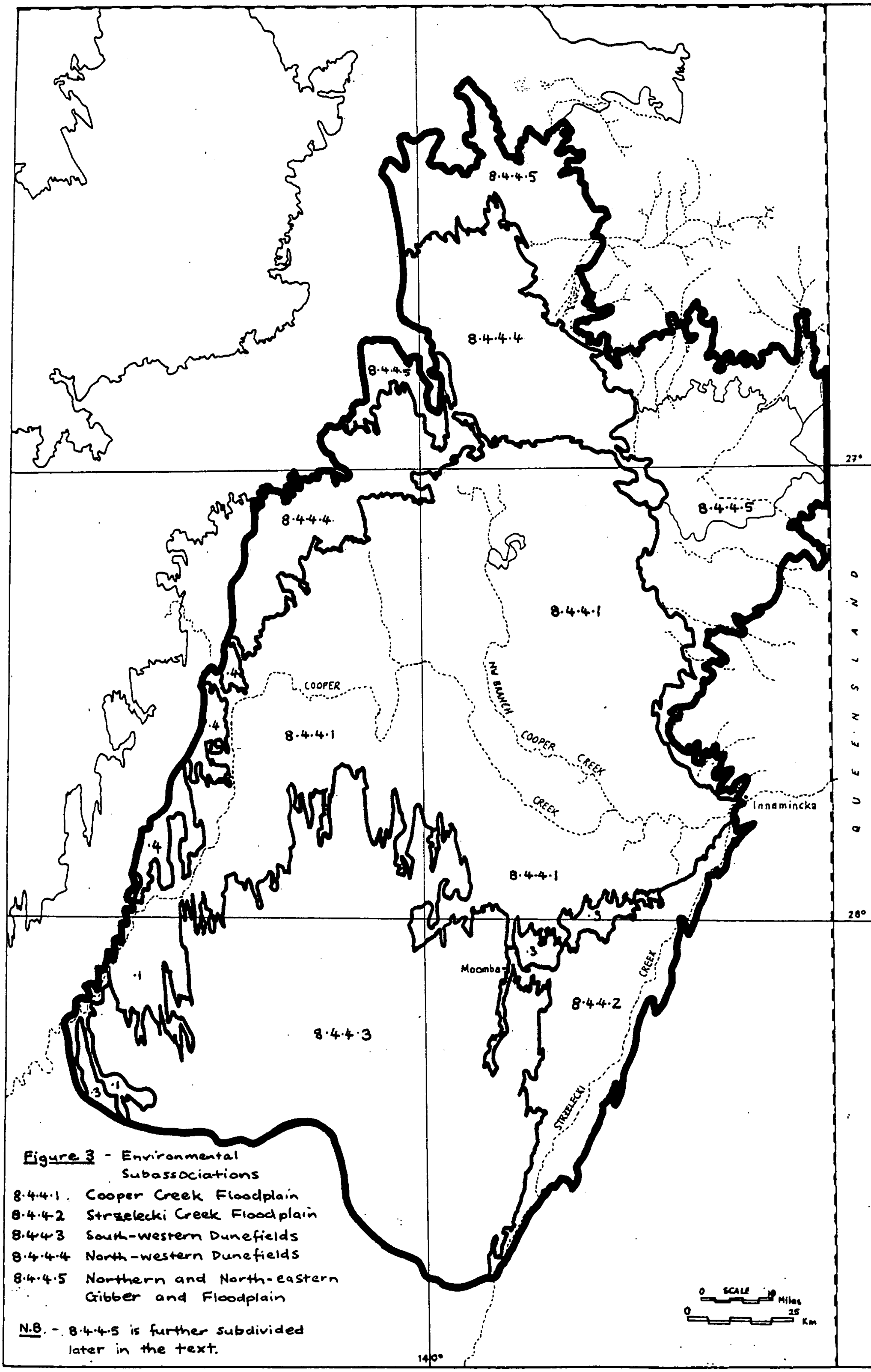


Figure 3 - Environmental Subassociations

8·4·4·1 Cooper Creek Floodplain
8·4·4·2 Strzelecki Creek Floodplain
8·4·4·3 South-western Dunefields
8·4·4·4 North-western Dunefields
8·4·4·5 Northern and North-eastern Gibber and Floodplain

N.B. - 8·4·4·5 is further subdivided later in the text.

The boundaries of the Cooper Creek Floodplain Environmental Subassociation 8.4.4.1 and Strzelecki Creek Floodplain Environmental Subassociation 8.4.4.2 are placed at the extremities of the major floodplain environments, with an arbitrary boundary between the two. In times of extreme flood, this whole area would be inundated and no boundary between the two would be evident. However, in an average year there is a marked distinction between the two. In fact, the entry of water into Strzelecki Creek (a distributary of the Cooper) as a result of flooding of the Cooper is quite rare (Section 2.5.2.6) due to the presence of a point-bar deposit at the junction of the two creeks. Both Environmental Subassociations contain some dunefields.

The remaining dunefields of the Strzelecki Desert in the south-west of the study area constitute the South-western Dunefields Environmental Subassociation 8.4.4.3. The close proximity of these dunefields to the sediment supply of the Cooper and Strzelecki Creeks has contributed to the paler colour of the dunes by addition of particles with a floodplain provenance, and which have not yet been weathered to the typical orange-red colour (see Section 2.3.3.1). This southern region is also drier than other parts of the study area, and so there is greater mobility and thus mixing of particles.

The North-western Dunefields Environmental Subassociation 8.4.4.4 divides the Northern and North-eastern Gibber and Floodplain Environmental Subassociation 8.4.4.5 from the Cooper Creek Floodplain Environmental Subassociation for a large part of the boundary of the latter. Environmental Subassociation 8.4.4.5 also contains dunefields.

As a result of fieldwork, the Northern and North-eastern Gibber and Floodplain Environmantal Subassociation 8.4.4.5 had to be divided into three separate Environmental Subassociations. These further divisions, the areas involved and detailed physiographic descriptions of all Environmental Subassociations recognised, are detailed in Section 4.3.2.

2.3.3 Land Zones

The Cooper Creek Environmental Association 8.4.4 is made up of three types of land zone complexes <u>viz</u>. dunefield complexes, floodplain and dunefield complexes, and gibber plain, dune and floodplain complexes; these land zone complexes are termed Environmental Subassociations (as discussed above). Within the land zone complexes are the three land zones of dunefield, floodplain and gibber plain.

The concept of the land zone is derived from Dawson (1974), in which it is defined as a broad grouping of similar land systems (smaller units of more homogeneous pattern - see Section 2.3.4) in which there is ..." similarity of physiography, soils, vegetation and geomorphic development. " For the purposes of this survey the concept of the land zone is applied more strictly than was done by Dawson (1974) to the three broad groupings evident in the study area - namely, dunefields, floodplains and gibber plains.

Dunefields and floodplains are the dominant land zones in 8.4.4. The gibber plain land zone is only developed in an extensive way in parts of the Northern and North-eastern Gibber and Floodplain Environmental Subassociation 8.4.4.5 (those parts, which form the basis of the Northern Gibber and Floodplain Environmental Subassociation 8.4.4.5 - as detailed in Section 4.3.2; there is also minor representation of gibber plains in the North-eastern Dunefield and Floodplain Environmental Subassociation 8.4.4.6 - also see Section 4.3.2).

The three land zones of dunefield, floodplain and gibber plain are now described. There precise locations can be determined by consulting the geological maps - STRZELECKI, GASON, KOPPERAMANNA, INNAMINCKA and CORDILLO.

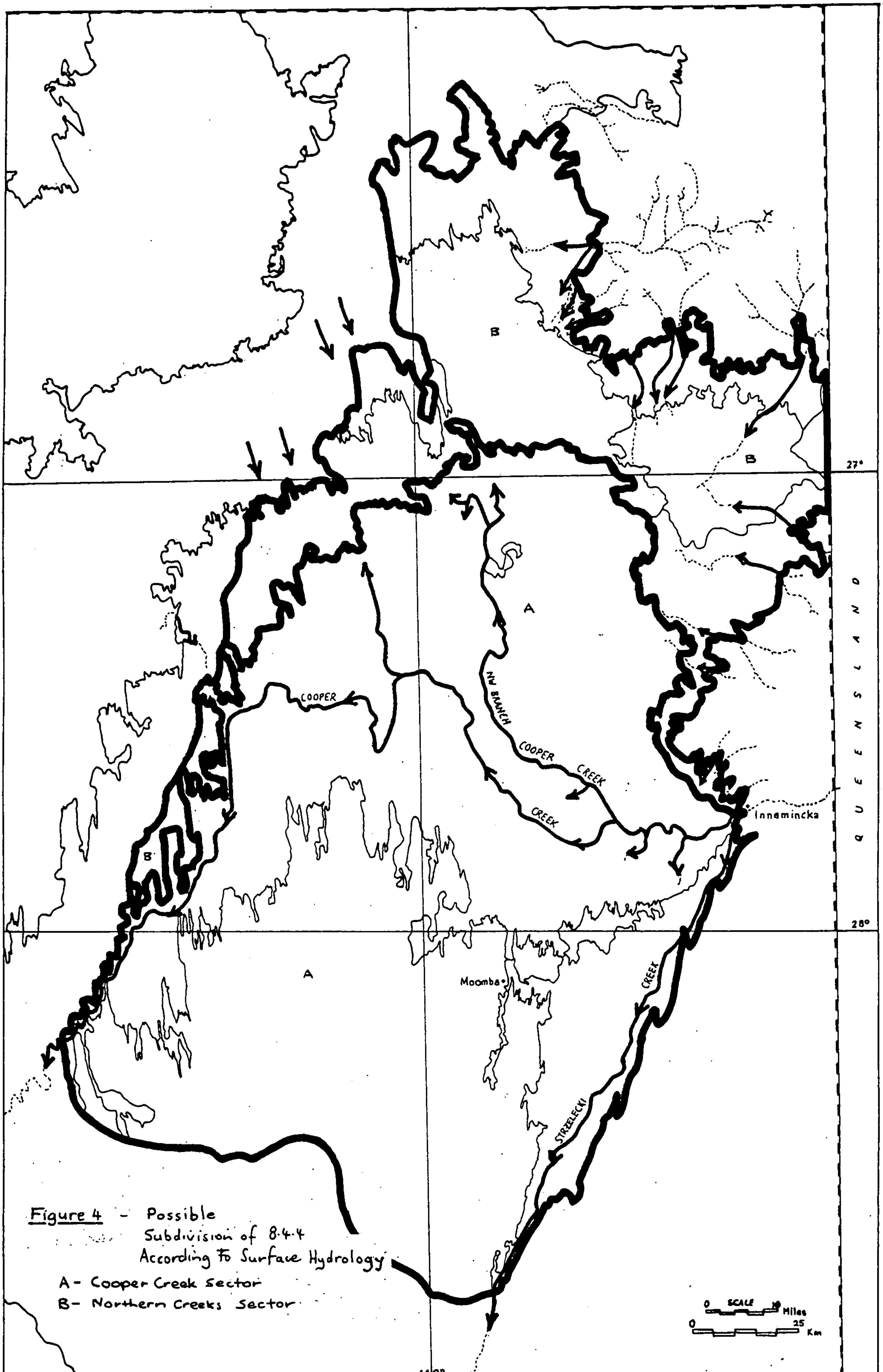


Figure 4 - Possible Subdivision of 8.4.4 According to Surface Hydrology

A - Cooper Creek Sector

B - Northern Creeks Sector

2.3.3.1 Dunefields

Twidale (1982) regards the North-East as part of the Central Australian Desert and its dunefields as belonging to a large regional system that includes the Strzelecki and Simpson Deserts. Most dunes are typically NNW-SSE trending and of approximately parallel form, usually being steeper on the eastern side and averaging 20 m in height (Williams, 1975; Twidale, 1982). Dune base is just above sea level (Williams, 1975). Sediment is brought into the Lake Eyre drainage basin by rivers such as the Cooper Creek and over time it is picked up by wind and carried in a northerly direction. It is initially piled into lee-side mounds that develop down wind into dune ridges (Twidale, 1982). The prominent wind direction in the region today is north-west (SANTOS, 1981). White and yellow sands picked up from the lakes and floodplains colour many dunes of the study area and distinguish the dunefield west of Strzelecki Creek from the orange-red dunes to the east. These pale sands gradually become pink and then red as the sands and associated clay particles are weathered during the drift northward (Twidale, 1982).

Other types of dunes in the study area include uncoordinated dunes of the north-east, undulating dunes of the central and southern floodplains (similar forms along the lee shores of Lake Eyre North are referred to as lunettes by Dulhunty, 1983) and very low dunes of the sand plains.

2.3.3.2 Floodplains

The floodplains of the Cooper and Strzelecki Creeks form a significant component of the habitats of Association 8.4.4, particularly for birds, frogs and fish. The Cooper Floodplain usually receives water during annual periods of flow, while the Strzelecki Creek flows much less often. Channels are a feature of both systems as are floodouts and associated terminal lakes which are widespread. Floodouts and terminal lakes form as a consequence of excessive quantities of water breaching the normally confining limits of channels (Twidale, 1982). Swamps are also found within the Cooper Floodplain only.

A smaller series of floodplains is found in the north and east of the study region, associated with ephemeral streams which arise on the consolidated gibber or duricrust of the Cordillo Surface.

In fact, the study region can be divided into two separate sections on the basis of surface hydrology (which to a large degree is the major determinant of habitat type in 8.4.4) related to floodplains (Fig. 4). The Cooper Creek Sector (Fig. 4 A) is fed mainly by the Cooper Creek, while the Northern Creeks Sector (Fig. 4 B) is fed by all streams other than the Cooper. In times of extreme flow there would be some input from A to B, but the reverse would be unusual. Division of the study region on the basis of surface hydrology though is not used in the present hierarchy, because it is too broad for our purposes and would add unnecessary complication.

2.3.3.3 Gibber Plains

Gibber plains consist of flat to gently undulating plains covered with angular fragments and have red duplex soils. Within 8.4.4 they constitute part of the broad ecotone that lies across the north of the study region between the dunefields and the consolidated duricrust or silcrete of the Cordillo Surface to the north (see Ludbrook, 1980). The ecotone achieves a maximum width of 25 km near Lake Moorayepe (26°21'S / 139°59'E) on CORDILLO.

In effect, the recognition of land zones in 8.4.4 is only for the purposes of very broad assessment of the study area. It also provides a stepping stone to what should be considered one of the more important levels of the hierarchial classification of 8.4.4 - the land system.

2.3.4 Land Systems

Christian and Stewart (1953, 1968-in Dawson, 1974), define a land system as: " an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation ". The concept of land system has been used widely (e.g. Specht, 1972; Dawson, 1974; Roberts and Naqvi, 1978; Australian National Parks and Wildlife Service, 1980; Environmental Research and Planning Group, 1980; Scott, in prep.). It has, however, been applied in a diverse way.

In fact, in the context of the ' Vegetation of South Australia ' , Specht (1972) uses the concept of the land system in its broadest sense and more often than not talks of land system<u>s</u> , rather than a particular land system, and in terms of broad generalisations. Environmental Research and Planning Group (1980), continue to use this broad-scale approach by considering Laut <u>et</u> <u>al</u>.'s (1977) Environmental Associations to be ' total land systems ', consisting of vegetation in conjunction with underlying soils/geology and topography. Currently in preparation is a similar treatment on the ' Land Systems and Land Regions of South Australia ' (Scott, in prep.), which C. Margules (pers. comm.) says is a reassessment of the ' Environments of South Australia ' of Laut <u>et</u> <u>al</u>. (1977), but it is still a broad-scale approach and leaves the study area little changed (C. Margules, pers. comm.).

The preceding are broad-scale approaches, which Graetz <u>et</u> <u>al</u>. (1982) say may be ecologically insensitive. But, Graetz <u>et</u> <u>al</u>. (1982) then propose a scheme of ecological classification based on functioning hydrological units. They cite an example of a dunefield, which ..." has similar internal diversity of structure and grain "... , from their study area, ' the southern Simpson Desert ". In the present study and that of Dawson (1974), however, the dunefield is considered to be a land zone, broader still than the land system. So, in effect, Graetz <u>et</u> <u>al</u>. (1982) are attempting to substitute one broad-scale approach for another.

Social and Ecological Assessment Pty. Ltd. (1982) use the concept of land system rather loosely in accordance with environmental units and subunits and also use terms such as environmental systems (not defined) interchangeably with land systems.

Roberts and Naqvi (1978) found difficulty in applying the concept of land systems in their study area in Tasmania; their land systems were largely based on topographic features. They found that vegetation, soils and topography were not related in the normal way - fire was the major determinant of vegetation type, and soil type was fairly constant across the landscape under the influence of a high reliable rainfall (Roberts and Naqvi, 1978).

Most of the workers above treated the land system as the basic level of classification. Dawson (1974) however, states:

> "In past surveys the land system description has been the important descriptive feature. When using reports of this type it is difficult to obtain detailed descriptions of land units without consulting the various component sections. As well, valuable site information may not be presented. To alleviate such problems in this survey, the land system remains basically descriptive and shows the relationship between the land units (individual components of a land system). More emphasis has been placed on the assessment of the land units ".

In this study though it is intended to apply the definition of land system in a precise way. Also, the land system will be treated as an end in itself rather than a means of identifying smaller units, because as stated by Australian National Parks and wildlife Service (1980): " Land systems give,..., an overall view of an area and ... can be helpful in developing management strategies ". Land systems occupy the central position in the hierarchial classification of 8.4.4.

Although Australian National Parks and Wildlife Service (1980) consider the land system classification used in the ' Plan of Management of Kakadu National Park ' to be a broad-scale approach, it is this kind of application of the definition of land system we wish to emulate in this survey. Australian National Parks and Wildlife Service (1980) also state: " Because land systems .. ... are the result of subjective non-parametric interpretation they are not necessarily compatible from one survey to another ", and " Land classification systems, whilst reflecting natural features, are affected by the scale of mapping and subjective judgement of individual team members ".

Two factors then, limit the use of the definition of land system in a way which affects individual surveys and hence, compatibility of surveys - namely, the scale of mapping and the subjective judgement of survey personnel.

It should be possible to account for the first limiting factor. Standard mapping scales are 1:250 000, 1:100 000 and 1:50 000. If the scale of 1:250 000 is too small, then a larger scale of mapping should be used i.e. 1:100 000, and if that does not work a larger scale still should be used, assuming the budget allows for this. Another possibility,if mapping is confounded by only small areas of the study region, is to focus in on these areas and map them at a larger scale. They can then be included in the smaller scale map as an 'inset'. Mapping scale(s) will obviously depend on the nature of the land surface. And, if the land surface is continuously changing the aim of survey compatibility may only be applicable to contiguous surveys.

Subjective judgement of survey personnel, the second limiting factor, is difficult to account for as expertise varies from one person to another based on experience and interests. Also available data on a particular area may be small, whereas on other areas it may be large. Essentially this limiting factor relates back to the purpose of the survey. If in the one survey, the purpose is to gain all information needed for building, say, a management plan, then subjective judgement may be an important influence on results. However, if the purpose of the survey is to gain as much information as possible upon which future surveys can build, then subjective judgement may not be such an important influence. Reassessments may discover that one persons views were a little misguided, and for a certian reason.Realisation of this allows adjustments to be made - the old adage of learning from ones' mistakes then applies. No one survey can satisfy everybody's view of a particular area of land surface!

Understanding the limitations related to useage of a land system category and with the aim of the present survey in mind, the purpose of using land systems in a hierarchial classification of Environmental Association 8.4.4 is to enable subdivision of the study area into smaller management areas with a more homogeneous pattern of topography, soils and vegetation. It is recognised though that the land system is a broad class in a hierarchial classification so it contains smaller units; this is implicit in the definition of land system. The nature of these smaller units - namely, Environmental units (after Laut et al., 1977), Environmental subunits and land units (e.g. Dawson, 1974), will now be discussed.

2.3.5 Environmental Units

Laut et al. (1977) identified four Environmental units - the basal or lowest category of their hierarchial classification of the ' Environments of South Australia ' - within Environmental Association 8.4.4, which they describe in detail

Table 1 - Environmental units of Environmental Association 8.4.4 (after Laut et al., 1977)

1a -	Environmental unit A		Environmental unit B	
Relative area	Co-dominant		Co-dominant	
Landform				
Type	Pan		Dune	
Slope class (%)	<1		3-10	
Maximum slope (%)	1		17	
Dimension	Large		Long	
Frequency	Common		Common	
Rock type	Clay		Sand	
Surface water				
Form	None		None	
Area/width				
Depth				
Origin/purpose				
Permanence				
Quality				
Liability to flood				
Soil				
Symbol and name	Ug5.24 : grey self-mulching cracking clays		Uc1.23 : red siliceous sands	Uc1.21 : whitish siliceous sands
Relative area	Dominant		Co-dominant	Co-dominant
Surface roughness	Gilgai		None	None
Depth	Deep		Deep	Deep
Drainage	Poorly drained		Well drained	Well drained
Reaction trend	Alkaline		Neutral	Neutral
Stoniness	None		None	None
Vegetative cover				
State	Degraded natural	Degraded natural	Disturbed natural	Disturbed natural
Relative area	Dominant	Subdominant	Dominant	Subdominant
Type	Low shrubland	Low woodland	Tall shrubland	Hummock grassland
Overhead flora	Qld. bluebush, old man saltbush	Coolibah	Sandhill wattle, whitewood, needlebush	Sandhill canegrass, hard spinifex
Ground flora	Canegrass, forbs, lovegrass	Lignum, elegant wattle, bindyi	Kerosene grass, forbs	Kerosene grass
Native vegetation				
Formation	C2 : chenopod shrubland	L2 : low woodland	S2 : tall shrubland	H2 : hummock grassland
Relative area	Dominant	Subdominant	Dominant	Subdominant
Alliance	*Chenopodium auricomum; Atriplex nummularia*	*E. microtheca - Muehlenbeckia cunninghamii*	*Acacia ligulata; Atalaya hemiglauca; Hakea* spp.	*Zygochloa paradoxa - Triodia basedowii*
Land use				
Utilization	Pastoral	No defined use	Pastoral	No defined use
Relative area	Dominant	Minor	Dominant	Minor
Product	Beef	-	Beef	-
Special features	-	-	-	-
Land limitations	Salinity	Salinity	Moderate drift	Moderate drift

Table 1 (cont'd)

Environmental unit C		Environmental unit D	
Subdominant		Subdominant	
Interdune low <1 1 Medium Common Sand, clay		Floodplain <1 1 Large N.a. Alluvium	
None		Channelled 10-50 m Shallow Streams Intermittent Limited suitability Intermittent	
Gn2.13 : red massive earths Dominant None Deep Well drained Alkaline None		Ug5.24 : grey self-mulching cracking clays Dominant Gilgai Deep Poorly drained Alkaline None	
Degraded natural Dominant Low shrubland Qld. bluebush, old man saltbush Kerosene grass, blackheads, lovegrass, forbs	Degraded natural Subdominant Grassland - Kerosene grass, blackheads, lovegrass, forbs	Degraded natural Dominant Low woodland Coolibah, beantree, gidgee Lignum, elegant wattle, old man saltbush	Degraded natural Minor Woodland River red gum Windmill grass, silky browntop
C2 : chenopod shrubland Dominant *Chenopodium auricomum; Atriplex nummularia*	G3 : grassland Subdominant *Aristida contorta; Eragrostis* spp.	L2 : low woodland Dominant *E. microtheca - Muehlenbeckia cunninghamii- Bauhinia carronii*	M2 : woodland Minor *E. camaldulensis*
Pastoral Dominant Beef - Slight drift	No defined use Minor - - Slight drift	Pastoral Dominant Beef - Intermittent flooding	

- 1b

Table 1 (cont'd) - 1c*

	Environmental unit E	Environmental unit F
Relative area	Minor	Minor
Landform		
Type	Salt lake	Gibber plain
Slope class (%)	<1	<1
Maximum slope (%)	1	1
Dimension	Small	Small
Frequency	N.a.	N.a.
Rock type	Salt, alluvium	Gibber/porcellanite
Surface water	None	None
Soil		
Symbol and name	None, salt	Dr1.32: crusty red duplex soils
Relative area		Dominant
Surface roughness		Stones
Depth		Moderately deep
Drainage		Well drained
Reaction trend		Neutral
Stoniness		None
Vegetative cover		
State	None	Degraded natural
Relative area		Dominant
Type		Tussock grassland
Overhead flora		-
Ground flora		Mitchell grass
Native vegetation		
Formation	-	G1 : very open (tussock) grassland
Relative area		Dominant
Alliance		*Astrebla pectinata*
Land use		
Utilisation	-	Pastoral
Relative area		Dominant
Product		Beef
Special features		-
Land limitations		Salinity

* 1c was compiled from other sections of Laut *et al*. (1977) in which salt lakes and gibber plains are more prominent.

(Province 8 - pp. 210-211, and included here as Table 1a and b, for convenience). Environmental units are based on landforms (Laut et al., 1977). Laut et al. (1977) though failed to recognise salt lakes as distinct from claypans, and also did not recognise gibber plains. These two Environmental units were recognised early in the present study from geological maps and although a minor component of the study area, are none-the-less an important component. Salt lakes and gibber plains are considered to be Environmental units E and F, respectively. They are described in detail in Table 1c, in the manner of Laut et al. (1977). Six Environmental units are therefore recognised in Environmental Association 8.4.4 - namely, Environmental unit A : claypan (renamed), Environmental unit B : dune, Environmental unit C : interdune low, Environmental unit D : floodplain, Environmental unit E : salt lake and Environmental unit F : gibber plain. Claypans and dunes are co-dominant, interdune lows and floodplains are subdominant, and salt lakes and gibber plains have minor status (Laut et al., 1977).

Only the dunefield land zone contains more than one Environmental unit. These are dunes, interdune lows, salt lakes and claypans. Floodplain and gibber plain land zones contain floodplain and gibber plain Environmental units, respectively. Small clay lenses in gibber plains are considered distinct from claypans and to be a habitat component of gibber plains.

2.3.6 Environmental Subunits.

The Environmental subunit category has been used previously (Social and Ecological Assessment Pty. Ltd., 1977). For the purposes of the present report though it will be used somewhat differently, as discussed below.

Within the floodplain Environmental unit of the study area are four components which are considered broader than the level of the land unit (see Section 2.3.7, below) - namely, floodout, channel, swamp and terminal lake components. In the present study these four components are ascribed to the level of Environmental subunit (within a hierarchial classification of 8.4.4). No such components are found within claypan, dune, interdune low, salt lake and gibber plain Environmental units, so Environmental subunits of these five Environmental units are the same i.e. claypan, dune, interdune low, salt lake and gibber plain, respectively. Nine Environmental subunits are therefore recognised, namely - claypans, dunes, interdune lows, floodouts, channels, swamps, terminal lakes, salt lakes and gibber plains. However, in order to ensure that there is no difficulty in allocating a particular feature of the landscape to one of these Environmental subunit categories, some clarification is required.

Firstly, because of their irregularity of inundation, terminal lakes may in some instances be considered analogous to very large claypans. For the purposes of this report though, terminal lakes and claypans are considered distinct. Terminal lakes have an obvious connection with floodplains e.g see the obvious connection of Lake Marrakoonamooka with the Cooper Creek floodplain on INNAMINCKA, whereas claypans have no such connection and are generally isolated within the dunefields. Laut et al. (1977) appear to have had a different perception of the connection between claypans and floodplains, however. They say (Province 8 - p. 208) that the Cooper Creek Environmental Association 8.4.4 consists of:

> " A field of parallel dunes and an extensive system of interconnected claypans periodically flooded by Cooper Creek ".

This obviously implies that the large areas of grey, self-mulching, cracking clays adjacent to the channel(s) of the Cooper Creek, which in this report are considered to represent floodplains (consisting of floodout, channel, swamp and terminal lake Environmental subunits), were perceived by Laut et al. (1977) to represent .. ..." an extensive system of interconnecting claypans "... In the present report the distinction between claypans and terminal lakes should be clearly evident.

Secondly, in some lakes fitting into the terminal lake category, where deflation processes have reached the water table resulting in the formation of a salt crust, there may be confusion as to whether these lakes also fall into the salt lake category. These lakes are most prominent at the extremities of floodplains and hence, are subject to very infrequent cycles of inundation by floodwaters e.g. Lake Perigundi. At times other than periods of flooding they assume the characteristics of salt lakes, but may during flood events have salinity levels which approach levels generally considered to be characteristic of freshwater. These terminal lakes should also be considered salt lakes.

All 9 Environmental subunits are made up of smaller components e.g. dune crests and dune slopes as components of dunes.These smaller components are considered to represent the basal category within a hierarchial classification of Environmental Association 8.4.4. They are land units, which are considered analagous to habitats. The analogy between land units and habitats is verified in Chapter 5 of this report and where appropriate, the habitat category supersedes the land unit category.

2.3.7 Land Unit(s) - A Definition

The definition of land units as,..., " the individual components of a land system " (Dawson, 1974), should be intuitively obvious as this is implicit in the definition of land system (Section 2.3.4). Two other definitions of land unit have been used, which may be usefully considered in order to arrive at a more terse definition of land unit more consistent with the purposes of this study.

Howard (1970, in Australian National Parks and Wildlife Service, 1980) defines a land unit as:

" a part of the land surface having a similar genesis and having major inherent features of consequence to land use - namely, topography, soils, vegetation and climate " .

This definition does not imply land use!

A more precise way of writing this definition, to avoid possible ambiguity, would be that a land unit is:

" a part of the land surface with the same genesis characterised by inherent features of topography, soils, vegetation and climate, which are of consequence to land use ".

The useage of the word 'same' in place of the word 'similar' is intentional to indicate that a land unit is the smallest recogniseable unit of the land surface, apart from the individual elements of topography, soils and vegetation. Further subdivision of a land unit would therefore be superfluous.

Hooper et al. (1973, in Australian National Parks and Wildlife Service, 1980) define a land unit as:

" an area of land which exhibits uniform photo-pattern on aerial photographs. It contains similar soils, vegetation and topographic elements throughout. Minor variation in any of these is allowable as a unit may contain areas of different land units too small to map. The limitations to land use and the land use potential of any land unit are usually but not necessarily similar throughout ".

Like Howard's definition above, this definition is also not as precise as is desirable. It contains too many aspects, which are open to diverse interpretation. And, some of these aspects do not apply to the study area. It order to improve this definition, to make it more precise and to ensure that it applies to the study area, the following points should be considered.

Firstly, the section on uniform photo-pattern on aerial photographs should be excluded as the [1] scale of aerial photographs available on 8.4.4 (average scale is 1:88 000 - see Appendix N) is too small to allow resolution of all areas of land which have the potential to show uniform photo-pattern - only the larger areas of uniform pattern are evident (particularly in the absence of significant ground reconnaissance), while the smaller areas are often masked by the grain of aerial photographs. In fact, at the scale of aerial photographs available on 8.4.4, land systems (groups of affiliated land units) are the only features consistently evident (see Section 4.3.3), although in some parts these also become obscure e.g. floodplains.

Secondly, soils, vegetation and topographic elements should be 'the same', not " similar ", ... " throughout ". This modification is considered necessary for the same reason as in the modification of Howard's definition i.e. to indicate that a land unit is the smallest recogniseable unit of the land surface, apart from the individual elements of soils, vegetation and topography.

Thirdly, " minor variation " should not be " allowable " and land units should not contain " areas of different land units too small to map ". If land units are to represent the basic unit of land surface pattern, expressed in terms of soils, vegetation and topographic elements, then it would be hoped that the scale of mapping is such that all minor variation is eliminated. In reality, elimination of all minor variation may be quite difficult to achieve but this should not prevent us from attempting to do so!

Fourthly, land use potential within a land unit should be considered 'the same throughout', not as stated by Hooper <u>et al</u>., " usually but not necessarily similar throughout ". In this way we continue to exclude minor variation and hence, the land unit remains at its basic level.

Fifthly, if land use potential is 'the same throughout', then limitations to land use potential will also be 'the same throughout'. This should be obvious, so there is no need to state this explicitly.

Taking these five points into account in modifying Hooper <u>et al</u>.'s definition of land unit, we get the following:-

> a land unit is " an area of land containing the same soils, vegetation and topographic elements throughout. Land use potential is the same throughout ".

If the elements in common between the two modified definitions of land unit (after Howard, 1970 and after Hooper <u>et al</u>., 1973 - both in Australian National Parks and Wildlife Service, 1980) are combined, the two important points which, in essence, serve to define a land unit are identified <u>viz.</u>

1. A land unit is an area of land surface with consistent (in genesis and expression) soils, vegetation and topographic elements, and:
2. A land unit has some (unspecified) potential for utilisation.

The only element not in common to both modified definitions is that of climate. (from Howard's definition). Climate is not an element of the land surface, rather, it is an effect which has played and continues to play an important part in the formative aspects of the elements (soils, vegetation and [2]topography) of the land surface. It is also an important determinant of land use potential and ultimately land use.

Combining the above two points the following definition of land unit is

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[1] This factor of scale applies equally well if not more-so to LANDSAT imagery, due to current levels of resolution available.

[2] Topography and landform are correlative.

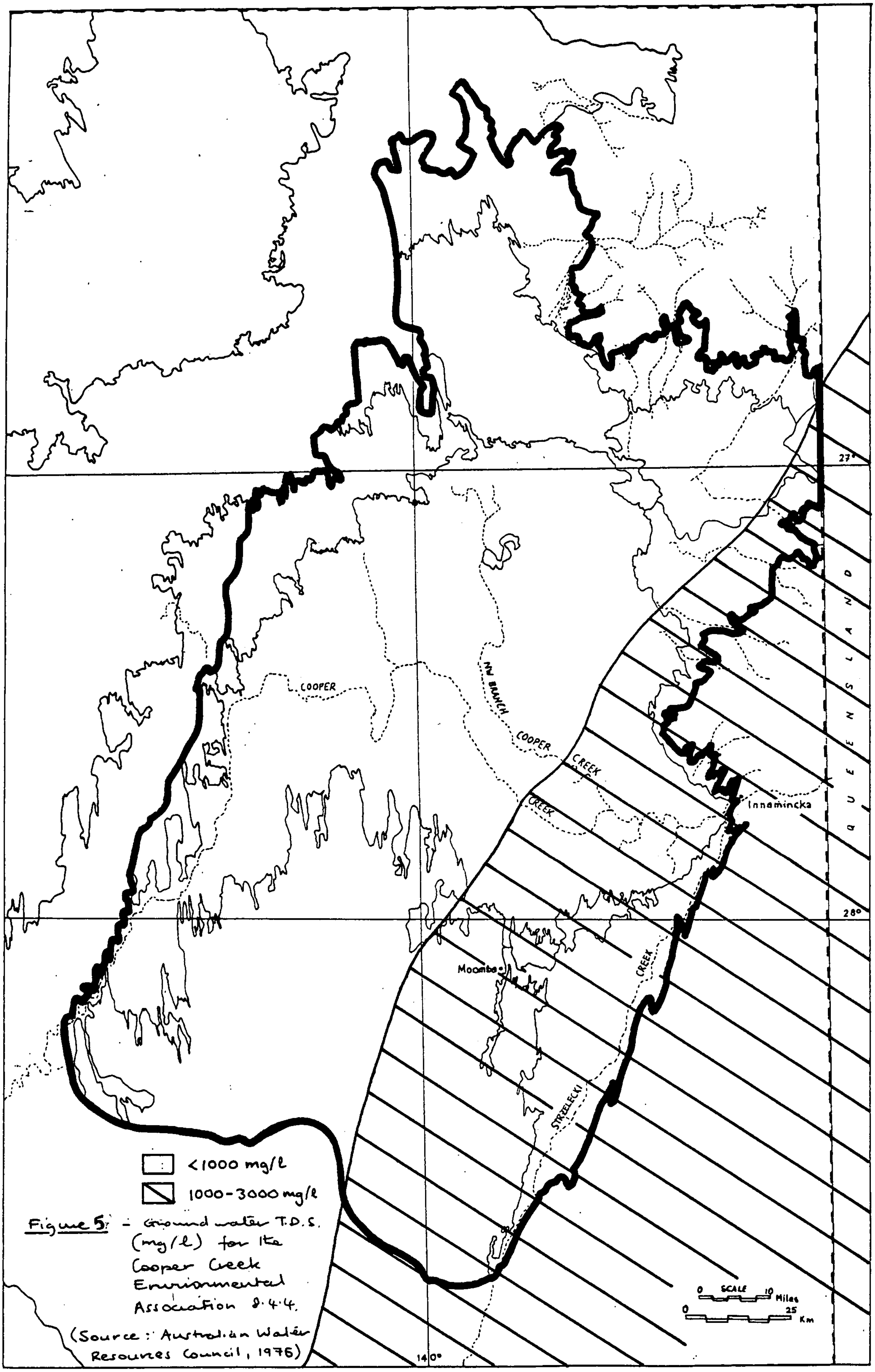


Figure 5: - Ground water T.D.S. (mg/l) for the Cooper Creek Environmental Association 8.4.4.

(Source: Australian Water Resources Council, 1976) attained viz. a land unit is an area of land surface with consistent (in genesis and expression) soils, vegetation and topographic elements and some (unspecified) potential for utilisation. If the qualifiers are excluded from this definition, a land unit is simply an area of land surface with consistent soils, vegetation and topographic elements and some potential for utilisation. The role of climate is implicit in this definition.

2.4 SALT LAKES AND SALINITY

2.4.1 General

Salt lakes are a feature of the north-west central and far west regions of the Cooper Creek Environmental Association 8.4.4, and are generally confined to the extremities of the Cooper Creek floodplain (and to a lesser extent the floodplain of the Strzelecki Creek), or they lie in the dunefields. Most of the lakes' salts are probably dominated by sodium chloride, which is the predominant salt in the majority of Australia's salt lakes (Johnson, 1980). No actual field testing was carried out in this survey.

The formation of the salt lakes is by wind deflation of alluvium until the water table is reached (King, 1960). They are thus able to receive groundwater seepage from salt impregnated alluvium about the lake - in annual cycles of filling with a consequent rise in water table, and then crystallisation that leaves a crust, upon subsequent fall of the water table (Johnson, 1980). A shallow groundwater horizon has been found to be present in the North-East of South Australia (Wopfner, 1961). Groundwater of the study area contains dissolved salts at two levels i.e. less than 1 000 mg per litre and between 1 000 and 3 000 mg per litre (Fig. 5), of which sodium is a major component (Australian Water Resources Council, 1976).

In contrast to salt lakes, claypans are defation hollows, which have not reached the groudwater table; no groudwater seepage is received, and, so no salt forms. In some areas, adjacent salt lakes and claypans are found.

The source of salts in the alluvium around lakes is considered to be connate salts (sea water salts entrapped in sediments from the time that the sediments were deposited in a marine environment) released during the erosion of marine sediments deposited when the North-East, along with a large part of Australia, was inundated by the sea in the Cretaceous (Johnson, 1980). Only some sediments contain reworked connate salts, while others are derived from non-marine strata. The reworked connate salts of the ancient marine rocks have been partly redistributed by wind or water motion to be retained to varying degrees by a surficial cover of alluvium in the form of dunefields and floodplains, which formed under the influence of low topographic relief and an arid climate. The salts that entered the closed system of the dunefields have tended to remain and contribute to salt lake formation, while those in the floodplain of the Cooper have been flushed in times of flood towards Lake Eyre, the focus of the endorheic Lake Eyre drainage basin (Johnson, 1980).

Some areas of saline alluvium or groundwater are passed through by the Cooper Creek, which results in instances of saline waterholes in a string of otherwise dilute ones e.g. Callamurra Waterhole, east of the study area (see Table 2C). The creek and freshwater lakes do contain some salts, of which sodium and bicarbonate ions predominate with chloride comprising a small part of the anion load (Table 2B). These salts are generally at insufficient levels to leave crusts and the minor ones that do form are usually dissipated through wind action. For instance, Coongie Lake, fed by the same creek that feeds Lake

TABLE 2 – ANALYSES OF VARIOUS COMPOSITIONS OF WATER AND SALT WITH RELEVANCE TO THE COOPER CREEK ENVIRONMENTAL ASSOCIATION (8·4·4) OR FOR COMPARISON.

(Source : Johnson, 1980)

A. LAKE EYRE WATER AND SALT CRUST COMPOSITION

Location	Date	Substance	Weight		EC	K^+	Na^+	Ca^{++}	Mg^{++}	Cl^-	$HCO_3^=$	$CO_4^=$	$SO_4^=$	NO_3^-	SiO_2	B	F^-	Dominant Group(s)
Lake Eyre North	March 1974	Water	–	A	n.a.	35	13800	300	42	21400	87	n.a.	1100	n.a.	0·5	0·18	0·9	Na-Cl, Ca-SO4
				B		<0·1	48·1	1·2	0·3	48·3	0·1	n.a.	1·8	n.a.	n.a.	n.a	n.a.	
Lake Eyre South	March 1978	Salt	9g/250 ml	A	n.a.	4	10810	296	33	16311	30	n.a.	806	n.a	3·5	0·09	0·68	Na-Cl, Ca-SO4
				B		<0·1	48·7	1·5	0·3	47·7	<0·1	n.a.	1·7	n.a.	n.a.	n.a.	n.a.	

B. RIVER AND FRESHWATER LAKE WATER COMPOSITION

Location	Date	Substance	Weight		EC	K^+	Na^+	Ca^{++}	Mg^{++}	Cl^-	$HCO_3^=$	$CO_4^=$	$SO_4^=$	NO_3^-	SiO_2	B	F^-	Dominant Group(s)
Unnamed shallow, clear W.H. on Cooper Creek, 15 km West of Innamincka	March 1978	Water	–	A	345	7·0	36	15·4	7·3	37	146	n.a.	16·0	n.a.	9·5	0·07	0·24	Na-Cl/HCO3
				C		5·7	50·8	24·4	19·0	26·6	64·5	n.a	8·9	n.a.	n.a.	n.a.	n.a.	
Coongie W.H. (deep, murky) N.W. arm Cooper Creek	March 1978	Water	–	A	625	14·8	76	7·0	9·7	47	265	30	20·6	n.a.	0·5	0·11	0·57	Na-Cl/HCO3/CO4
				C		7·8	68·3	7·2	16·5	18·6	75·4		6·0	n.a.	n.a.	n.a	n.a.	
Kudrienitchie W.H. (deep, clear) N.W. arm Cooper Creek	March 1978	Water	–	A	450	10·9	39	18·0	10·9	19·5	189	36	19·5	n.a.	2·0	0·08	0·40	Na - HCO3/CO4
				C		7·4	45·0	23·8	23·8	10·5	81·9		17·6	n.a.	n.a.	n.a.	n.a.	
Marianna W.H. (shallow, isolated), 20 km West of Cordillo Downs	March 1978	Water	–	A	135	8·2	12·6	7·2	1·8	12·6	45	n.a.	8·0	n.a.	1·0	0·04	0·17	Na - HCO3
				C		16·5	43·3	28·3	11·8	27·8	59·5	n.a	12·7	n.a.	n.a.	n.a.	n.a.	
Coongie Lake (shallow, milky) N.W. arm Cooper Creek	March 1978	Water	–	A	1270	31·0	253	15·0	16·2	177	381	51	51·3	n.a.	6·0	0·63	1·04	Na-Cl/HCO3/CO4/SO4
				C		5·8	79·3	5·4	9·6	35·7	56·7		7·6	n.a.	n.a.	n.a.	n.a.	

C. SALINE WATER COMPOSITION

Location	Date	Substance	Weight		EC	K^+	Na^+	Ca^{++}	Mg^{++}	Cl^-	$HCO_3^=$	$CO_4^=$	$SO_4^=$	NO_3^-	SiO_2	B	F^-	Dominant Group(s)
Nappamerrie W.H., Qld	n.a.	Water	–	A	640	6·2	86	26·6	10·6	152	76	n.a.	26·0	1·0	16·5	0·11	0·59	Na-Cl
				C		2·6	61·3	21·7	14·2	70·6	20·5	n.a.	8·8	n.a.	n.a.	n.a.	n.a.	
Callamurra W.H.	n.a.	Water	–	A	880	7·4	116	37·0	15·0	216	106	n.a.	29·2	0	12·0	0·1	0·24	Na-Cl
				C		2·2	60·6	22·1	15·0	72·6	20·2	n.a.	7·1	n.a.	n.a.	n.a.	n.a.	
Cooper Creek at Innamincka Causeway	n.a.	Water	–	A	830	7·8	110	19·0	13·9	198	116	n.a.	26·4	0	12·0	0·06	0·28	Na-Cl
				C		2·8	67·6	13·4	16·2	69·6	23·6	n.a.	6·8	n.a.	n.a.	n.a.	n.a.	
Bore Water from depth of 23m at Innamincka	n.a.	Bore Water	–	A	3100	10·5	517	90·1	68·7	730	396	n.a.	266	10·5	68·0	0·49	0·41	Na-Cl
				C		0·8	68·3	13·6	17·1	63·2	19·9	n.a.	16·8	n.a.	n.a.	n.a.	n.a.	

D. RAIN WATER COMPOSITION

Location	Date	Substance	Weight		EC	K^+	Na^+	Ca^{++}	Mg^{++}	Cl^-	$HCO_3^=$	$CO_4^=$	$SO_4^=$	NO_3^-	SiO_2	B	F^-	Dominant Group(s)
Innamincka; from tank	April 1978	Rainwater (Tank)	–	A	72	0·8	1·9	2·8	0·4	4·5	30	n.a.	5·5	6·5	n.a.	n.a.	n.a.	Ca - HCO3
				D		n.a.	31·6	55·3	13·0	16·4	68·5	n.a.	15·1	n.a.	n.a.	n.a.	n.a.	
Birdsville, Qld; from tank	April 1978	Rainwater (Tank)	–	A	335	6·2	38	17·0	5·1	51	73	n.a.	26·8	6·0	n.a.	n.a.	n.a.	Na-Cl/HCO3
				D		n.a.	56·5	29·1	14·4	45·0	37·5	n.a.	17·5	n.a.	n.a.	n.a.	n.a.	

A – analysis in mg/l
B – percentage composition, calculated from equivalents.
EC – electrical conductivity in micromhos/cm at 25ºC.
C – percentage of total anions or cations, calculated from equivalents.
D – percentage of total anions or cations, calculated from equivalents; three major anions and cations included

Eyre, has remained permanently fresh (Wopfner, 1970; Table 2B and refer to Table 2A for comparison).

The saline waters of Nappamerrie,east of the study area in Queensland (Table 2C),have been observed to cause normally turbid, milky waters of the Cooper to become clear in times of flood, when clay particles become floculated by the salt content (Mr. M. Steel in Johnson, 1980). However, the overall contribution of such saline waterholes to the salt load of the creek downstream in the study area is considered to be negligible (Johnson, 1980)

Such saline areas in the Cooper Creek Environmental Association are uncommon . In Table 2B is shown results of analyses of water from several waterholes and lakes within the study area, which can be seen to have generally negligible salt content when compared with the figures for Lake Eyre (Table 2A). Even the saline area around Innamincka (Table 2C) is relatively fresh in comparison.

The chemical composition of rainfall can give an indication of the chemical character of soils of the local environment, as surface dust is carried in winds and subsequently washed down in rain. Where there is no dust and no salt, the rain is nearly as fresh as distilled water (as in the Mt. Kociusko district - Johnson, 1980). Of relevance is a recent study to determine the relationship between soil salt levels and solute levels in rainfall along the Moomba to Sydney pipeline (Johnson and Rice, 1978 in Johnson, 1980). They found that salinity levels varied markedly, and that soils were of similar composition to rain water from the same region in terms of salt content. Soil leachate fell into two major groups - sodium bicarbonate and sodium chloride dominant - and two smaller groups viz. calcium bicarbonate dominant and no dominance.

The following observations are worthy of note:-

- calcium carbonate is probably the dominant constituent of soil dust
- all soils contain some sodium chloride
- gypsum (hydrated calcium sulphate) is the source of soil sulphate

The two rainfall analyses for Innamincka and Birdsville (Table 2D) indicate the levels of particular ions about the study region and they suggest a predominance of carbonate in soils. Around Innamincka, calcium is also prominent, while sodium chloride attains prominence near Birdsville. More saline lakes are found in the Birdsville area. Similarly, analysis of rainfall from the region of the north-west duefields should also indicate a higher proportion of sodium chloride, due to the presence of salt lakes there.

2.4.2 Fauna of Salt Lakes - General

While little is known about the fauna of salt lakes, the occurrence of Foraminifera has been noted (Ludbrook, 1965), and the incidence of spiders, with vertical burrows topped by silk, several hundred metres in from the margin has been observed (Mollemans, unpubl. data). Numerous dead insects have also been observed entrapped within and on the salt crust of lake floors. These have undoubtedly been blown onto lakes by wind and perished.

Salt lakes may also form barriers to faunal migration, in particular, to the ground dwelling faunal components. This will obviously occur while they carry water, but may also be significant when the water has evaporated leaving only salt crust. Salt lakes are a harsh environment.

During the study of Environmental Association 8.4.4 salt lakes were not surveyed, although plant collections were made in the vicinity of some examples e.g. Lake Perigundi (Appendix R). They are however, an important component of the environment of Association 8.4.4 and as such warrant further attention.

2.5 CLIMATIC AND RELATED CONSIDERATIONS

The Cooper Creek Environmental Association 8.4.4 is an arid, desertic region within one of the largest inland drainage basins in the world, in which large rivers, now reduced to intermittent creeks, once flowed (Price, 1955). In this section the more significant climatic influences, the nature of flows along Cooper and Strzelecki Creeks, and the phases of the moon are outlined.

2.5.1 Climatic Considerations

The climatic influences to be dealt with are rainfall, temperature and evaporation, and winds. Some concluding remarks will also be made on the general effects of climate on the biota of 8.4.4.

2.5.1.1 Rainfall

Rainfall of arid areas of Australia has been said to be extremely erratic (Madigan, 1946), as well as seasonal and highly intermittent (Price, 1955). The following data for the study area support these conclusions, although it will be apparent that unseasonal rains are also significant at times.

Graphs of rainfall data for the period January 1979 to August 1983 (Appendix C1-5; and refer also to Appendix C6, which shows the combined rainfall data for these five years) show well the variability of the rainfall in the study area. In some months total rainfall exceeded 120 mm (Appendix C1 - January 1979), whereas the rainfall for some years does not even total 60 mm (Appendix C4 - 1982). The fact that rainfall records for Moomba and Innamincka Homestead, which are separated by a distance of only 60 km, can vary by as much as 50 mm in some months (Appendix C3 - January and July 1981) shows that rainfall across the study area can be extremely localised.

Most rain falls on only a few days each month, mostly in summer. The recent (January 1984) flooding of the north of the State was caused by heavy rains over a few days, which were apparently very localised - Moomba recorded 33 mm on January 13 and 99 mm on January 14, while Birdsville received 25 mm on January 12 and 22 mm on January 13 (Bureau of Meteorology). Association 8.4.4 is in the Eremaean zone of Burbidge (1960), in an area with a summer rainfall influence.

Annual totals, mean annual totals and mean monthly totals of rainfall recorded at Birdsville, Cordillo Downs, Innamincka (which relate directly to the study area), Marree (for comparison) and Tambo, Queensland (on the upper reaches of the Barcoo River - a source of the Cooper) are tabled in Appendix D. These data show that rainfall for Birdsville, Cordillo Downs and Innamincka is much more erratic than that for Marree or Tambo. Although Birdsville, Cordillo Downs, Innamincka and Marree have essentially the same mean annual totals, Marree's annual totals show much less deviation from the annual mean. The minimum annual rainfall for Tambo is 37.5 mm greater than the average of mean annual totals for the other four stations.

Rainfall in Australia's arid regions has a reliability of less than 30 per cent (Nix, 1981). The data in Appendix D support the conclusions of Madigan (1946) and Price (1955) concerning the erratic and intermittent nature of the rainfall, and because of this the amount of rainfall received at specific localities within the study area cannot be estimated. General remarks only can be made about the likely level of rainfall received by the region as a whole over particular periods of time.

2.5.1.2 Temperature and Evaporation

Mean monthly maximum and minimum temperatures for Moomba and Birdsville, and monthly totals of evaporation for Moomba are shown in Appendix E (1-5). Mean monthly temperatures are highest in February and lowest in July. Temperatures for Moomba are often 1-2°C below those for Birdsville, about 250 km to the NNE. Over the period January 1979 to August 1983, annual mean maxima for Moomba and Birdsville, respectively, were 29.6°C and 30.3°C, and minima 15.1°C and 15.5°C.

Evaporation is generally at a minimum during June/July and at a maximum in December. This means that evaporation is highest when the summer rains can be expected and lowest when the Cooper Creek is generally flowing (see Section 2.5.2). Because of the high evaporation rates experienced across the study area as a whole, surface waters do not remain long, except in the deeper waterholes and lakes.

2.5.1.3 Winds

Appendix E(1, 2) shows wind directions recorded at Moomba between 1977 and 1979. The most frequent wind direction is north-west (SANTOS, 1981). The winds that are experienced from November to March are often hot and drying (Appendix E1-6), and their effects are discussed below.

2.5.1.4 Individual and Combined Effects of Climatic Conditions

The temperature, evaporation and rainfall data show that Association 8.4.4 is truly arid. As a consequence, the organisms of the study area are subject to a high degree of environmental stress (dessication caused by high temperatures and lack of water) in the warmer months. Perennial plants have evolved various adaptations enabling them to withstand such conditions (e.g. small leaves, involuted leaves, leaves with a stellate tomentum, leaf shedding and succulence) and refer to Symon (1982) for a description of the xeromorphic adaptations exhibited by Solanum oligacanthum. Animals, on the other hand, because of their mobility, have evolved a range of behavioural adaptations that enable them to evade (to varying degrees) the extremes of summer e.g. by burrowing (Macrotis lagotis), being crepuscular or nocturnal (most mammals and reptiles of the region), or by emigrating (on a local and regional scale - Macropus rufus and many species of birds).

Hot, drying winds, that are experienced between November and March, have several significant effects. Evaporation rates increase dramatically with increasing wind speed, leading to the rapid drying up of surface waters. They also contribute to the dessication of the biota by increasing transpiration (and perspiration) rates. Another effect is that of sand blasting. Apart from its importance geomorphologically as an eroding agent, this process can be particularly detrimental to seedling plants. Winds pick up surficial particles of sand and carry them at abnormally high velocities over the land surface, wrenching newly established seedlings from the ground and severely abrading others. In a wider context, the problems of soil drift and desertification in the Australian arid zone are well known - overgrazing by stock and rabbits has led to the greater mobility of the land surface since pastoral occupation. The general role that wind plays in the dispersal of many plants (by seed) is noted.

2.5.2 Flows along the Cooper and Strzelecki Creeks

2.5.2.1 Introduction

The main channel of the Cooper Creek carries water annually between April and July (Wopfner, 1970), and less frequently at other times in response to aseasonal rainfall within any part of the catchment. Very occasionally the Cooper Creek system feeds considerable volumes of water from Queensland into the east side of Lake Eyre North, while sometimes the Strzelecki Creek flows into Lake Blanche, which if filled then feeds into Lake Callabonna (Price, 1955). Although the Strzelecki Creek is a distributary of the Cooper, it rarely flows due to discharge from the Cooper. Most flows are the result of local runoff alone.

Bonython (1955) considers that the Cooper Creek is the chief supplier (potentially at least) of water to Lake Eyre, but Mason (1955) believes that the Warburton is more significant. Mason based his conclusions on rainfall data and the existence of the Warburton groove (a deep channel within the lake), with no equivalent structure emanating from the mouth of the Cooper. Both rivers must flow very significantly to fill Lake Eyre (Bonython, 1955), and this only occurs as a result of abnormal incidence, distribution and amount of rainfall (Mason, 1955) as occurred in 1949-50 and 1973-74. The 1974 water level in Lake Eyre is said to have resulted from the greatest flooding event in the past 500 years (Dulhunty in Johnson, 1980). This level has been exceeded at least three times in the past 3 000 years (Dulhunty in Litchfield, 1983).

The pattern of flows along creeks running into Lake Eyre is dependent upon rainfall, runoff efficiency in catchments, actual river levels and flow data (Mason, 1955). Mason (1955) analysed the pattern using rainfall data (district averages) alone with limited success.

For a more detailed determination, restricted to the Cooper and Strzelecki Creeks, much of the necessary information is readily available from government authorities - rainfall statistics from the Bureau of Meteorology, and the river level and flow data from the Water Resources Branches of the South Australian Engineering and Water Supply Department (E&WS) and Queensland Water Resources Commission (WRC). There are various recording stations along the Cooper Creek including Callamurra Waterhole (E&WS) east of Innamincka and Currareva, Qld (WRC), near Windorah just below the junction of the Barcoo and Thompson Rivers - data has been obtained from both these stations. Information pertaining to catchment runoff efficiency is sketchy, although the State's water resources authorities can supply estimates relating to particular flow events.

2.5.2.2 Reliability of Flow Prediction using Rainfall Data Alone

The Strzelecki Creek has been reliably reported to have flowed 15 times in the last 101 years <u>viz.</u> 1882, 1906, 1936, 1949, 1950, 1951, 1955, 1956, 1963, 1971, 1973, 1974 (the largest), 1976, 1977 and 1979 (Mr. B. Nicholson, pers. comm.). That only three flows have been (reliably) reported prior to 1949, indicates that the record is incomplete, although the Strzelecki Creek channel was well silted for <u>ca</u>. 30 years after the turn of the century, making substantial flow unlikely (Mr. G. B. Ragless, pers. comm.), at least during this period. Rainfall data from Innamincka, which has been recorded since 1883, shows that three of the reported flows occurred in years when the rainfall was well below average (1951, 1963 and 1977 - Appendix D), and probably a fourth time in 1882 (based on the record for Birdsville in that year - Appendix D). This indicates that the rainfall in these years fell (largely) in a single event. It is obvious therefore, that the use of rainfall data alone is insufficient to precict the liklihood of flow unless individual rainfall events are included in the data. Thus Mason's (1955) attempt to use monthly district averages is not valid, nor would be the use of monthly totals from individual stations.

It is pointed out that nearly all flows along the Strzelecki result from local runoff; only in the years 1950 and 1974 of the 15 years mentioned above, did overflow from the Cooper cause the Strzelecki to run, and in these two years local runoff provided the initial impetus again.

2.5.2.3 Runoff Efficiency in Catchments

Although no firm data are available on runoff efficiency in catchments, several pertinent comments can be made.

When the country dries up, as during each summer or in the longer term due to drought, the land surface becomes parched, and a large part of any initial shower will be taken up by the substrate prior to runoff occurring. No obvious flows will occur when showers are only sufficient to wet the catchment, and this is thought to be the usual case with showers in the region. Therefore, for the Cooper and Strzelecki Creeks to flow, requires a heavy, intense shower or a succession of smaller events to provide flow impetus. Once flow has been initiated, barriers such as loess deposits in channels and over the floodplain generally, which develop during longer drought periods (e.g. the silting of the Strzelecki Creek channel for ca. 30 years after the turn of the century (Mr. G. B. Ragless, pers. comm.), as mentioned previously), impede flow progress. These barriers must be swept away before significant flow can occur, and this can only be achieved by prolonged heavy rain.

One such event occurred during 1949-50. The catchment of the Cooper received heavy, sustained rainfall in 12 of the 24 months. Local rainfall in the North-East in 1949 was important in clearing sandhills which had developed across its course near Kopperamanna in the preceding drought, thus opening the way for floodwaters to fill Lake Eyre in 1950 (Mason, 1955).

With any break in wetting of the land surface (of frequent occurrence), the runoff efficiency is low. The efficiency increases with successive showers and increases markedly when substantial flows clear any barriers that may have formed during a preceding dry period. Runoff efficiency in catchments then is determined by regularity and intensity of rainfall events in the catchment. And substrate nature, is also of considerable importance.

2.5.2.4 Flow Data - A Summary of Four Years Flow Data from two Recording Stations along the Cooper Creek

If large quantities of water are to reach the study area, significant falls of rain must be experienced in the catchment areas of the Barcoo and Thompson Rivers. Appendix G(1-4) displays the flow data recorded at Callamurra Waterhole (27°42'S / 140°52'E) and Currareva, Qld (25°20'S / 144°44'E).

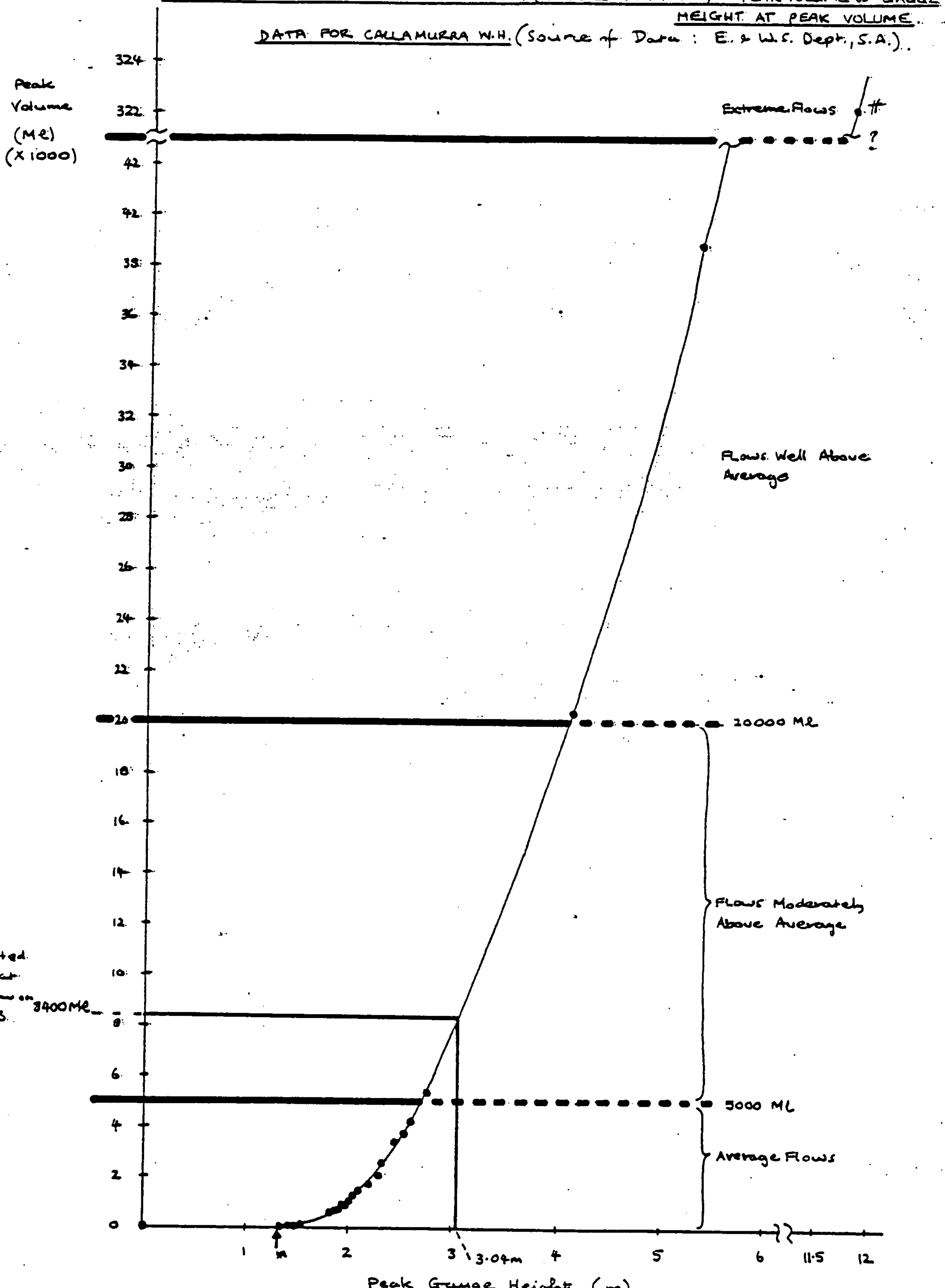
During average years less than five per cent of the water recorded at Currareva reaches Callamurra Waterhole and passes into the Cooper floodplain west of Innamincka (e.g. 1980, 2.04% - Appendix G2; 1982, 4.9% - Appendix G4). The remainder spreads out in the "Channel Country" in the Malagarga - Durham Downs district. In periods of greater than average rainfall e.g. 1979, as much as 20 per cent of the water received at Currareva may reach Callamurra Waterhole and hence the Cooper floodplain (Appendix G1). The amount of water received at Callamurra fromCurrareva is probably significantly higher again in years of exceptional flow as in 1974.

2.5.2.5 Flows along the Cooper Creek During 1983

Although no graphable records are yet available for the period after February 3 1983, initial flow charts for Callamurra Waterhole were observed. In addition, an officer of the E&WS was at Callamurra making field observations at the time of peak flow on July 10. This information is summarised in Table 3.

Figure 6 – PEAK VOLUME DAYS FOR ALL MONTHS FROM OCTOBER 1978 TO JANUARY 83 INCLUSIVE, AND ONE RECORD FOR FEBRUARY 1974 (FOR COMPARISON) – PEAK VOLUME vs GAUGE HEIGHT AT PEAK VOLUME.

DATA FOR CALLAMURRA W.H. (Source of Data: E. & W.S. Dept., S.A.).



FM'84

* – Instrument (Gauge) Height is 1.340 m

\# – Recorded volume of 322000 Ml for peak flow on 18/2/74 is a doubtful estimate as instrument overtopped – estimated by correlation between Innamincka Causeway and Nappamerrie levels and field observations.

Table 3 - Date, Level and Status of Flow at Callamurra Waterhole from 3 ii 83 to 10 vii 83

Date	Level (m)	Status of Flow
3 iii 83	1.340 (= gauge height)	start of recorded flow
2 iv 83	1.78	peak
4 iv 83	1.77	second peak
17 iv 83	1.523	low
20 iv 83	2.13	peak
15 v 83	1.7	low
19 vi 83	2.1	small peak
2 vii 83	2.045	peak (end of chart)
10 vii 83	3.04*	peak for year

* equivalent to 2 m over Innamincka causeway.

In relation to Table 3, the following information is relevant. Between the peaks and lows, the rises and falls in water level tend to be gradual. This indicates the presence of a spring in the region of the waterhole (E&WS, unpubl. data). The spring may emanate from a shallow groudwater horizon reported to be present in the North-East of South Australia by Wopfner (1961). Some of the water appears to be slightly saline (see Section 2.4.1). This horizon is apparently charged when the Cooper Creek flows, and it gradually discharges as the water level drops. During a reconnaissance flight on August 14 1983, 35 days after peak flow, water was observed to be still flowing strongly over the causeway at Innamincka. The floodwater front had reached a point (27°51'S / 139° 28'E) near Lake Perigundi on September 17 1983. It took 68 days to reach this point from the time peak flow was recorded at Callamurra Waterhole (it is assumed that the peak in July of 3.04 m was needed for the 1983 flow to reach Lake Perigundi i.e. that the previous smaller peaks would not have provided sufficient impetus alone). This was after a two year drought, and so the channels may have been partially blocked by loess deposits. During more exceptional flows, the channels would be cleared more rapidly. There was a gap of 20 days between peaks at Currareva and Callamurra, although the slope of the land is greater between these two stations than in the Cooper floodplain in 8.4.4 (Wopfner, 1970).

If the monthly peak gauge heights are plotted against volume using data presented in Appendix G(1-4), the resulting relationship (Fig. 6) can be used to give an estimate of the volume of flow that passed into the study area in July 1983 during the peak flow period. An estimated volume of 8400 Ml/day passed through Callamurra Waterhole at this time, and it is thought that there may have been sufficient impetus for this flow to have barely reached Lake Hope before stopping.

2.5.2.6 Classes of Flow along the Cooper and Strzelecki Creeks

Flows caused by rainfall in the catchment of the Cooper Creek upstream from the study area can be divided into four main classes, while local rains can also initiate flow. The four classes of flow are described below:-

- Average Flows - generally occur annually between April and July; water flows to about as far as Cuttapirie Corner Waterhole on the main channel and Coongie Lake on the North-West Branch; the location of last remnants of the northern river red gum _Eucalyptus_ _camaldulensis_ _var_. _obtusa_ indicates the outer limits of influence of this flow event.
- Flows Moderately Above Average (Level 1 Flood) - occur irregularly in response to greater than average rainfall; water flows to Lake Goyder on the North-West Branch and may reach Lake Hope on the main channel; thought to occur once

every three or four years on average.

- Flows Well Above Average (Level 2 Flood) - occur rarely in response to much greater than average rainfall; water covers much of the Cooper Creek floodplain and fills Lake Hope to capacity (maximum depth of 10 m); floodwaters may reach Lake Eyre; once every 6-10 years on average.
- Extreme Flows (Level 3 Flood) - extremely rare events as a result of heavy rainfall over an extended period; floodwaters enter the Strzelecki Creek and flow along the Cooper to Lake Eyre in substantial quantities; such events may occur every 40 to 60 years on average.

As has been stated previously, the amount and intensity of rainfall events in the catchment are not the only determinants of the magnitude of flows along the Cooper Creek. Time of year in which flow events occur is an important consideration, as in summer high evaporation rates may significantly reduce the area affected by floodwaters. Also, the main channel and parts of the floodplain may be blocked by wind blown sands (see Section 2.5.2.3). Only the more significant flow classes would have sufficient velocity to clear the channels and open up the pathway to Lake Eyre. Additional factors are the time between flow events and the number of drought years between such events. Level 2 and 3 floods are generally the result of successive peaks with short intervening periods derived from more than one rainfall event. Channel floors and margins are saturated (and cleared) by the initial pulse, enabling subsequent pulses to travel faster and further before loss of impetus occurs.

Different classes of flow have been recognised in the past in Environmental Association 8.4.4 e.g. White (1917b) wrote of the Cooper: " A little further back, where the country is covered in big flood times, quite a forest of box trees grow " (box tree = coolibah). As White (1917b) has recognised, the pattern of vegetation found on the Cooper floodplain is critically influenced by the intensity and frequency of flood events. In fact an ordered zonation of vegetation occurs with increasing distance from the major channels, that can be correlated with the classes of flow distinguished above. It is thought that definable vegetation types can be correlated with the specific frequency of inundation experienced by various parts of the floodplain in the following manner - tall woodland near major channels that are annually filled by Average Flows; woodland and tall shrubland in less frequently inundated areas (Level 1 Flood); tall to low shrubland (with or without emergent stunted coolibah) in even less frequently inundated areas (Level 2 Flood); forbland/herbland in least frequently inundated areas (as influenced, although perhaps insignificantly, by Level 3 Floods). The first three classes of vegetation viz. tall riparian woodland, woodland/tall shrubland and shrubland, are probably dependent upon the frequency of inundation that they receive for their existence on the floodplain. In contrast, the ephemeral herbland/forbland may be more dependent on local rainfall events for its periodic expression rather than the extremely infrequent occurrence of a Level 3 Flood.

The description of the pattern and causes of the vegetation zonation on the Cooper floodplain is an over-simplification. For instance, topographical variations on the floodplain will result in a complex distribution of vegetation types with plant associations typical of one class of inundation occurring within the zone of another. Similarly stock grazing may have significantly altered the zonation of vegetation on the floodplain.

The Strzelecki Creek experiences two classes of flow - one as a result of extreme flows (Level 3 Floods) along the Cooper, when water spills over into the Strzelecki system near Innamincka, and the other as a result of local runoff. In contrast with the Cooper, the latter is the usual class of flow. A similar zonation of vegetation is observed on the Strzelecki floodplain, correlated with frequencies of inundation, as is described above for the Cooper floodplain, although the first class of vegetation (tall riparian woodland) is not represented on the Strzelecki floodplain, because flows are not an annual event.

2.5.2.7 Relative Status of the 1983 Flow along the Cooper Creek

The relationship between peak flow and peak gauge height, as depicted in Fig. 6, can be used to indicate the status of any flow event, relative to other flow events, in terms of the main classes of flow described above. In Fig. 6 the limits selected for separation of each main class of flow are for the most part arbitrary, as they are based on a limited period of records. A more accurate picture could be obtained by procuring longer term records and relating them to records from other recording stations. Such information could be used to speculate on the intensity of flood events as a result of heavy rainfall in Queensland; hence field surveys could be timed to coincide with the incidence of flood peaks (or other levels) in the particular area of interest.

Little confidence is attached to the limit set between Level 2 and Level 3 Floods in Fig. 6. It is known, however, that a peak of 5.36 m, recorded on February 23 1979 (Appendix G1), was insufficient for water to enter the Strzelecki Creek and in the context of this report, floods achieve Level 3 status only when flood waters enter the Strzelecki Creek from the Cooper. In fact the Strzelecki Creek did flow in 1979, but this was between January 18 and 26 (Mr. B. Nicholson, pers. comm.) a month before peak gauge height at Callamurra Waterhole, and so it was almost certainly due to local runoff. The actual level required before water enters the Strzelecki Creek may be about 7.0 m, although no published information is available.

For the flow which peaked on July 10 1983 and which influenced the study area during the field surveys, it can be gauged from the graph (Fig. 6), that this was a flow of moderately above average status (i.e. a Level 1 Flood).

2.6 PHASES OF THE MOON AT THE TIME OF FIELD SURVEYS

The phases of the moon for the period August to December 1983 are shown in Table 4.

Table 4 - Phases of the Moon* (August to December 1983).

	August	September	October	November	December
New	9	7	6	5	4
First	16	14	14	13	12
Full	24	22	22	20	20
Last	31	30	29	27	27

*(Source - Department of Marine and Harbours).

Notes:-

New moon rises with the sun at dawn.
First moon rises at midday, and so is seen for the first half of the night.
Full moon rises at dusk.
Last moon rises at midnight, and so is seen for the last half of the night.
Nocturnal animals thought to be most active soon after sunset, having been without food all day. They are more easily caught in pitfall traps if there is no moon for the early part of the night.

2.7 LAND EXPLORATION AND PASTORAL OCCUPATION

Charles Sturt named the Cooper Creek in 1844 after the Chief Justice of South Australia (Mincham in Litchfield, 1983). On August 14 1845 Sturt, on an exploration expedition in a NNW direction from Fort Grey Depot found and named Strzelecki Creek in the vicinity of Mudlalee Waterhole and later that year traversed the Cooper floodplain and central North-western dunefields on a journey via Mickiepooloo Hill and Lake Etamunbanie to a point 23 km ESE of the present location of Birdsville (Pearce, 1978). A.C. Gregory followed in 1858 when he came along the Cooper Creek from Queensland and followed the Strzelecki Creek down to Lake Blanche and further south in search of traces of Ludwig Leichhardt's lost expedition (Pearce, 1978; Mincham in Litchfield, 1983). Goyder had named Lake Blanche in 1857.

In 1859, a very dry year, Samuel Stuckey travelled north between Lakes Gregory and Blanche and discovered Lake Hope, one of the overflows of the lower Cooper Creek (Mincham in Litchfield, 1983). It is a large freshwater lake (Pearce, 1978), which Samuel White found completely inundated to a depth of 33 feet (10 m) in an ornithological expedition to the vicinity of Lake Perigundi in 1863 (Parker, 1980b).

1860-61 were the years of the ill-fated Burke and Wills expedition to the Gulf of Carpentaria (e.g. Pearce, 1978). The Victorian search party led by Alfred W. Howitt reached the abandoned depot (65) near Nappamerrie (Qld) in September 1861; they buried Burke and Wills and rescued King (Pearce, 1978). Alfred Mckinlay led the South Australian search party later in 1861 and found the grave of Wills; Howitt returned for the remains of Burke and Wills in 1862 (Pearce, 1978).

In 1862 Lake Hope was established as a cattle run by Thomas Elder in partnership with Stuckey and his brother in the Dieri tribal lands, which extended well to the north of the Cooper (Pearce, 1978; Mincham in Litchfield, 1983). About 1 000 Dieri originally inhabited the lower Cooper (Pearce, 1978) and thousands of aborigines lived along the Cooper in the 1860's (White, 1917b.

In early 1860 a favourable season in the south led to pastoral expansion (Mincham in Litchfield, 1983) with sheep, angora goats, cattle and horses being depastured in the central-northern parts of the State. However, in 1860-61 the European farmers experienced their first dry season, and the ensuing drought lasted six years (Pearce in Parker, 1980b). In 1864 the "Great Drought" set in, devastatingthe country beyond Goyder's Line. The great drought broke in 1866, at which time a major push northwards began - camels were introduced "to facilitate transport to and from the outlying runs", and a police station was built at Lake Hope due to conflict between aborigines and station hands (Mincham in Litchfield, 1983).

In 1868 the Lake Hope aborigines attacked Mundowdna Station (Mincham in Litchfield, 1983) and in retaliation all men, women and children were killed near Lake Massacre (White, 1917b) - only the dogs were spared!

In 1871 Captain Starlight brought stolen cattle down what is now the Strzelecki Track (S.A. Govt. Tourist Bureau, 1983), which was formally opened by Conrick of Nappamerrie later on (Mincham in Litchfield, 1983). The Strzelecki Track has been drought prone since stocking began and was temporarily closed in the 1880's (Mincham in Litchfield, 1983).

In 1874-75 J.W. Lewis was in the North-East at a particularly dry time on a journey in which he followed the Cooper upstream from Lake Eyre to six miles into Queensland (Lewis, 1875). Lewis's objectives were to map the country in and around Lake Eyre and to investigate the suitability of the land for pastoral occupation (Sutton, 1927). The expedition's naturalist - the indefatiguable Frank W. Andrews - discovered the Eyrean Grasswren Amytornis goyderi, and collected further specimens of the Night Parrot Geopsittacus occidentalis from along the Cooper.

The initial 3 540 km^2 of Innamincka Station was taken up in 1864 (Pearce, 1978) and the separate selection of Coongie was also made at about this time, although there is some confusion over the exact time (see Pearce, 1978 and Vickery in Litchfield, 1983 for conflicting accounts). Coongie was the scene of large scale killings of the aborigines in the 1880's (Pearce, 1978). In 1904 the drought affected Coongie and Innamincka runs were bought by Kidman for £34 000 and Coongie, became an outstation of Innamincka (Pearce, 1978). The edition of Kullamurra, Nappa Coongee and Merty Merty to the run gave it an area of about 27 500 km^2 and it carried an average of about 12 000 head which at times increased to 25 000 (Vickery in Litchfield, 1983). The present Gidgealpa Station was once part of Innamincka (Mr. J. Vickery, pers. comm.).

Clifton Hills was taken up in June 1876 incorporating an area of 5 000 km^2, which carried 7 740 cattle in 1882 (Pearce, 1978). It was subsequently expanded for a time to include Kanowana and Lake Hope in 1914 (see below).

Pandie Pandie as a run of 260 km^2 was taken up in 1876 and expanded to the east and west in the following year (Pearce, 1978).

In 1877 an area of 1 840 km^2 known as Cadelgo Downs was taken up and expanded in the following year. It was combined with Cordillo Downs by the Beltana Pastoral Company in 1903. Cordillo Downs had been stocked with 600 cattle and 10 000 sheep in 1878 over an area of 3 375 km^2 (Pearce, 1978). Haddon Downs was also taken up in 1878 and became part of Cordillo Downs in 1905 (Pearce, 1978). In the 1880's perhaps as many as 35 000 sheep and 7 500 cattle were on Haddon Downs, but their numbers were substantially reduced by the end of a 10 year drought in 1906 (Pearce, 1978; Mincham in Litchfield, 1983). Cordillo Downs (the original property) had a 120 stand blade shearing shed and sheep numbers at one time exceeded 80 000 but were down to (only) 20 000 in 1931 when it closed due to drought and the depression - it re-opened as a cattle station in 1940 (Pearce, 1978).

Kanowana was taken up in 1883 and both Kanowana and Lake Hope were merged with Clifton Hills in 1914 by the Beltana Pastoral Company after the Lake Hope homestead had been abandoned for some time due to drought - Clifton Hills once covered 28 500 km^2 but this was later reduced to about 21 000 km^2 (Pearce, 1978).

Kullamurra near Innamincka, and Nappa Coongee, Murteree (=Merty Merty) and Tinga Tingana along the Strzelecki Creek were taken up at about the same time - Birkett and Company had Tinga Tingana in 1883 (Litchfield, 1983; Vickery in Litchfield, 1983). They were all added to Innamincka for a time due to drought (Vickery in Litchfield, 1983).

In 1884 the government announced it had abandoned plans for a rail link between Farina and Innamincka via the Strzelecki Track (Litchfield, 1983).

The period of rapid growth ran out in the 1890's, a time of prolonged drought, widespread devastation wrought by rabbit plagues and overstocking, and the marauding hordes of dingoes that had multiplied as a result of the rabbit explosion - the previously held optimism for the potential of the land was never to return (Mincham in Litchfield, 1983). Several of the stations in the far west of the study area were forced to close in 1901 due to the string of drought years (Pearce, 1978; Mincham in Litchfield, 1983).

Between 1862 and the early 1880's most of the land now occupied as pastoral country was taken up, and has thus been stocked (almost continuously) for a period of a hundred years or more. Sheep were grazed extensively on many of the stations in the North-East up until the 1930's (Mr. G.B. Ragless, pers. comm.), but they have all been converted to cattle since.

The current pastoral leases are shown(in relation to 8.4.4)in Appendix H.

2.8 PASTORALISM, ARIDITY AND DESERTIFICATION

Madigan (1946) wrote of the "Dead Heart" : " The history of the country is made up of a series of long droughts broken by short periods of comparatively heavy rain, which put the land in good heart for a year or two, from which happy state it slowly but inevitably falls away again until the next rain comes.". Two such instances of drought breaking rains occurred in 1949/50 and 1973/74 (Mincham in Litchfield, 1983).

In 1916 the renowned ornithologist Capt. S.A. White visited the study area during one of the more favourable seasons in a long drought phase. He gives the impression, in his writings, that he has lost faith in his fellow men because of the disgusting treatment meted out to the country and its former occupants, and he alludes (White, 1917b) to some apparent changes in the study area as follows: " The country has changed ... through stocking and rabbits and the numerous blacks have disappeared for ever, wiped out and exterminated by the White Man." Of particular species or groups of plants, he writes: " Nature has placed a wonderful sand binder in much of the sandhills in the canegrass (Zygochloa paradoxa), and here again man has interfered and allowed stock to eat and trample this rush, or grass, down. . . Consequently the sand is drifting for miles and miles ", and, " Unfortunately stock and rabbits have reduced if not altogether exterminated many of the native grasses ", also,"eremophilas are not as common as in unstocked areas of the interior." Of the old man saltbush Atriplex nummularia, he writes, that it: " must have been plentiful before the country was stocked, but has been killed out through constant feeding anywhere near permanent water." He concludes by writing: " The season (1916) was one of the finest on record, but no end of good seasons will wipe the destruction caused by stock and rabbits. Many species of native shrubs have been eradicated over vast areas, thus allowing the sand to drift; and in a normal season this is a howling desert. I should have liked to have seen the country after such a splendid season as last year (1916) only before the despoiling hand of white man took hold of it. There is little doubt the flora and fauna were in a much better state. Unfortunately the aspect of the country has been much changed since it has been taken up and stocked."

Since the occupation of the pastoral lands of the study area and the wider arid zone, there have developed two central, partly opposing schools of thought on the causes of the deterioration of the arid lands. The pastoralist holds the view that anything eaten by stock is "feed" and that rabbits and other herbivores (native and feral) are competitors for this feed and water as well. According to the pastoralist, the major reasons for the deterioration of arid lands are rabbits in particular, and the regular occurrence of drought e.g. " By 1934,... the Strzelecki Track had become so dry and sandy owing to the ravages of rabbits and drought " (Vickery in Litchfield, 1983). The opposing view is that uncontrolled stocking of arid lands has also palyed a major part in its deterioration. This latter view was obviously held by White (1917b).

Perhaps the 1934 example given above is a poor choice as " Dust storms intensified following the long 1930's drought. Even the Cobbler sandhills of the Strzelecki Track were reasonably negotiable previously. Dust storms were a way of life for 20 years " (Litchfield, 1983) and " By 1934 even camel teams were unable to traverse the Strzelecki Route due to the thirty years of intermittent drought after the turn of the century " (Pearce, 1978), as obviously conditions were particularly severe at this time. However, prior to pastoral occupation of the region, some 500 species of plant grew in the study area (Appendix R) and many of these grew along the Strzelecki Creek; some of them apparently from Queensland (via Cooper Creek in times of extreme flow) e.g. " There is little doubt that the seeds of this tree (Queensland bean <u>Lysiphyllum gilvum</u>) have been carried down by floodwaters in Cooper Creek far up in Queensland and then into the Strzelecki " (White, 1917b). Even an orchid, the bluebeard caladenia <u>Caladenia deformis</u> and the blue bush <u>Maireana sedifolia</u> once grew here (Tate, 1889), but they have not been collected since last century and may now be locally extinct (see Appendix R).

Returning to the pastoralist's view, rabbits and drought have the effect (if the land is subject to a heavy stocking rate) of reducing the potential feed for stock, so that eventually all feed will be eaten and then even less palatable species will be taken; finally the stock perish from lack of feed. Five herds of cattle numbering as many as 25 000 have perished "to a beast" on Innamincka alone in the past (Vickery in Litchfield, 1983). More than 20 000 head perished on Innamincka in the drought before 1916 (White, 1917b). Doubtless, similar accounts could be found for other properties, when all feed had been consumed and waters evaporated. This is even the case in the 1980's as Vickery (in Litchfield, 1983) writes: " At time of writing, it appears that the sixth herd is also due to perish unless rains come." Apparently the thought of destocking in such times does not occur.

Although it is believed by some that cattle only forage in the "better" parts of the Cooper floodplain, such as the Coongie district, and never venture to the extremities of the floodplain, and that the major damage in these areas is due to rabbits, it appears that a number of times in the past during droughts they have been forced by sheer weight of numbers to forage in outlying areas till they perished. White (1917b) reported that as a result of dry conditions, dead cattle were extremely common ("more common than trees") along the Strzelecki and Cooper Creeks and near Lake Perigundi. Marked changes has already occurred to the vegetation by this stage (White, 1917b). The margins of Lake Perigundi were said to be well timbered by McKinlay in 1861 (Pearce, 1978), but this is no longer the case.

It is apparent even today, that there is little consideration shown for the future potential of the country as a feed source. For example, " When the river frontage and Coongie Lakes are eaten out the cattle are put onto the bores south and north of the river, on the outside country of the run " and then, " If the rains do not come before the area is eaten out, we must watch the cattle grow weak and perish " (Vickery in Litchfield, 1983).

Is there a "safe" carrying capacity where stock need not perish and the vegetation does not have to be "eaten out" ? If there is, it has not been considered important or practical in the past.

In fact, warnings have been given, but ignored. Ratcliffe (1936), in a pamphlet on ' Soil Drift in the Arid Pastoral Areas of South Australia ', wrote: " The basis of stocking of the saltbush country is considered and it is pointed out that it is fundamentally unsuited to stocking at a constant level, unless that level is determined on a "poor season" basis. Periodic overstocking is otherwise inevitable." This pamphlet was published after a considerable period of grazing and drought, so the lessons were learnt through difficult times. The comments of Ratcliffe (1936) apply equally well to other areas of arid land apart from the "saltbush country" mentioned by him, and since no major changes in grazing regimes have been implemented to this day, these comments are still pertinent. Perhaps some thought should be given to a form of long-term rotational grazing to stave off the effects of deterioration and allow for periods of recovery and seedling establishment and development; just as agricultural lands are periodically rested from cropping to allow for maintenance of soil nutrient status. Rabbit eradication at such times would also be advantageous.

Madigan (1946) stated the following: " It is obvious that a rainfall of five inches (127 mm) or under is practically useless. It is only the exceptional rains that bring any profit to the land, so that success must be the exception and not the rule, and that makes it a gambler's country. It is an exciting game, but can be played with success only by players with the necessary experience, and what is more important, with sufficient resources behind them to tide them over the lean years." Although the average rainfall of the study area is slightly higher (ca. 170 mm), the statement equally applies, and it can be added in admiration that the "players" need to be tough as well as experienced, and to possess sufficient personal resources in addition to the more material ones.

The problem lies in the nature of the "game" of odds that the pastoralist plays. As a dry spell of any duration progresses, the pastoralist simply waits for the relieving rains, which in many cases do come before significant stock losses are incurred (the fodder plants may well suffer in the process, however). If the rains do not come that day, week or month, there is just as much chance that they will come the next day (week or month, as did happen previously - at least on most occasions). Stock prices are rock bottom, and so there is no incentive for the pastoralist to destock; why should he, when if he can see out this dry spell, his stock will fetch a very fine price once they are fattened up on the "green pick" that follows a good rain? It is his gamble,because he has to bear the cost of the drought alone. However, he is gambling not only with his (short term) potential income, but also with the property of the general public, which he has leased in order to earn his living. The same land has the potential to feed countless generations and satisfy other needs of future societies over a considerably longer period of time. It is his responsibility, and that of the relevant authorities, to see that the land which is in his care is adequately treated.

A committment to the proper conservation of resources in the arid pastoral lands has already been made by the community in the form of the Pastoral Board, that desires of the pastoralist that he properly manages the land. However, the effectiveness of this body in adequately preserving the status of pastoral lands needs review. The stocking regimes today are certainly less intensive than at some times in the past and therehas apparently been some recovery of the land (although it is pertinent to remember that extinct species can never be recovered no matter how well their habitat may). Even with the paddock subdivision associated with the Dept. of Agriculture's Brucellosis and Tuberculosis Eradication Programme, many properties are still run on an open-range basis. Innamincka Station will apparently be able to hold more stock as a result of paddock development, but it should provide for more control over stocking pressure (Mr. G. Drewin, pers. comm.).

At present,in times of prolonged drought, the prevailing view of the pastoralist seems to be (see Vickery in Litchfield, 1983) to allow his herds to perish and concomitantly the country to be severely degraded as well. This may be because no "costs" are incurred, whereas destocking may actually cost him money (mustering and trucking costs may be greater than market value during a drought) - remembering that the rains may come next week thus avoiding the enormous costs of restocking. If this state of affairs is allowed to continue, desertification may well become a greater problem than it is already.

The costs are seen as purely monetary. However, the long term costs may be greater (immeasurably so) than the potential dollar profit from any one run. There is a concern that many species of trees and shrubs in the study area and the wider arid zone are not being replaced by adequate recruitment of seedling stages of the life cycle - one of the prime reasons for the suggestion made previously (in this subsection) of the possibility of implementing a form of long-term rotational grazing in arid pastoral lands. Lack of adequate seedling recruitment has been recognised as the main reason (under the influence of grazing) for the decreasing prominence of Eucalyptus spp. in agricultural areas (Sullivan and Venning, 1982), and of Acacia spp. in the southern arid zone (e.g. Lange and Purdie, 1976; Crisp, 1978). Loss of habitat for native fauna will be one inevitable result of further decline in the prominence of character plant species within the study area.

Suffice it to say that the minimum requirement for the adequate protection of pastoral lands is the institution of educational programmes and legislation to ensure that effective destocking does occur at certain times e.g. that destocking becomes mandatory after a certain period of drought has elapsed. Naturally, the pastoralist's welfare is also of importance, and the costs incurred in meeting the demands of the community at large should be shared by the community as a whole and not borne solely by the pastoralist. However, the conservation of the land, its resources and heritage are of prime importance.

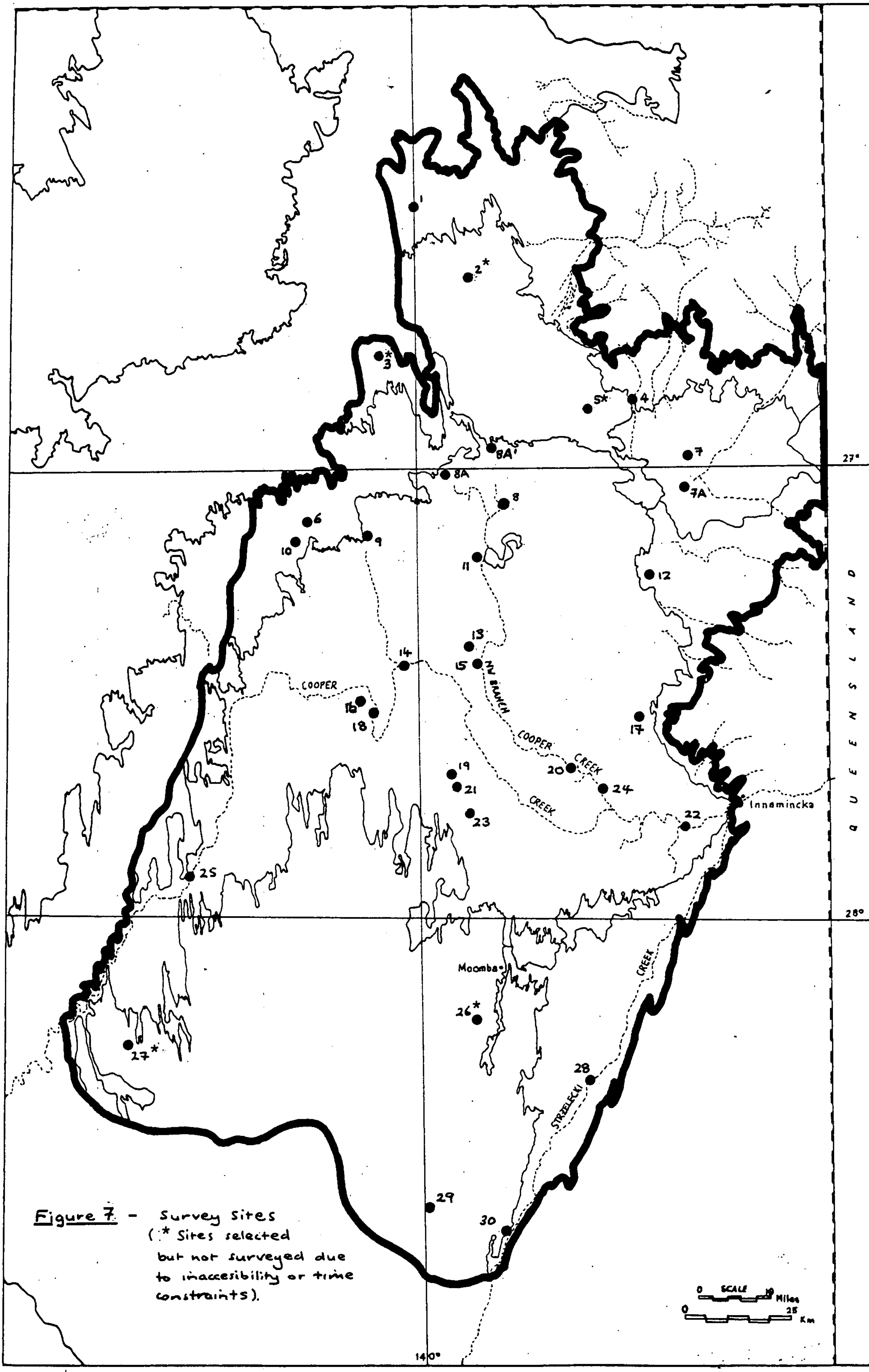


Figure 7 - Survey sites
(* Sites selected but not surveyed due to inaccesibility or time constraints).

3. MATERIALS AND METHODS

3.1 SELECTION OF SURVEY SITES

Survey sites were initially selected on the basis of:-

- inspection of aerial photographs and maps (geological and topographical).
- accessibility (use of tracks and potentially seismic lines).
- literature search - trapping at sites trapped previously may shed light on any changes that may have taken place through time at a particular site and by inference other sites.
- an aerial reconnaissance flight on August 14 1983 in an attempt to assess the likely importance of the flooding event and to provide a general overview of the study region.

The sites were selected to encompass all types of habitat identified in the region at least once, and ensuring that each (identified) Environmental Subassociation (Section 2.3.2) was surveyed. It was planned to spend approximately four days at each site. Survey sites were planned to be confined to a single land zone, and the biota of individual habitats (up to four) were sampled by trapping for mammals, bird censusing, trapping and active searching for herpetofauna, vegetation transecting and quadratting, and incidental observations and collections. All known habitat variation (at least the geomorphological component) was identified from 1:250 000 geological maps prior to the field trips. This habitat variation included dune crests, dune slopes, interdune areas, claypan margins and floors, and salt lake margins and floors in dunefields; floodout margins and floors, channel edges, ephemeral channels, waterholes, swamp margins and floors, and terminal lake margins and floors in floodplains; the gibber plain proper and gibber plain clay lenses in gibber plains. Time constraints precluded the detailed surveying of all other habitats that were identified in the field, but not evident from the geological maps. However, general observations on the nature of these habitats were made. All sites surveyed were marked and tagged.

32 sites were selected (depicted in Fig. 7) for surveying. Due to time constraints and problems of inaccessibility, only 27 sites (and not all of these were as originally designated) were in fact surveyed. It is hoped that the remainder will be surveyed in the future along with other significantly different areas that were identified during field trips, as they represent areas, about which little is known, within the study region.

3.2 MAPPING PROCEDURES, SCALES USED AND DATA COLLECTION

It was intended to use very recent LANDSAT thematic maps in addition to aerial photography in field surveys. This LANDSAT information proved to be unavailable at the time required, and so this aspect of the study was severely curtailed, except for the provision of a 1:250 000 Colour Image (Bands 4,5,7 - 104-079) of the region by the Outback Management Branch, Dept. of Lands. This proved useful in the planning stages and also enabled identification of areas of obvious grazing pressure - evident as distinct cross-fence contrast in some parts of the study area.

Aerial photography, including stereo pair coverage of survey sites (average scale 1:88 000 - Appendix N) and a complete set of 1:100 000 aerial photograph mosaics, dated between 1979 and 1981 were also made available by the Outback

Management Branch. The alteration of site locations, due to inaccessibility and time constraints, meant that workers at these altered sites had no aerial photographs,but in the main survey crews were supplied with the relevant photographs. The date and scale of photographs were amenable to broad-scale land system and vegetation mapping, where this was attempted.

Most of the results and analyses presented in this report relate directly to published 1:250 000 map sheets, due to unavailability of larger scale maps and thematic LANDSAT images.

The absence of better aerial photograph coverage did not hamper field operations, due to the development of a set of data gathering sheets for field use by N.P.W.S. officers and consultants, covering site, vegetation and vertebrate details,respectively (copies of these sheets are presented in Appendix I). Some deficiencies were found in the use of the data sheets, such as lack of space for specific information relating to traplines(i.e. trapline no., trap type, no. of traps used and spacing, and trap nights) or area surveyed (e.g. 1 or 10 or 100 etc. ha), but they certainly helped maintain a consistency in data format; these data being destined for computer manipulation.

An attempt has been made to produce detailed base maps for possible future mapping of habitats of the study area at a scale of 1:100 000, although this scale may yet prove to be too broad for adequate habitat representation. A single, smaller scaled (1:125 000) map has also been compiled along similar lines; both the 1:100 000 maps and the 1:125 000 map are derived from enlargements of other 1:250 000 map sheets. These maps have been lodged with the Survey and Research Section, N.P.W.S.

3.3 ASSESSMENT OF SURVEY SITES

Assessment of survey sites involved checking the representativeness of selected survey sites in the field and then sampling them using the following methodologies. A proposed methodology (Appendix J) was submitted to the Survey and Research Section prior to the first field trip. The progress report (Appendix K) details modifications of the methodology that were considered necessary at the completion of the first field trip.

3.3.1 Methodology used in the Assessment of Habitats

3.3.1.1 Methodology used by the Consultants

Methods used at the seven permanent sites surveyed by the consultants consisted of vegetation sampling and description.

3.3.1.1.1 Sampling of Vegetation

At each site selected to represent a major vegetation type, a permanent quadrat was established by locating permanent markers at each of the four corners. A photographic record was taken of the quadrats. Quadrat sizes were based on species vs area determination, and were generally in the order of 15 m X 15 m. In addition to the permanent quadrat, a second quadrat was sampled in the vicinity along with a one kilometre transect. The incidence of all plant species present in quadrats and within a five metre radius at intervals (generally 50 m - depending on the species richness of the association) along the transect was recorded. Unknown species were collected for later identification. Visual estimates of projected foliage cover, cover of litter and amount of bare ground were also made. At each site, observable features, such as soil type, landform type and effects of grazing were also noted.

3.3.1.1.2 Description of Vegetation

Vegetation types were described in terms of strata present, height, projected foliage cover of each stratum, and constantly recurring species in each stratum. Vegetation associations were classified according to the dominant stratum (= the stratum with most biomass). Within a given stratum, species were listed in order of decreasing prominence.

Within identified land zones, qualitative observations were made from vehicular and pedestrian traverses. This was done to establish the relationship between adjacent land systems and to assist in producing a vegetation map. An attempt was made to map vegetation using aerial photography with limited success (poor contrast and scale).

3.3.1.2 Methodologies used by Officers of the N.P.W.S.

Officers of the N.P.W.S. established two permanent sites and made incidental observations and collections of plants at another 18 sites. At each of these sites, the minimum accomplished was the assessment of the prominent plant community within any habitat in which a trap line was established, and a collection of the more common plants from it made. Notes on other incidental observations were taken. The methodologies used at the 2 permanent sites differed from each other and also from that used by the consultants. The information gained is included in the results.

3.3.2 Methodologies used in the Assessment of Fauna

3.3.2.1 Mammals

The following procedures were conducted to intensively survey the small mammal fauna at each site visited by the consultants. Trap lines consisted of 100 metres of drift fence with ten pitfall traps equally spaced along the fence, 18 box traps (Sherman or Elliot) placed one on either side of the fence between each two pots, and 32 box traps in a line out from the end of the drift fence at approximately 15 metre intervals. Traps were checked daily and pitfalls twice daily. The trapping protocol was varied from that described above on occasion (e.g. due to trap malfunction or lack of time to complete a line of pitfalls in one day). Each trap line was placed in a different habitat type at each site. For example, the fifth site (Site 6) was chosen to represent the North-western Dunefields. At this site trap lines were layed on a dune crest in unconsolidated sand vegetated with <u>Zygochloa paradoxa</u>, on a dune crest depression on soft consolidated sand vegetated with <u>Triodia basedowii</u>, in a interdune with hard consolidated sand vegetated with <u>Acacia ligulata</u> mainly, and on a floodout area of cracking grey clay vegetated sparsely with low forbs.

Considerable effort was made at each site to locate and capture species using a net and spotlight from the vehicle. At suitable locations, mistnets were erected to catch bats.

Other incidental observations were made. Sightings of large mammals, traces of other species (e.g. faeces, tracks, burrows) and skeletal remains were collected. An owl pellet deposit at Toolache Waterhole on the Strzelecki Creek was excavated by and the animal remains identified by Mr. Graeme Medlin.

In addition to the seven sites surveyed by the consultants, a further 20 sites were surveyed by officers of N.P.W.S. The trapping effort, which included pitfall lines, Elliot traps and mistnetting varied at each of these sites.

3.3.2.2 Birds

Each permanent site surveyed by the consultants was censused in the mornings using a [1]standardised "point-census technique", and the technique is briefly outlined as follows:-

1. Observer moves to a point (chosen in a non-subjective manner) in the habitat to be surveyed.
2. At this point, one minute is spent prior to the start of the five minute census period searching for all birds within 50 m of the observer, using visual and audible cues.
3. During the five minute census period, the distance of birds within 50 m of the observer is estimated at each of time 0, 60, 120, 180, 240, and 300 s. Other birds at greater distances are also noted at these times. An indication is made whether the individual has been "scored" in a previous interval between these times in the five minute period. The closest distance of birds in flight is recorded.
4. A note is made for each observation as to whether it was by visual or audial means, and if by visual whether it was first noticed by visual or audial cues.
5. The observer moves quickly 150 m to the next point to initiate the next census period, recording species noticed en route.
6. Numerical densities of species within particular habitats can be determined with appropriate analysis.

In addition to the point censuses, time was spent driving/walking short distances looking for different habitat types. All birds noticed while travelling and stopped were recorded in a log book. Cryptic species were specifically looked for in appropriate habitat. Birds seen while travelling between sites were also logged.

At the permanent sites surveyed by the N.P.W.S., the bird census involved general observations or observations over a set period of time. Data sheets for the remaining 18sites surveyed by the N.P.W.S. also contain bird notes, and some officers made notes of observations between sites.

3.3.2.3 Reptiles

The majority of collections of reptiles were made in the same pitfall traps as used to survey mammals. Occasionally reptiles were also caught in aluminium box traps set for mammals.

Active searching techniques were employed to collect reptiles during the day and night. During the day, rocks, logs and rubbish were turned and reptiles seen at large were pursued. Many burrows were also excavated. At night, spotlighting was conducted from a vehicle and on foot.

3.3.2.4 Frogs

Calls were detected and where possible, the calling animal collected. This was usually done at twilight or with a spotlight after dark. The pitfall traps also proved useful for the capture of frogs at one site after heavy rainfall. N.P.W.S. made a collection of one species that was not collected by the consul-

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[1] Standardised "point-census technique" recommended by Dr. H.F. Recher of the Australian Museum (Dr. D.C. Paton, pers. comm.).

tants.

3.3.2.5 Fish

At representative waterholes and swamps along the Cooper, samples of aquatic fauna were collected using a dip net of 300 μm plankton mesh. At several waterholes an eight metre seine net with 1.5 mm mesh size was also used and at one site a 50 m gill net with mesh size 45 mm was set to catch fish.

3.3.2.6 Aquatic Invertebrates

Samples of aquatic invertebrates were taken at representative waterholes and swamps along the Cooper Creek and in a puddle at the side of the Strzelecki Track. They were collected using a dip net of 300 μm plankton mesh and with a seine net eight metres long and having a mesh size of 1.5 mm. The sampling sites included the first 20 mm of the leading edge of the floodwaters which contained a high density of copepods.

A light trap was provided by Mrs. Alice Wells of the University of Adelaide to collect adult Trichoptera. Collections were made at two sites.

3.4 DURATION OF FIELD TRIPS

The first field trip undertaken by the consultants was between September 14 and October 2, while the second field trip was between October 26 and November 10. In addition, plant collections were made by one of the consultants in the study area between October 17 and 19.

N.P.W.S. officers undertook their first trip between September 18 and 24. Four officers remained for an additional four days.

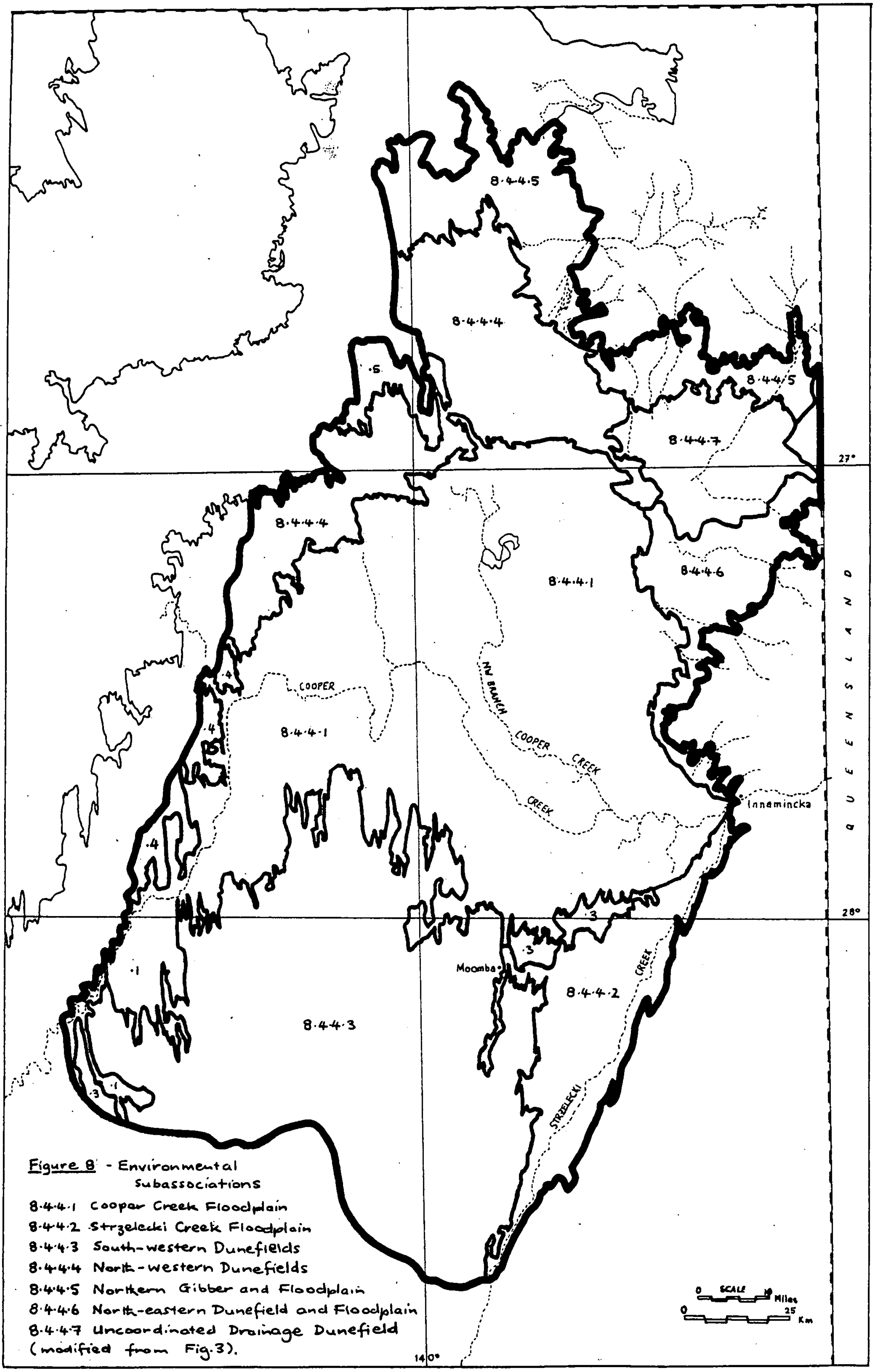


Figure 8 - Environmental Subassociations

8·4·4·1 Cooper Creek Floodplain
8·4·4·2 Strzelecki Creek Floodplain
8·4·4·3 South-western Dunefields
8·4·4·4 North-western Dunefields
8·4·4·5 Northern Gibber and Floodplain
8·4·4·6 North-eastern Dunefield and Floodplain
8·4·4·7 Uncoordinated Drainage Dunefield
(modified from Fig. 3).

4. RESULTS

4.1 INTRODUCTION

So far, habitat has been defined solely on landform criteria as used by Laut et al. (1977; see Sections 1.4 and 3.1). In reality, a proper evaluation of habitat requires consideration of both physical (especially landform and soils) features and biotic characteristics (in particular the dominant vegetation types). Variation within habitats has been ignored, as, in the context of this report, where habitats are the basal category (analogous to land units - see Section 2.3) in a hierarchial classification of 8.4.4, such intra-habitat variation is minimised, while inter-habitat variation is maximised. Interfaces between habitats have also been ignored.

In this section, it will become apparent that habitat as perceived by a botanist may be somewhat different to habitat as perceived by a zoologist. This difference reflects the different needs of various groups of organisms, and it confounds the attempt to have a uniform assessment of habitats within any region. This problem is looked at in Chapter 5.

4.2 DATA COLLECTION

4.2.1 Site Localitions

Information relating to principal survey site locations is presented in Appendix N (see also Fig. 7). More detailed information relating to habitats (up to four) sampled at each site is provided in data sheets and the 1:250 000 geological maps held by the N.P.W.S. A gazetteer of all locations mentioned in the text is provided as Appendix V.

4.2.2 Data Collected

Well over 300 data sheets were completed during the survey at the 27 sites and in intervening regions. There is a further body of information relating to the study area in the form of trip logs, bird censusing sheets and other incidental notes. The data have yet to be subjected to computer analysis, and so comments made in this report are based on a qualitative assessment of the information.

4.3 INFORMATION RELATING TO THE ASSESSMENT OF HABITATS

4.3.1 Plant species

A total of 1086 plant specimens (Appendix L) representing 49 families, 145 genera and 279 species (including 10 distinct subspecies and 17 distinct varieties - Appendix M) were collected. The habitat preferences of plant species (subspecies and varieties) is indicated in Appendix M, as is the status of each in the study area. 465 of the specimens were collected by the subconsultant botanist, mainly in the vicinity of the seven permanent sites surveyed by the consultants and along the North-west Branch of the Cooper. The remaining specimens were collected at the other 20 sites (two permanent) surveyed by the N.P.W.S., and so it can be seen that coverage of the study area was not even.

4.3.2 Environmental Subassociations

As a result of field surveys, one of the initial five Environmental Subassociations (Northern and North-eastern Gibber and Floodplain, 8.4.4.5 - see Section 2.3.2; Fig. 3) has been divided into three separate Environmental Subassociations (Fig. 8). This was due to recognition of its internal variation. These three Environmental Subassociations viz.8.4.4.5, 8.4.4.6 and 8.4.4.7 are much more homogeneous.

Seven Environmental Subassociations are thus recognised in the Cooper Creek Environmental Subassociation 8.4.4, as shown in Fig. 8. These Environmental Subassociations are:-

- Cooper Creek Floodplain Environmental Subassociation 8.4.4.1
- Strzelecki Creek Floodplain Environmental Subassociation 8.4.4.2
- South-western Dunefields Environmental Subassociation 8.4.4.3
- North-western Dunefields Environmental Subassociation 8.4.4.4
- Northern Gibber and Floodplain Environmental Subassociation 8.4.4.5
- North-eastern Dunefield and Floodplain Environmental Subassociation 8.4.4.6
- Uncoordinated Drainage Dunefield Environmental Subassociation 8.4.4.7

Environmental Subassociations 8.4.4.5 and 8.4.4.6 are named according to their major distinguishing features, while 8.4.4.7 is so-named because the drainage pattern is an uncoordinated combination of centripetal (to claypans or sandy interdunes) and dendritic drainage patterns. Detailed physiographic descriptions of all Environmental Subassociations recognised are given below.

4.3.2.1 Cooper Creek Floodplain Environmental Subassociation, 8.4.4.1

8.4.4.1 occupies the central part of the Cooper Creek Environmental Association 8.4.4. Landforms are dunes, interdunes, pans and floodplains, and small areas of sand plain. Geology is predominantly represented by aeolian and fluvial deposits. Soils are cracking clays, sands and earths. Vegetation consists of shrublands, grasslands and fringing woodlands, with forblands/herblands conspicous in better seasons. Climate is characteristic of Province 8 (Section 2.1.1), although micro-climatic variation is likely in regularly inundated areas or those which hold water over several seasons. 8.4.4.1 is subject to flooding of various intensity (see Section 2.5.2.6).

4.3.2.2 Strzelecki Creek Floodplain Environmental Subassociation, 8.4.4.2

8.4.4.2 occupies the south-eastern part of the Cooper Creek Environmental Association 8.4.4. Landforms, geology, soils and vegetation are similar to 8.4.4.1, although tall riparian woodland is absent from the Strzelecki Creek (Section 2.5.2.6). Climate is characteristic of Province 8 (Section 2.1.1), although micro-climatic variation is likely in the event of floodwaters of the Cooper Creek entering the Strzelecki Creek. This occurs rarely (see Section 2.5.2.6).

4.3.2.3 South-western Dunefields Environmental Subassociation, 8.4.4.3

8.4.4.3 occupies the south-western part of the Cooper Creek Environmental Association 8.4.4. Landforms are dunes, interdunes and pans. Geology consists predominantly of aeolian deposits. Soils are sands, earths and cracking clays. Vegetation consists of hummock grasslands, shrublands and forblands/herblands. Climate is characteristic of Province 8 (Section 2.1.1).

4.3.2.4 North-western Dunefields Environmental Subassociation, 8.4.4.4

8.4.4.4 occupies the north-western and northern parts of the Cooper Creek Environmental Association 8.4.4. Landforms, geology, soils and vegetation are similar to 8.4.4.3, but salt pans are more prominent in this Subassociation and hence, salt lake soils and associated vegetation. Climate is characteristic of Province 8 (Section 2.1.1).

4.3.2.5 Northern Gibber and Floodplain Environmental Subassociation, 8.4.4.5

8.4.4.5 occupies the extreme northern fringe of the Cooper Creek Environmental Association 8.4.4, between the extensive dunefields within 8.4.4 and silcretes of the 'Cordillo Surface' to the north. Landforms are dunes, interdunes, pans, floodplains, gibber plains and associated topographic features (e.g. gibber plain gutters). Geology consists predominantly of aeolian and fluvial deposits and weathered duricrust (or silcrete) of the 'Cordillo Surface' - gibber. Soils are sands, earths, red duplex soils and cracking clays. Vegetation consists of shrublands, hummock and tussock grasslands, and fringing woodland, with forblands/herblands prominent in better seasons. The diveristy of plant species is highest here, associated with gibber plains; aided by the high nutrient status of the gibber plain red duplex soils (Cleland et al., 1925) - plant growth is most conspicuous in broken parts of the gibber surface, where the underlying soil is exposed in the absence of a close surface cover of gibber fragments. Climate is characteristic of Province 8 (Section 2.1.1).

4.3.2.6 North-eastern Dunefield and Floodplain Environmental Subassociation, 8.4.4.6

8.4.4.6 occupies the central-north-eastern part of the Cooper Creek Environmental Association 8.4.4. Landforms are sand plains, low dunes and interdunes, floodplains, and small occurrences of gibber plain. Geology consists predominantly of aeolian and fluvial deposits, with small areas of gibber. Sand, cracking clay, earth and red duplex soils predominate. Vegetation consists of hummock (and minor tussock) grasslands, shrublands and forblands/herblands (in better seasons). Climate is characteristic of Province 8 (Section 2.1.1).

4.3.2.7 Uncoordinated Drainage Dunefield Environmental Subassociation, 8.4.4.7

8.4.4.7 occupies the north-eastern part of the Cooper Creek Environmental Association 8.4.4. Landforms are circular or ovoid dunes, interdunes and pans, and drainage lines with small areas of associated floodplain. Geology consists predominantly of aeolian and fluvial deposits. Soils are sands, earths and cracking clays. Vegetation consists of hummock (and minor tussock) grasslands, shrublands and forblands/herblands (in better seasons). Climate is characteristic of Province 8 (Section 2.1.1).

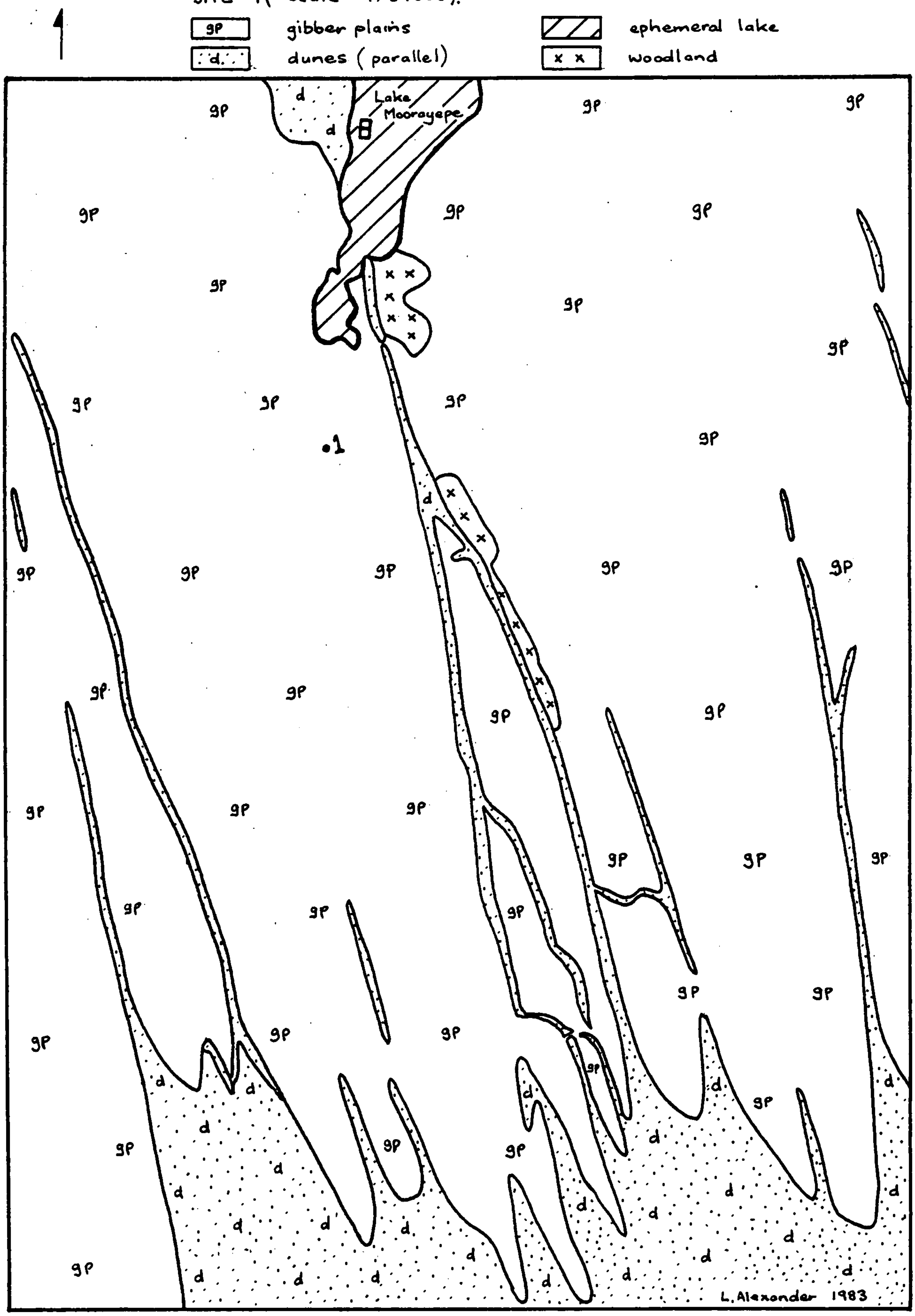
4.3.3 Land Zones

Survey site locations (Fig. 7; Appendix N) included examples of the three land zones viz. dunefields, floodplains and gibber plains. Each land zone was sampled at one or more site(s). Within the land zones, the following land systems were recognised.

4.3.4 Land Systems

During the survey of the Cooper Creek Environmental Association 8.4.4, vegetation - land system mapping was attempted using available aerial photogaphy and data was collected to enable delineation of all land systems present.

Figure 9 - Preliminary Vegetation - Land System Map of the Region Around Site 1 (Scale 1: 87000). 1km



4.3.4.1 Attempts at Vegetation - Land System Mapping using Available Aerial Photography

Vegetation - land system mapping was attempted in the vicinity of the seven permanent sites surveyed by the consultants viz. Sites 1, 4, 6, 14, 23, 25 and 28 (Fig.s 9-15; see also Fig. 7 for site locations in the study area). The black and white aerial photograph scale (average 1:88 000 - Appendix N) and age (some were taken in 1979), didn't allow for a very satisfactory discrimination of finer elements within the broad dunefield (dune crests were clearly visible), floodplain or gibber plain land zones e.g. Zygochloa paradoxa areas, Atriplex nummularia areas, Chenopodium spp. areas and certain grassland/herbfield areas. Vegetation of a more extensive nature, such as lignum Muehlenbeckia cunninghamii in Embarka Swamp (Fig. 13) and some channel-edge woodland (Fig.s 12 and 15) however, was clearly visible on photographs. In attempting to map areas, where the finer elements were not visible due to aerial photograph limitations, general descriptive terms such as floodplains, dunes and lignum swamp have been used. The vegetation of finer elements (habitats) in these broader areas is described in detail in Section 4.3.7.

It can be seen from the preceding paragraph that the scale of aerial photography available on 8.4.4 is amenable to attempts at vegetation - land system mapping (Fig.s 9-15) only in-so-far as such maps show the relationship between adjacent (broad) land system types and some of the vegetation components. Particularly, when such mapping is attempted with limited ground reconnaissance, which can only be the case with with current budgetary limitations (a trend that is likely to continue). To enable more detailed land system mapping, larger scale aerial photography i.e. probably 1:50 000 scale and/or detailed ground reconnaissance is required. For adequate habitat representation, larger scale aerial photography again will likely be required.

4.3.4.2 Land Systems Identified from Field Data

Land systems of the study area can be identified initially according to their presence in the land zones viz. dunefields (D), floodplains (F) and gibber plains (GP). Their characteristics can then be described in such a way as to conform to the definition of land system as: " an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation " (see Section 2.3.4). This is accomplished in the following subsections.

4.3.4.2.1 Land Systems of the Dunefields

Dunefields are the dominant land zone of Environmental Association 8.4.4. Four distinctive types of dunefield are recognised viz. parallel dunefields (Dp - trending approximately north-south), uncoordinated drainage dunefields (Du), undulating dunefields (or lunettes - see Dulhunty, 1983) (Dlun) and sand plains with very low dunes (Ds). The land systems within these dunefield types are detailed below.

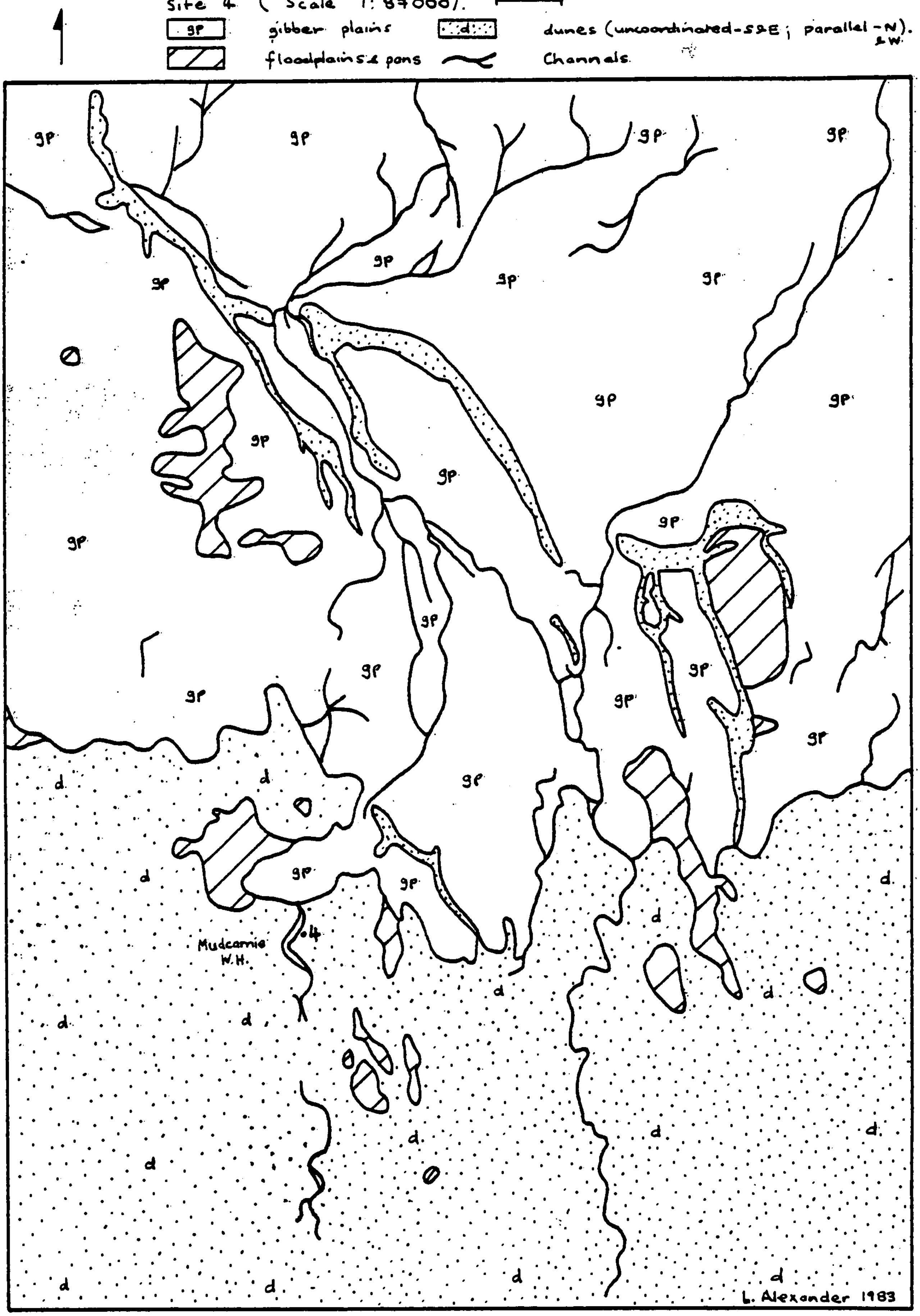
Land System Dp1

Parallel, red sand dunes with Triodia basedowii hummock grassland dominant on dune slopes and in interdunes. Zygochloa paradoxa hummock grassland is dominant on dune crests and upper slopes. Occurs as large expanses such as in the North-western Dunefields Environmental Subassociation 8.4.4.4 (e.g. Site 6 and 10; see also Fig. 11).

Land System Dp2

Parallel, red sand dunes with Acacia spp. tall open shrubland over ephemeral forbland dominant on dune slopes and in interdunes. Zygochloa paradoxa hummock

Figure 10 - Preliminary Vegetation - Land System Map of the Region Around Site 4 (Scale 1: 87000). 1km



grassland is dominant on dune crests and upper slopes. Occurs as relatively large expanses as in parts of the Cooper Creek Floodplain Environmental Subassociation 8.4.4.1 (e.g. west of Site 14; see also Fig. 12).

Land System Dp3

Parallel, orange sand dunes with Acacia spp. - Cassia spp. - Eremophila spp. mixed shrubland dominant on dune slopes and in interdunes. Zygochloa paradoxa hummock grassland is dominant on dune crests and upper slopes. Occurs as expanses (possibly large) in that part of the study area around Mudcarnie Waterhole (i.e. east (and probably west) of Site 4; see also Fig. 10).

Land System Dp4

Parallel, deep red sand dunes with Acacia ligulata low open woodland dominant on dune slopes and in interdunes. Zygochloa paradoxa hummock grassland is dominant on dune crests. Occurs as isolated expanses within the Cooper Creek Floodplain Environmental Subassocaition 8.4.4.1 (e.g. near Site 23; see also Fig. 12).

Land System Dp5

Parallel, deep red sand dunes with Acacia spp. low open shrubland dominant on dune slopes and in interdunes. Zygochloa paradoxa hummock grassland is dominant on dune crests. Occurs as isolated and larger expanses in the south-west part of the study area (e.g. near Site 25; see also Fig. 14).

Land System Dp6

Parallel, deep red sand dunes with Atalaya hemiglauca - Acacia spp. low, very open woodland dominant on dune slopes and in interdunes. Zygochloa paradoxa hummock grassland is dominant on dune crests. In parts, these dunes may have several parasitic dunes of the uncoordinated type or elements of uncoordinated type dunes on top - this is to be confirmed in a future survey. Occurs as isolated expanses adjacent to gibber plains in the Northern Gibber and Floodplain Environmental Subassociation 8.4.4.5 (e.g. near Site 1; see also Fig. 9).

Land System Dp7

Parallel, deep red sand dunes with Acacia ligulata - Salsola kali ephemeral low open shrubland dominant throughout - characterised by a lower diversity of species than other deep red dunes. Occurs as isolated expanses within the Cooper Creek Floodplain Environmental Subassociation 8.4.4.1 (e.g.near Site 14; see also Fig. 12).

Land System Dp8

[1]Paler coloured dunes of more recent deposition with Acacia ligulata low open shrubland dominant on dune slopes and in interdunes. Cynanchum floribundum low, very open shrubland is dominant on dune crests. Occurs as isolated expanses in the south-west part of the study area (e.g. the eastern South-western Dunefields Environmental Subassociation 8.4.4.3; see also Fig. 15) - more open and mobile dunes; few perennial species to bind the soil.

Land System Dp9

[1]Paler coloured dunes of more recent deposition with Acacia ligulata low open shrubland dominant on dune slopes and in interdunes. Ephemeral composites and Salsola kali dominate on dune crests. Occurs as isolated expanses in the Strzelecki Creek Floodplain Environmental Subassociation 8.4.4.2 (e.g. due west of Toolache Waterhole, where the dunes are a very pale (whitish) colour; see also Fig. 15).

Land System Dp10

[1]Paler coloured dunes of more recent deposition with ephemeral forbland dominant

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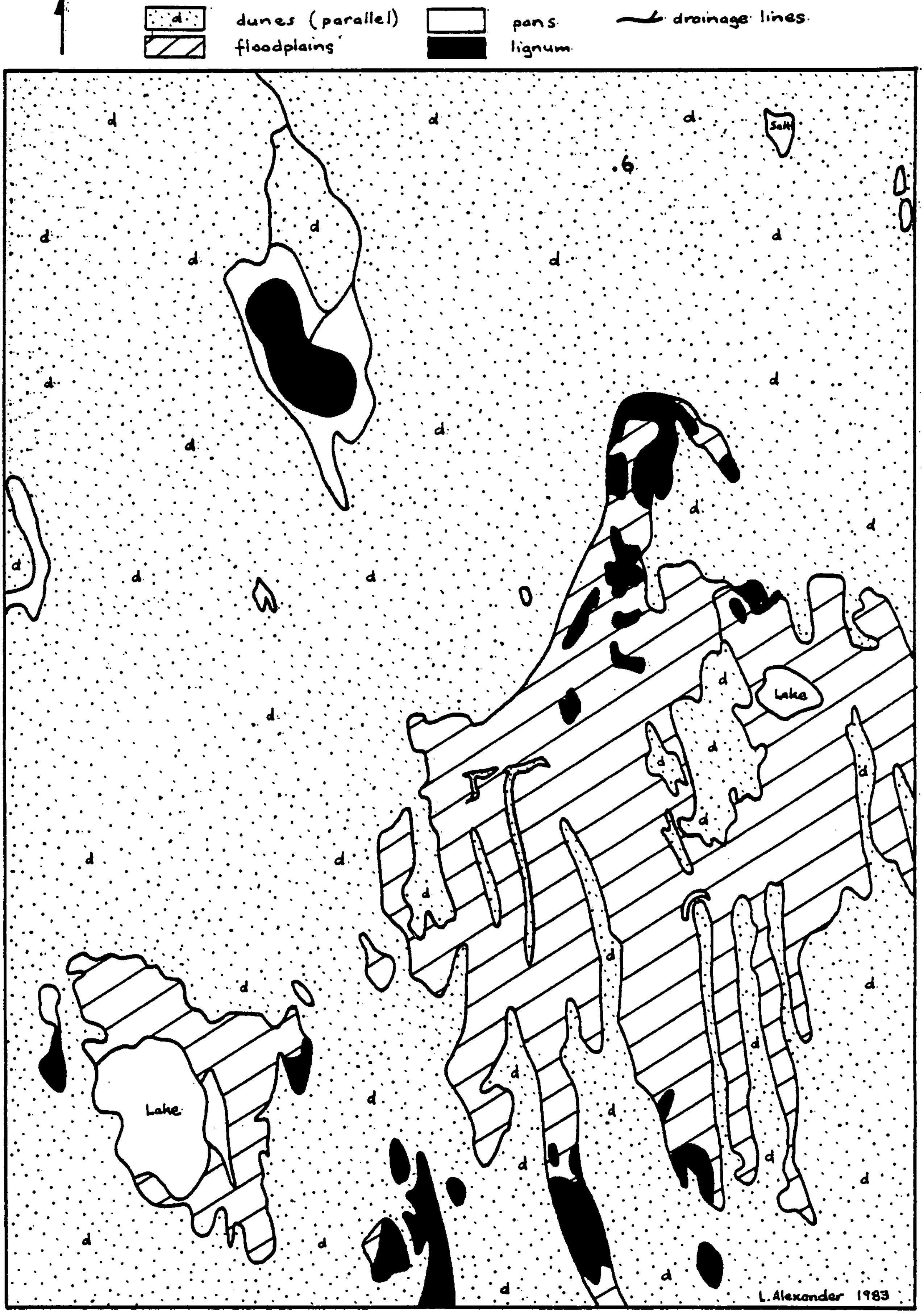
[1]Paler colour indicates proximity to sand sources.

Figure 11 - Preliminary Vegetation - Land System Map of the Region Around Site 6. (Scale 1:88 000). 1km



on dune slopes and in interdunes. Sparse Zygochloa paradoxa occupies dune crests. Occurs as isolated expanses within the Cooper Creek Floodplain Environmental Subassociation 8.4.4.1 (e.g. Site 16).

Land System Dp11

[1]Paler coloured dunes of more recent deposition with ephemeral forbland/herbland dominant throughout. Contains scattered Acacia ligulata and Cynanchum floribundum. Occurs as isolated occurrences within the Cooper Creek Floodplain Environmental Subassociation 8.4.4.1 (e.g. dunes bordering Coongie Lake).

Land System Dp12

[1]Paler coloured dunes of more recent deposition with ephemeral forbland dominated by Salsola kali on dune slopes and in interdunes only. Occurs as isolated occurrences in the south-west part of the study area (e.g. near Site 25; see also Fig. 14).

- -

Land System Dunc

Deep orange dune ridges around circular or ovoid interdunes, which are in parts modified by typical drainage lines of the dendritic type. Zygochloa paradoxa hummock grassland is dominant on dune crests and upper slopes, while Acacia spp. - Cassia spp. - Eremophila spp. mixed shrubland is dominant on lower dune slopes. Plant communities in interdunes are of five different types, which identify the different interdune habitats in this land system (see Section 4.3.7). Uncoordinated drainage dunefields are a localised apparently unique dunefield type mostly restricted to the area shown in Fig. 8 (e.g. near Site 4 and at Sites 7 and 7A; see also Fig. 10), and adjacent districts over the border in Queensland (refer to Dawson and Boyland, 1974).

- -

Land System Dlun

Areas of numerous small undulating dunes or sand fields of red clayey sands with gentle slopes mostly abutting the northern and north-eastern margins of some floodouts and swamps (e.g. near Sites 23 and 28; see also Fig.s 13 and 15). Acacia spp. - Cassia spp. mixed shrubland is dominant throughout. These undulating dunes, sand fields or lunettes (Dulhunty, 1983) are generally located between floodplains and adjacent parallel dunefields, and so the presence of both floodplains and parallel dunefields may be a prerequisite for their formation i.e. assuming they are of recent origin, as, they are present on the northern and north-eastern margins of floodplains, whereas the most frequent direction of wind today is north-west (see Section 2.5.1.3); slope of the floodplain surface is also of significance (Dulhunty, 1983).

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Land System Ds1

Sand plains of very low dunes with Cassia spp. - Acacia spp. mixed open shrubland over Triodia basedowii hummock grassland dominant. Occurs as large expanses in the north-east part of the study area (i.e. Environmental Subassociation 8.4.4.6; see Section 4.3.2.6).

Land System Ds2

Sand plains of pale to yellow sandy loam over clay with Acacia spp. - Hakea spp. mixed shrubland dominant. Occurs as isolated expanses in the study area (e.g. in the Cooper Creek Floodplain Environmental Subassociation 8.4.4.1 around Site 24).

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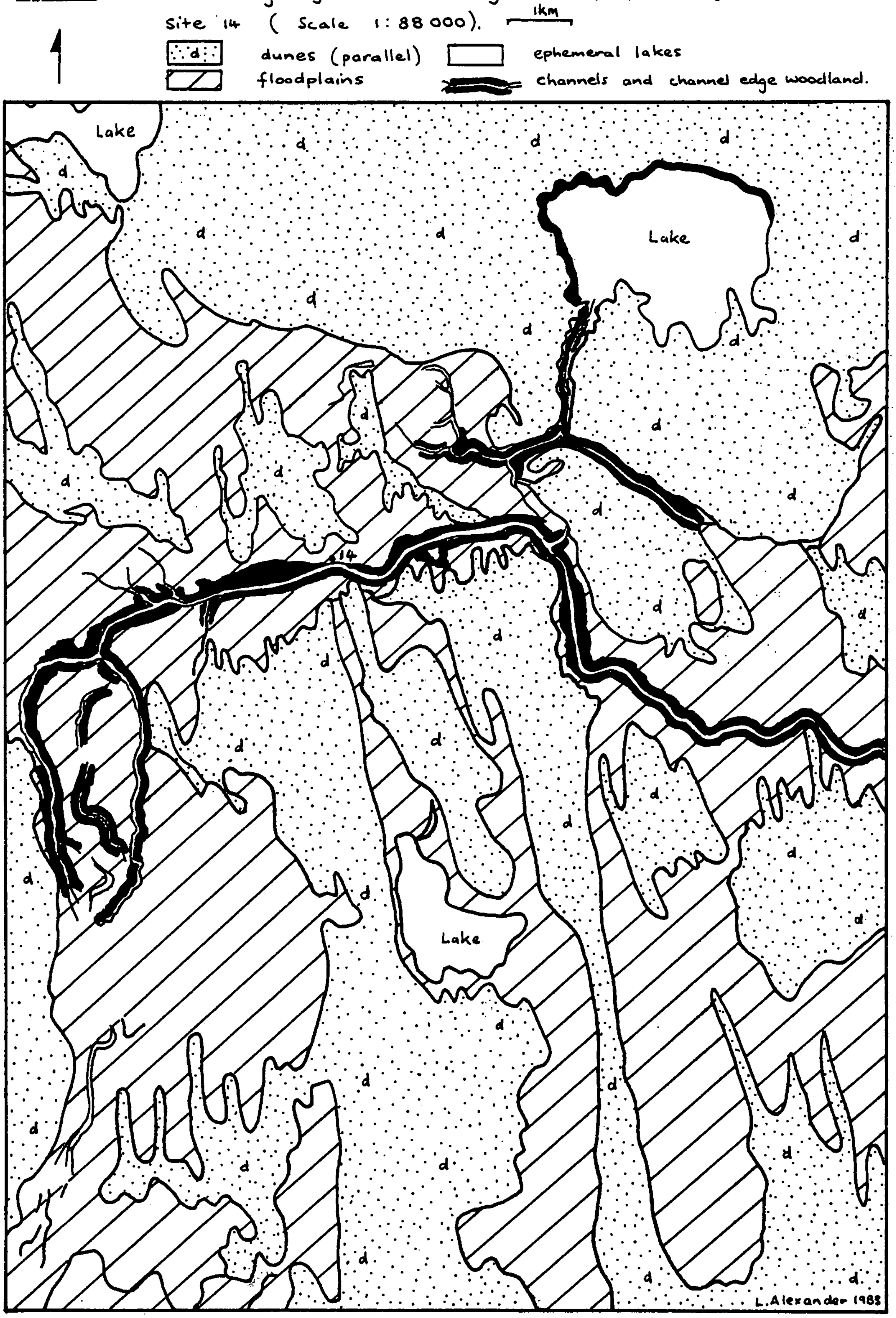
[1]Paler colour indicates proximity to sand sources.

Figure 12 - Preliminary Vegetation - Land System Map of the Region Around Site 14 (Scale 1: 88 000).



Land System Ds3

Sand plains of pale grey sands with Acacia victoriae low open woodland dominant. Occurs as isolated expanses in the study area (e.g. 14 km NW of Scrubby Camp Waterhole, where is was slightly undulating in nature and described in field notes as a dune slope/plain).

Land System Ds4

Sand plains of yellow grey hard silty clays with low (< 30 cm) open ephemeral forbland dominant. Occurs as isolated expanses in the study area (e.g. west of Site 28; see also Fig. 15).

4.3.4.2.2 Land Systems of the Floodplains

Floodplains are the subdominant land zone of 8.4.4. Three major floodplain environments are recognised viz. the Cooper Creek floodplain (Fc), the Strzelecki Creek floodplain (Fs) and other floodplains in 8.4.4 (Fo). The land systems within these floodplain environments are detailed below.

Land System Fc1

Floodplain areas of the [1]Cooper Creek with Eucalyptus microtheca + Lysiphyllum gilvum + Eucalyptus camaldulensis var. obtusa tall to low fringing woodland dominant on pale grey silty clay or cracking clay soils. Occurs in areas subject to most frequent inundation (e.g. Chillimookoo and Toonman Waterholes near Site 14, Embarka Waterhole near Site 23 and Sites 13 and 15; see also Fig. 12).

Land System Fc2

Floodplain areas of the Cooper Creek with Eucalyptus microtheca - Acacia stenophylla low fringing woodland dominant on grey silty clay soils. Occurs in areas subject to most frequent inundation (e.g. near Site 14; see also Fig. 12).

Land System Fc3

Floodplain areas of the Cooper Creek with Eucalyptus microtheca - Acacia salicina - A. stenophylla -Eremophila bignoniiflora low open fringing woodland dominant on silty clay soils. Occurs in areas subject to frequent inundation (e.g. near Sites 18 and 25; see also Fig. 14). Vegetation of a much reduced areal extent and species composition than most frequently inundated areas.

Land System Fc4

Floodplain areas of the Cooper Creek with Eucalyptus microtheca - Acacia stenophylla low, very open fringing woodland dominant on silty clay soils. Occurs in areas subject to less frequent inundation (e.g. near Site 25; see also Fig. 14).

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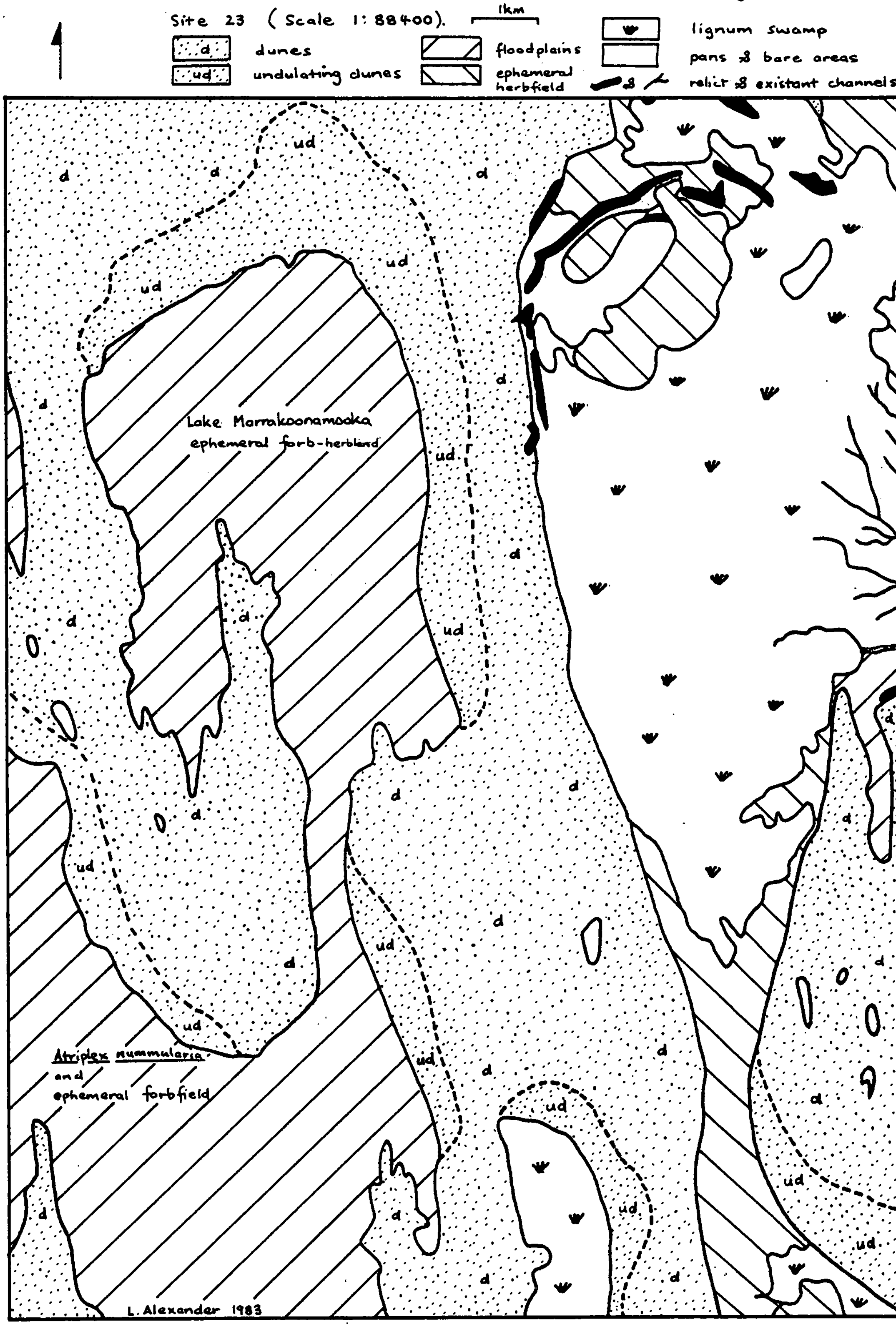
[1]In defining the land systems of the Cooper Creek floodplain, reference is made to levels of inundation as discussed in Section 2.5.2.6. Those areas affected by average flows and level 1, 2 and 3 floods of the Cooper and local runoff are considered most frequently inundated. Areas affected by level 1, 2 and 3 floods of the Cooper and local runoff are considered frequently inundated. Less frequently inundated areas are affected by level 2 and 3 floods of the Cooper and local runoff. And, least frequently inundated areas are affected by level 3 floods of the Cooper and local runoff; local runoff is generally of greater significance due to the rarity of occurrence of level 3 flood events (see Section 2.5.2.6). It is noted however, that correlation of vegetation types with levels of inundation can only be approximate. This is due to the tenuous nature of the subdivision of flows along the Cooper into the four main classes, which is based on limited data (Section 2.5.2.5). Still, water is the major determinant of vegetation distribution (Section 1.4) and type in the study area.

Figure 13 - Preliminary Vegetation - Land System Map of the Region Around Site 23 (Scale 1: 88400).



Land System Fc5

Floodplain areas of the Cooper Creek with Eucalyptus microtheca low open woodland dominant on pale sandy clay soils. Occurs in areas subject to less frequent inundation (e.g. on the northern and north-western margins of Embarka Swamp; see also Fig. 13).

Land System Fc6

Floodplain areas of the Cooper Creek with Eucalyptus microtheca low, very open woodland over Halosarcia indica ssp. leiostachya low, very open shrubland dominant on hard grey non-cracking clay soils of saline depressions. Occurs in areas subject to less frequent inundation (e.g. near Site 6; see also Fig. 11).

Land System Fc7

Floodplain areas of the Cooper Creek with Muehlenbeckia cunninghamii tall to low (2-3 m) shrubland dominant on grey cracking clay soils. Occurs in areas subject to most frequent inundation (e.g. near Site 23 - Embarka Swamp; see also Fig. 13).

Land System Fc8

Floodplain areas of the Cooper Creek with Muehlenbeckia cunninghamii tall open shrubland over ephemeral forbland dominant on grey cracking clay soils with silty sections. Occurs in areas subject to most frequent inundation (e.g. Site 13 - Tirrawarra Swamp).

Land System Fc9

Floodplain areas of the Cooper Creek with Muehlenbeckia cunninghamii tall, very open shrubland over sparse ephemeral forbland dominant on grey clay soils. Occurs in areas subject to frequent inundation (e.g. near Site 25; see also Fig. 14).

Land System Fc10

Floodplain areas of the Cooper Creek with sparse Muehlenbeckia cunninghamii tall shrubland patches over a generally absent or dead ground layer on grey clay soils. Occurs in areas subject to less frequent inundation (e.g. near Site 25 - appearred not to have been inundated for some time; see also Fig. 14).

Land System Fc11

Floodplain areas of the Cooper Creek with Muehlenbeckia cunninghamii low shrubland to low open shrubland dominant on grey cracking clay soils. Occurs in areas subject to most frequent inundation (e.g. near Site 14; see also Fig. 12).

Land System Fc12

Floodplain areas of the Cooper Creek with Muehlenbeckia cunninghamii low open shrubland dominant on clay soils. Occurs in areas subject to frequent(/most frequent)inundation (e.g. near Site 6; see also Fig. 11).

Land System Fc13

Floodplain areas of the Cooper Creek with Muehlenbeckia cunninghamii low, very open shrubland dominant on clay soils. Occurs in areas subject to most frequent inundation (e.g. Site 15).

Land System Fc14

Floodplain areas of the Cooper Creek with Acacia victoriae low open shrubland over Halosarcia indica ssp. leiostachya with occasional Muehlenbeckia cunninghamii dominant on sandy clay soils. Occurs in areas subject to most frequent inundation (e.g. Kudriemitchie Waterhole).

Land System Fc15

Floodplain areas of the Cooper Creek with Atriplex nummularia low shrubland to low open shrubland dominant on grey cracking clay soils. Occurs in areas subject to frequent inundation (e.g. near Site 14; see also Fig. 12).

Figure 14 - Preliminary Vegetation - Land System Map of the Region Around Site 25 (Scale 1 : 88 000). 1km

Land System Fc16

Floodplain areas of the Cooper Creek with Atriplex nummularia low open shrubland dominant on clay soils. Occurs in areas subject to frequent inundation (e.g. near Site 6; see also Fig. 11).

Land System Fc17

Floodplain areas of the Cooper Creek with Eragrostis australasica low open grassland dominant on grey cracking clay soils. Occurs in areas subject to less frequent inundation (e.g. near Site 23 - a component of Embarka Swamp; see also Fig. 13).

Land System Fc18

Floodplain areas of the Cooper Creek with Chenopodium nitrariaceum low open shrubland dominant on grey cracking clay soils. Occurs in areas subject to less frequent inundation (e.g. near Site 23 - a component of Embarka Swamp and Fly Lake; see also Fig. 13).

Land System Fc19

Floodplain areas of the Cooper Creek with Halosarcia indica ssp. leiostachya low open shrubland with sparse Meuhlenbeckia cunninghamii on sand/clay soils. Occurs in areas subject to less frequent inundation (e.g. margins of Coongie Lake). May be indicative of atypical saline conditions.

Land System Fc20

Floodplain areas of the Cooper Creek with Halosarcia indica ssp. leiostachya low open chenopod shrubland dominant on saline clay soils. Occurs in areas subject to less frequent inundation (e.g. near Site 25; see also Fig. 14).

Land System Fc21

Floodplain areas of the Cooper Creek with Atriplex spp. - Sclerolaena spp. low, very open chenopod shrubland dominant on clay soils. Occurs in areas subject to less frequent inundation (e.g. near Site 14; see also Fig. 12).

Land System Fc22

Floodplain areas of the Cooper Creek with ephemeral forbland dominant on grey cracking clay soils. Occurs in areas subject to least frequent inundation (e.g. Lake Oolgoopiarie).

Land System Fc23

Floodplain areas of the Cooper Creek with ephemeral forbland dominant on hard grey clay soils. Occurs in areas subject to least frequent inundation (e.g. near Site 25; see also Fig. 14).

Land System Fc24

Floodplain areas of the Cooper Creek with low ephemeral forbland/herbland dominant on grey cracking clay soils. Occurs in areas subject to least frequent inundation (e.g. Lake Marrakoonamooka; see also Fig. 13).

Land System Fc25

Floodplain areas of the Cooper Creek with ephemeral herbland dominant on clay soils. Occurs in areas subject to least frequent inundation (e.g. Lake Apachirie).

Land System Fc26

Floodplain areas of the Cooper Creek with ephemeral herbland dominant on hard, grey, usually non-cracking clay soils. Occurs in areas subject to least frequent inundation (e.g. near Site 14; see also Fig. 12).

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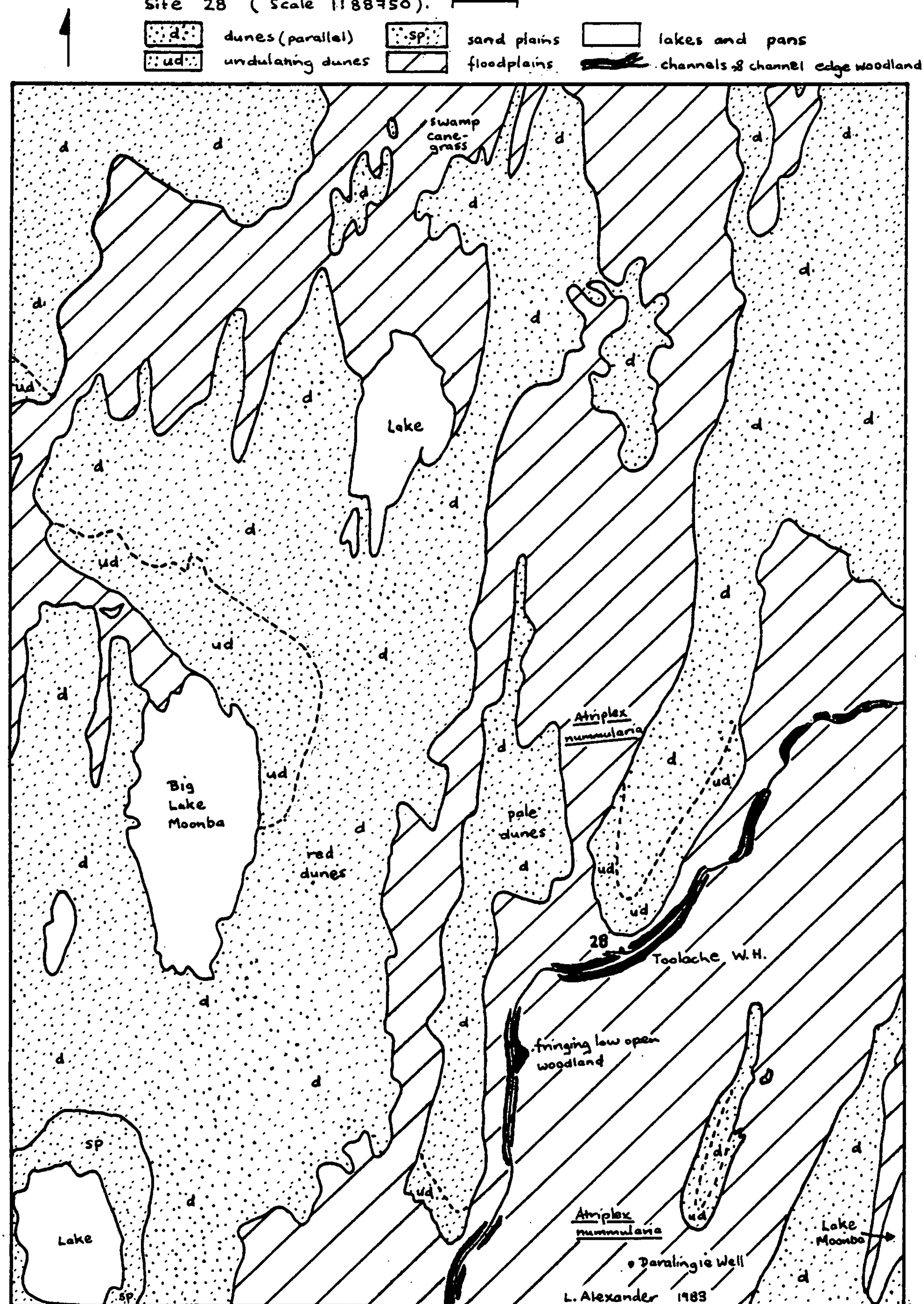
Figure 15 - Preliminary Vegetation - Land System Map of the Region Around Site 28 (Scale 1:88750).



Land System Fs1

Floodplain areas of the [1]Strzelecki Creek with Eucalyptus microtheca - Lysiphyllum gilvum - Acacia stenophylla low open woodland dominant on pale silty clay soils (e.g. margins of the Strzelecki Creek near Site 28; see also Fig. 15).

Land System Fs2

Floodplain areas of the Strzelecki Creek with Muehlenbeckia cunninghamii - Chenopodium auricomum low open shrubland dominant on(generally) clay soils (e.g. near Site 28; see also Fig. 15).

Land System Fs3

Floodplain areas of the Strzelecki Creek with Atriplex nummularia low open shrubland dominant on grey silty clay soils (e.g. near Site 28; see also Fig. 15).

Land System Fs4

Floodplain areas of the Strzelecki Creek with Eragrostis australasica low grassland dominant on (generally) clay soils (e.g. near Site 28 - generally restricted to microdepressions; see also Fig. 15).

Land System Fs5

Floodplain areas of the Strzelecki Creek with low (< 30 cm) open ephemeral forbland dominant on yellow-grey silty clay soils (e.g. near Site 28; see also Fig. 15).

- -

Land System Fo1

Floodplain areas of [2]other floodplains in 8.4.4 with Eucalyptus terminalis - E. microtheca + Acacia cyperophylla + Eremophila bignoniiflora + Grevillea striata low open woodland dominant on silty clay soils (e.g. near Site 4; see also Fig. 10).

Land System Fo2

Floodplain areas of other floodplains in 8.4.4 with Acacia cyperophylla - Eucalyp-

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[1]In defining the land systems of the Strzelecki Creek, the following factors are noted. Floodplain areas of the Strzelecki Creek are affected by level 3 floods of the Cooper and local runoff; local runoff is generally of greater significance due to the rarity of occurrence of level 3 flood events (Section 2.5.2.6). Vegetation, ranges from woodland through shrubland to forbland (with herblands conspicuous in better seasons) depending, like the Cooper Creek floodplain, on frequency of inundation. Frequency of inundation of areas of the Strzelecki Creek floodplain is dependent on elevation of the land surface and preferred areas of influence (if any) of local rainfall events. Presently available data does not allow for correlation of land systems of the Strzelecki Creek floodplain with specific frequencies of inundation. Soils are generally grey clays, but sand mobility on dunes due to the drier, disturbed nature of this part of the study area leads to some intermixing (evident as sandy clay soils in some parts).

[2]In defining the land systems of other floodplains in 8.4.4, the following factors are noted. As with the Cooper and Strzelecki Creek floodplains, vegetation distribution and type is dependent on frequency of inundation. In other floodplain areas of 8.4.4, inundation is due mainly to local runoff, which emanates from elevated areas of the 'Cordillo Surface' outside the study region or in the NW occurs rarely fromoverflows of the Diamantina River. Frequency of inundation though is presently indeterminate due to the absence of flow data for these floodplains. Vegetation ranges from woodland through shrubland to forblands. Soils are generally clays.

tus - Eucalyptus microtheca - Hakea eyreana low open fringing woodland dominant on sandy clay soils (e.g. Candradecka Creek in Environmental Subassociation 8.4.4.6).

Land System Fo3

Floodplain areas of other floodplains in 8.4.4 with Acacia victoriae - A. farnesiana + Santalum lanceolatum tall open shrubland dominant on (generally) clay soils (e.g. near Site 4; see also Fig. 10).

Land System Fo4

Floodplain areas of other floodplains in 8.4.4 with Cassia phyllodinea - C. oligophylla low shrubland dominant on (generally) clay soils (e.g. near Site 4; see also Fig. 10).

Land System Fo5

Floodplain areas of other floodplains in 8.4.4 with ephemeral forbland dominant on grey cracking clay soils (e.g. Lake Moorayepe, near Site 1; see also Fig. 9).

4.3.4.2.3 The Gibber Plain Land System

Gibber plains constitute a relatively minor land zone of Environmental Association 8.4.4. The gibber plain land zone (GP) encompasses a single land system (GP1s). The characteristics of this land system are detailed below.

Land System GP1s

[1]Gibber plains of red duplex soils largely covered by a close surface cover of gibber fragments and dominated by Astrebla pectinata open grassland. It is noted that the close surface cover of gibber fragments impedes establishment of plants and hence, gibber plains are essentially bare. However, where vegetation is established on the gibber plain proper, it is generally dominated by Astrebla pectinata open grassland (e.g. near Sites 1 and 4; see also Fig.s 9 and 10).

4.3.5 Environmental Units

Environmental units within 8.4.4 are claypans (A), dunes (B), interdune lows (C), floodplains (D), salt lakes (E) and gibber plains (F), which are components of the land systems detailed above (Sections 2.3.4 and 2.3.5).

In the dunefield land systems, four component Environmental units occur viz. claypans (A), dunes (B), interdune lows (C) and salt lakes (E), while the Environmental units within floodplain and gibber plain land systems are floodplains (D) and gibber plains (F), respectively. To identify Environmental units within specific land systems it is necessary to use both the land system and the Environmental unit identifiers e.g. in land system Dp1 (Section 4.3.4.2.1, p. 42) the specific Environmental units are ([2]potentially) Dp1 (A) - claypans, Dp1 (B) - dunes, Dp1 (C) - interdune lows and Dp1 (E) - salt lakes. And, specific floodplain and gibber plain Environmental units would be, for example, Fc1 (D) and GP1s (F) within land systems Fc1 and GP1s, respectively. Recognising Environmental units in this way is in keeping with the hierarchial classification of 8.4.4.

4.3.6 Environmental subunits

Environmental subunits within 8.4.4 are claypans, dunes, interdune lows,

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[1]In the study area gibber plains are disseminated amongst dunefield and floodplain land systems. This complex provides for a unique geomorphic environment, the habitats of which encompass a diveristy of flora and fauna not parallelled elsewhere in the study area.

[2]Not all areas of dunefield contain salt lakes or claypans.

floodouts, channels, swamps, terminal lakes, salt lakes and gibber plains (Section 2.3.6). Five of these can be identified in the same way as Environmental units, but using lower case letters i.e. claypans (a), dunes (b), interdune lows (c), salt lakes (e) and gibber plains (f). The remainder are components of a single Environmental unit (floodplains, D) so need further qualification. This is accomplished by adding further lower case letters to identify these floodplain components, as follows: floodouts (df), channels (dc), [1]swamps (ds) and [1]terminal lakes (dtl). Environmental subunits in 8.4.4, then, are claypans (a), dunes (b), interdune lows (c), floodouts (df), channels (dc), swamps (ds), terminal lakes (dtl), salt lakes (e) and gibber plains (f). To identify the Environmental subunits in specific land systems, it is necessary to use the land system, Environmental unit and Environmental subunit identifiers e.g. in land system Dpl, the dune Environmental subunit would be Dpl (B) b.

The preceding information is used below to identify habitats in the study area with particular assistance from identified plant components.

4.3.7 [2]Habitats Identified on the Basis of Plant Communities

In a previous subsection (4.3.4.2), as a result of vegetation survey, a number of identified plant communities were grouped according to land systems. Plant communities also serve to distinguish habitats within particular land systems. And, interfaces between some land systems (and land zones). The range of habitats identified on the basis of plant communities is detailed in this subsection. Habitats are located according to land systems, Environmental units (E.u.) and Environmental subunits (E.s.), hence, landform and soils features are also considered in their characterisation.

In this section, it will be noted (as in the section on land systems - Section 4.3.4.2) that examples often relate to sites surveyed by the consultants. This is due to the detailed nature of data available on these sites (1, 4, 6, 14, 23, 25 and 28) all of which were surveyed as permanent sites. Also in this subsection, although often lengthy species lists are included for plant communities, these species will not all be found in the one area in the field. At sites surveyed,vegetation cover was frequently restricted to less than 30% of the ground surface (refer to Data Sheets - in a separate volume), with the remainder bare or less frequently covered with leaf litter. Each species list provided thus covers a representative area occupied by the particular plant community in question.

Habitats 1-3 in land system Dpl

Habitat 1: E.u. Dpl (B) - dune, E.s. Dpl (B) b - dune.

- Dune crests and upper slopes

  Zygochloa paradoxa hummock grassland

  Associates: *Crotalaria cunninghamii*, *C. eremaea* subsp. *eremaea*, *Ptilotus obovatus* var. *obovatus*, *Myriocephalus stuartii*, *Trichodesma zeylanicum* and *Trachymene glaucifolia*.

  (e.g. see background of Photo. 1).

Habitat 2: E.u's Dpl (B)/ Dpl (C) - dune/interdune low, E.s's Dpl (B) b/ Dpl (C) c - dune/interdune low.

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[1]Swamp and terminal lake Environmental subunits are not components of all floodplains in 8.4.4.

[2]This is not a complete list as salt lakes were barely surveyed (Section 2.4), and due to the size of the study area other habitats are likely to have been inadvertently omitted.

Dune slopes and interdunes - Triodia basedowii hummock grassland.

Overstorey: Acacia spp. - Cassia spp. low or tall open shrubland.
Associates: Acacia ligulata, A. murrayana, A. tetragonaphylla, Cassia nemophila var. nemophila, C. nemophila var. zygophylla, Atalaya hemiglauca (groves) and Hakea leucoptera (solitary low trees).

Understorey: Triodia basedowii.

Ground cover: very open forb-herbland.
Forbs and herbs: Myriocephalus stuartii, Gnephosis eriocarpa, Helipterum floribundum, Phyllanthus fuernrohrii, Trachymene glaucifolia, Convulvulus erubescens, Salsola kali, Trichodesma zeylanicum, Portulaca intraterranea and Atriplex spongiosa.

Grasses: Eragrostis setifolia and Aristida contorta.

(e.g. Photo 1).

Habitat 3: E.u's Dp1 (A)/ Dp1 (C) - claypan/interdune low, E.s's Dp1 (A) a/ Dp1 (C) c - claypan/interdune low.

Clay flats and interdunes with red clayey sand soils - ephemeral forbland (dominated by chenopods).

Forbs: Salsola kali, Atriplex spongiosa, A. angulata, A. velutinella, Sclerolaena diacantha, S. bicornis, Maireana coronata, Euphorbia wheeleri, E. tannensis ssp. eremophila var. eremophila, Eragrostis setifolia, Convulvulus erubescens, Gnephosis foliata, Calocephalus platycephalus and Haloragis aspera.

Habitats 4-6 in land system Dp2.

Habitat 4: E.u. Dp2 (B) - dune, E.s. Dp2 (B) b - dune.

Dune crests and upper slopes - Zygochloa paradoxa hummock grassland.

Ephemeral associates: Trachymene glaucifolia, Crotalaria eremaea ssp. eremaea and Tribulus hystrix.

(e.g. foreground of Photo 2).

Habitat 5: E.u's Dp2 (B)/ Dp2 (C) - dune/interdune low, E.s's Dp2 (B) b/ Dp2 (C) c - dune/interdune low.

Dune slopes and interdunes - Acacia spp. tall open shrubland.

Overstorey: species include Acacia ligulata, A. victoriae, A. oswaldii, A. tetragonaphylla, Cassia nemophila var. nemophila (lower slopes) and Atalaya hemiglauca (groves).

Also: Owenia acidula and Hakea leucoptera (common on western slopes).

Ground cover: ephemeral forbland.
Most common ephemeral forbs (this survey): Myriocephalus stuartii, Helipterum moschatum, Portulaca intraterranea, Atriplex velutinella, Convulvulus erubescens, Sida spp. (? S. corrugata - see Appendix R), Abutilon otocarpum, Blennodia canescens, Trachymene glaucifolia and Salsola kali.

(e.g. Photo 2)

Habitat 6: E.u. Dp2 (C) - interdune low, E.s. Dp2 (C) c - interdune low.

Open interdune flats - ephemeral forbland.

Ground cover (only): same as for Habitat 5 (above).

(e.g. Photo 2).

Habitats 7-8 in land system Dp3.

Photo 1 - Permanent quadrat in interdune dominated by Triodia basedowii hummock grassland north of Karawinnie Waterhole (Site 6).

Habitat 7: E.u. Dp3 (B)-dune, E.s. Dp3 (B) B - dune.

Dune crests and upper slopes - Zygochloa paradoxa hummock grassland.

Associates: Ptilotus latifolius, P. obovatus var. obovatus, Crotalaria eremaea ssp. eremaea, C. cunninghamii, Cassia pleurocarpa var. pleurocarpa, Psoralea australasica, Calotis erinacea, Scaevola depauperata, Trachymene glaucifolia, Salsola kali, Cynanchum floribundum, Tribulus occidentalis and Myriocephalus stuartii.

Habitat 8: E.u's Dp3 (B)/ Dp3 (C) - dune/interdune low, E.s's Dp3 (B) b/ Dp3 (C) c - dune/interdune low.

Dune slopes and interdunes - Acacia spp. - Cassia spp. - Eremophila spp.

Photo 2 - Wide interdune census site with Acacia spp. tall open shrubland dominant (near Site 6). Includes some open interdune flats of ephemerals and Zygochloa paradoxa hummock grassland dominated dune crests and upper slopes (foreground).

Photo 3 - Dunes between Embarka Swamp and Lake Marrakoonamooka (left background). Zygochloa paradoxa hummock grassland on dune crest (foreground), Acacia ligulata low open woodland in interdune area (middle) with some bare areas (± claypans), and Acacia spp. - Cassia spp. mixed shrubland on undulating dunes (in far distance) bordering Lake Marrakoonamooka (refer also to Fig. 13).

mixed shrubland.

Overstorey - common species: Acacia dictyophleba, A. murrayana, A. ligulata, Eremophila maculata, E. longifolia, Cassia nemophila var. nemophila, C. nemophila var. zygophylla, C. pleurocarpa var. pleurocarpa, Atalaya hemiglauca, Dodonaea viscosa, Grevillea stenobotrya, Adriana hookeri, Santalum lanceolatum, Hibiscus krichauffianus and Hakea leucoptera.

Ground cover: Triodia basedowii hummock grassland.

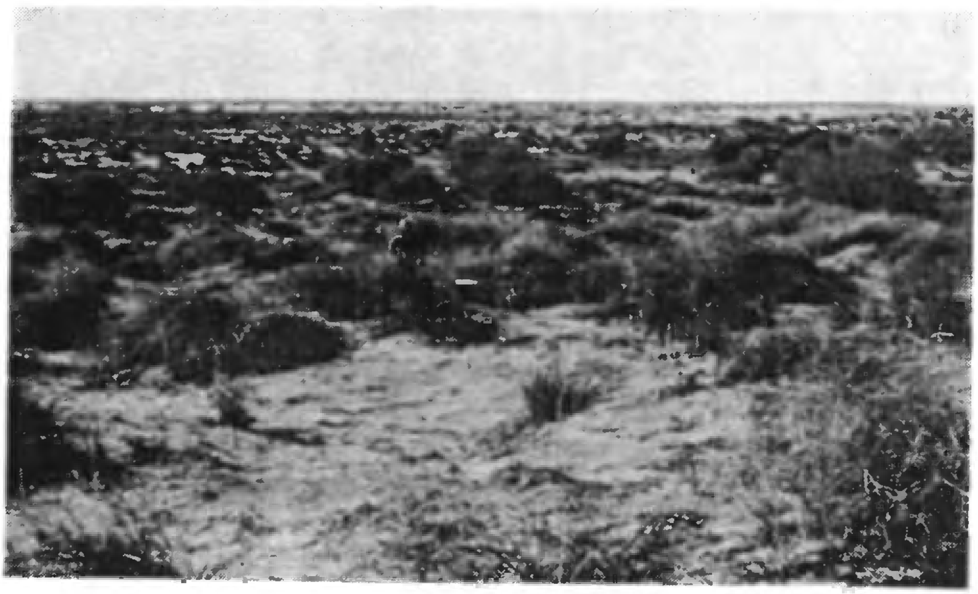

Photo 4 - Looking west towards terminal salt lake (left far distance) from the area of trap line 3, Site 25. Dune crest dominated by Zygochloa paradoxa hummock grassland (foreground) with interdune dominated by Acacia spp. low open shrubland (± claypans).

Associates: Myriocephalus stuartii, Aristida contorta, Ptilotus polystachus var. polystachus, Abutilon spp. and Tephrosia sphaerospora.

Habitats 9-11 in land system Dp4.

Habitat 9: E.u. Dp4 (B) - dune, E.s. Dp4 (B) b - dune.

Dune crests - Zygochloa paradoxa hummock grassland.

Ephemerals between hummocks: Trichodesma zeylanicum, Tribulus spp., Myriocephalus stuartii, Abutilon otocarpum and Senecio gregorii.

(e.g. Photo 3).

Habitat 10: E.u's Dp4 (B)/ Dp4 (C) - dune/interdune low, E.s's Dp4 (B) b/ Dp4 (C) c - dune/interdune low.

Dune slopes and interdunes - Acacia ligulata low open woodland.

Overstorey - other shrubs and small trees common are: Acacia murrayana, Cassia nemophila var. nemophila, Acacia tetragonaphylla, occasional Atalaya hemiglauca (groves) or Hakea leucoptera (solitary, usually on western slopes).

Ground cover: low ephemeral forb-grassland.
Ephemerals: Portulaca intraterranea, Trachymene glaucifolia, Lechenaultia divaricata, Enneapogon avenaceus, Convulvulus erubescens, Euphorbia tannensis ssp. eremophila var. eremophila, Myriocephalus stuartii, Phyllanthus fuernrohrii and Salsola kali.

(e.g. Photo 3).

Habitat 11: E.u. Dp4 (A) - claypan, E.s. Dp4 (A) a - claypan.

Claypans in interdunes - low ephemeral forb-herbland or bare.

Ephemeral forbs: Atriplex spongiosa, Sclerolaena bicornis, S. diacantha, and S. intricata.
Many ephemeral herbs include: Tephrosia sphaerospora and Calocephalus platycephalus.

(e.g. Photo 3).

Habitats 12-15 in land system Dp5.

Habitat 12: E.u. Dp5 (B) - dune, E.s. Dp5 (B) b - dune.

Dune crests - Zygochloa paradoxa hummock grassland.

Occasional assocaite: Cynanchum floribundum.

(e.g. Photo 4).

Habitat 13: E.u's Dp5 (B)/ Dp5 (C) - dune/interdune low, E.s's Dp5 (B) b/ Dp5 (C) c - dune/interdune low.

Dune slopes and interdunes - Acacia spp. low open shrubland.

Overstorey - common associates: Acacia ligulata, A. murrayana, A. victoriae, A. oswaldii, Cassia nemophila var. nemophila and occasional Hakea leucoptera trees.

Occasional ground cover in interdunes: Triodia basedowii hummock grassland.

(e.g. Photo 4).

Habitat 14: E.u. Dp5 (A)-claypan, E.s. Dp5 (A) a - claypan.

[1]Claypans in interdunes - ephemeral forbland.

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[1]Although in this instance claypans are considered as one habitat, it may, in certain circumstances, be advantageous to consider the claypan fringe and floor as separate habitats e.g. where a species of fauna inhabits a samphire Halosarcia indica ssp. leiostachya fringe (see p. 55), but is not known to frequent a claypan floor.

Claypan fringe: Morgania floribunda and sometimes Halosarcia indica ssp. leiostachya.

Claypan floor: Atriplex spongiosa, A. leptocarpa, Salsola kali, Frankenia cinerea and Babbagia acroptera.

(e.g. Photo 4).

Habitat 15: E.u. Dp5 (E) - salt lake, E.s. Dp5 (E) e - salt lake.

Salt lake componets of land system Dp5: not surveyed.

(e.g. Photo 4).

Habitats 16-17 in land system Dp6.

Habitat 16: E.u. Dp6 (B) - dune, E.s. Dp6 (B) b - dune.

Dune crests - Zygochloa paradoxa hummock grassland.

Ephemerals commonly present: Tribulus hystrix, Crotalaria eremaea ssp. eremaea, C. cunninghamii, Cynanchum floribundum, Myriocephalus stuartii and Ptilotus latifolius.

(e.g. Photo 5).

Habitat 17: E.u's Dp6 (B)/ Dp6 (C) - dune/interdune low, E.s's Dp6 (B) b/ Dp6 (C) c - dune/interdune low.

Dune slopes and interdunes -

Overstorey: Atalaya hemiglauca - Acacia spp. low open woodland.
Common acacia: A. murrayana and occasionally A. victoriae and A. ligulata.

Understorey: Hibiscus krichauffianus - Swainsona rigida - Sida ammophila - Scaevola ovalifolia - Lechenaultia divaricata - Enchylaena tomentosa - Ptilotus polystachus var. polystachus low open shrubland.

Ground cover: Triodia basedowii hummock grassland.

A diversity of other species include: Glycine canescens, Myriocephalus stuartii, Sclerolaena diacantha, Salsola kali, Psoralea spp., Aristida contorta, Crotalaria cunninghamii, Tribulus hystrix, Trichodesma zeylanicum and Abutilon spp.

(e.g. Photo 6).

Habitats 18-19 in land system Dp7.

Habitat 18: E.u. Dp7 (B) - dune, E.s. Dp7 (B) b - dune.

Dunes -

Overstorey: Acacia ligulata - Salsola kali ephemeral low open shrubland.

Ground cover: ephemeral herbland.
Ephemerals: composites, Haloragis aspera and Nicotiana velutina.

Habitat 19: E.u. Dp7 (C) - interdune low, E.s. Dp7 (C) c - interdune low.

Interdunes - vegetation the same as Habitat 18 (above).

(refer also to land system description - Dp7, p. 43).

Habitats 20-22 in land system Dp8.

Habitat 20: E.u. Dp8 (B) - dune, E.s. Dp8 (B) b - dune.

Dune crests - Cynanchum floribundum low, very open shrubland.

Associate colonisers and ephemerals: Salsola kali, Crotalaria cunninghamii, Senecio gregorii, Myriocephalus stuartii, Helipterum moschatum, Blennodia pterosperma and Portulaca intraterranea.

Photo 5 - Dune crest dominated by Zygochloa paradoxa hummock grassland near Site 1. Gibber plain in left background.

Habitat 21: E.u's Dp8 (B)/ Dp8 (C) - dune/interdune low, E.s's Dp8 (B) b/ Dp8 (C) c - dune/interdune low.

Dune slopes and interdunes - Acacia ligulata low open shrubland.

Overstorey - shrub and small tree associates: Acacia victoriae, A. tetragonaphylla, A. oswaldii, Atalaya hemiglauca, Eremophila longifolia, Cassia nemophila var. nemophila, C. nemophila var. zygophylla and Hakea leucoptera.

Ground cover: very open ephemeral forb-herbland.

Photo 6 - Red dune slope adjacent to a trap line of Site 1, with Atalaya hemiglauca - Acacia spp. low open woodland dominant. Zygochloa paradoxa and Ptilotus latifolius (both in foreground) and gibber plain (in right background) also evident.

Photo 7 - Paler coloured dunefield 5 km north of Toolache Waterhole. Sparsely covered dune crests with ephemeral composites and Salsola kali dominant. Interdunes and dune slopes with Acacia ligulata low open shrubland dominant.

Ephemerals: Tetragonia tetragonioides, Atriplex spongiosa, Zygophyllum ammophilum, Nicotiana velutina, Senecio gregorii, Portulacá intraterranea, Atriplex velutinella, Myriocephalus stuartii and Helipterum moschatum.

Habitat 22: E.u's Dp8 (A)/ Dp8 (C) - claypan/interdune low, E.s's Dp8 (A) a/ Dp8 (C) c - claypan/interdune low.

Clay flats in interdunes - bare or Atriplex nummularia low open shrubland

Associates: Sclerolaena intricata, S. lanicuspis, Babbagia acroptera,

Photo 8 - Paler coloured (whitish) dunes bordering claypan adjacent to clay flat 1 km SW of Pilalchilpna Waterhole (near Site 25), carrying ephemeral forbland on dune slopes and in interdunes only.

Atriplex spongiosa, *A. angulata*, *Haloragis aspera*, *Bulbine alata* and *Senecio gregorii*.

Habitats 23-25 in land system Dp9.

Habitat 23: E.u. Dp9 (B) - dune, E.s. Dp9 (B) b - dune.

Dune crests - ephemeral composites and *Salsola kali*.

(e.g. Photo 7).

Habitat 24: E.u's Dp9 (B)/ Dp9 (C) - dune/interdune low, E.s's Dp9 (B) b/ Dp9 (C) c - dune/interdune low.

Dune slopes and interdunes - *Acacia ligulata* low open shrubland.

Overstorey - shrub and small tree associates: *Acacia victoriae*, *A. tetragonaphylla*, *A. oswaldii*, *Atalaya hemiglauca*, *Eremophila longifolia*, *Cassia nemophila var. nemophila*, *C. nemophila var. zygophylla* and *Hakea leucoptera*.

Ground cover: very open ephemeral forb-herbland.
Ephemerals: *Tetragonia tetragonioides*, *Atriplex spongiosa*, *Zygophyllum ammophilum*, *Nicotiana velutina*, *Senecio gregorii*, *Portulaca intraterranea*, *Atriplex velutinella*, *Myriocephalus stuartii* and *Helipterum moschatum*.

(e.g. Photo 7).

Habitat 25: E.u. Dp9 (A) - claypan, E.s. Dp9 (A) a - claypan.

Interdune claypans - hard red clay surfaces either bare or ephemeral herbfield.

Composite colonisers and chenopod sub-shrubs: *Senecio gregorii*, *Calotis porphyroglossa*, *Helipterum moschatum*, *Myriocephalus stuartii*, *Gnephosis eriocarpa*, *Tephrosia sphaerospora*, *Swainsona oroboides*, *Convulvulus erubescens*, *Phyllanthus lacunarius*, *Atriplex spongiosa*, *Sclerolaena bicornis*, and *Crinum flaccidum*.

(e.g. just evident in the interdune of Photo 7 - near left margin 3/4 up photo).

Habitats 26-27 in land system Dp10

Habitat 26: E.u. Dp10 (B) - dune, E.s. Dp10 (B) b - dune.

Dune crests - sparse cover of *Zygochloa paradoxa* ± ephemeral forbs.

Habitat 27: E.u's Dp10 (B)/ Dp10 (C) - dune/interdune low, E.s's Dp10 (B) b/ Dp10 (C) c - dune/interdune low.

Dune slopes and interdunes - ephemeral forbland.

Dominant forb: *Salsola kali*.

Other ephemeral forbs may include: *Phyllanthus fuernrohrii*, *Lechenaultia divaricata*, *Tribulus occidentalis* and *Tephrosia sphaerospora*.

Habitats 28-29 in land system Dp11

Habitat 28: E.u. Dp11 (B) - dune, E.s. Dp11 (B) b - dune.

Dunes - ephemeral forb-herbland.

Forbs and herbs: *Nicotiana velutina*, *Portulaca intraterranea*, *Trichodesma zeylanicum*, *Salsola kali*, *Myriocephalus stuartii*, *Crotalaria cunninghamii*, *C. eremaea ssp. eremaea*, *Ptilotus polystachus var. polystachus*, *P. latifolius*, *Abutilon otocarpum*, *Psoralea spp.*, *Tephrosia sphaerospora* and *Swainsona rigida*.

Scattered shrubs: *Acacia ligulata* and *Cynanchum floribundum*.

Habitat 29: E.u. Dpl1 (C) - interdune low, E.s. Dpl1 (C) c - interdune low.

Interdunes - vegetation the same as for dunes (see Habitat 28 and land system description Dpl1, p. 44).

Habitats 30-31 in land system Dpl2

Habitat 30: E.u. Dpl2 (B) - dune, E.s. Dpl2 (B) b - dune.

Dune crests - bare.

(e.g. Photo 8).

Habitat 31: E.u. Dpl2 (B)/ Dpl2 (C) - dune/interdune low, E.s. Dpl2 (B) b/ Dpl2 (C) c - dune/interdune low.

Dune slopes and interdunes - ephemeral forbland.

Dominant forb: Salsola kali.

Other ephemeral forbs may include: Phyllanthus fuernrohrii, Lechenaultia divaricata, Tribulus occidentalis and Tephrosia sphaerospora.

(e.g. Photo 8).

Habitats 32-38 in land system Dunc (e.g. Photo's 9-11).

Habitat 32: E.u. Dunc (B) - dune, E.s. Dunc (B) b - dune.

Dune crests and upper slopes - Zygochloa paradoxa hummock grassland.

Associates: Ptilotus latifolius, P. obovatus var. obovatus, Crotalaria eremaea ssp. eremaea, C. cunninghamii, Cassia pleurocarpa var. pleurocarpa, Psoralea australasica, Calotis erinacea, Scaevola depauperata, Trachymene glaucifolia, Salsola kali, Cynanchum floribundum, Tribulus occidentalis and Myriocephalus stuartii.

Habitat 33: E.u. Dunc (B) - dune, E.s. Dunc (B) b - dune.

Lower dune slopes - Acacia spp. - Cassia spp. - Eremophila spp. mixed shrubland.

Overstorey - common species: Acacia dictyophleba, A. murrayana, A. ligulata, Eremophila maculata, E. longifolia, Cassia nemophila var. nemophila, C. nemophila var. zygophylla, C. pleurocarpa var. pleurocarpa, Atalaya hemiglauca, Dodonaea viscosa, Grevillea stenobotrya, Adriana hookeri, Santalum lanceolatum, Hibiscus krichauffianus and Hakea leucoptera.

Ground cover: Triodia basedowii hummock grassland.
Associates: Myriocephalus stuartii, Aristida contorta, Ptilotus polystachus var. polystachus, Abutilon spp. and Tephrosia sphaerospora.

[1]Habitats 34-38: E.u. Dunc (C) - interdune low, E.s. Dunc (C) c - interdune low. These are habitats characteristic of circular or ovoid interdunes within the uncoordinated drainage dunefields - land system Dunc, which are distinguished according to predominating vegetation and in some cases soils characteristics. Habitats 34-38 are distinct habitat types.

Habitat 34: Circular or ovoid interdune type 1 with Triodia basedowii dominant.

Overstorey: Acacia spp. - Cassia spp. low, very open shrubland.
Principal species: Acacia dictyophleba, A. ligulata, A. murrayana, Cassia

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[1]Claypans are thought to be a component of a number of interdunes encompassed by habitats 34-38, while salt lakes are considered unlikely. Where they occur, claypans constitute additional habitats (particularly when they carry water). However, the lack of detail on claypans in presently available data does not justify further habitat subdivision to include these.

Photo 9 - Triodia basedowii hummock grassland dominated interdune within the Uncoordinated Drainage Dunefield Environmental Subassociation 8.4.4.6.

nemophila var. nemophila and C. oligophylla.

Ground cover: Triodia basedowii hummock grassland.

(e.g. Photo 9).

Habitat 35: Circular or ovoid interdune type 2.

Fringing overstorey: Hakea eyreana + Eucalyptus terminalis low open woodland.

Ground cover: open ephemeral herbland beneath trees and at centre of interdune, with occasional Triodia basedowii associated with trees. Ephemerals: Swainsona oroboides, Atriplex spongiosa, Gnephosis foliata, Teucrium racemosum var. racemosum and Haloragis aspera.

(e.g. Photo 10).

Photo 10 - Hakea eyreana low open woodland dominated interdune near Mudcarnie Waterhole (Site 4).

Photo 11 - Eremophila macdonnellii tall open shrubland in an interdune near Mudcarnie Waterhole (Site 4).

Habitat 36: Circular or ovoid interdune type 3 with ephemeral forbland on soils with a higher clay fraction.

Principal ephemerals: Sclerolaena bicornis, S. diacantha, Atriplex spongiosa, A. limbata, Gnephosis foliata, Astrebla pectinata, Eragrostis dielsii, Euphorbia australis, E. tannensis ssp. eremophila var. eremophila, Euphorbia spp., Teucrium racemosum var. racemosum, Crinum flaccidum, Morgania glabra and Frankenia uncinata.

Habitat 37: Circular or ovoid interdune type 4.

Overstorey: Eremophila macdonnellii tall open shrubland.
Other tall shrubs or low trees that may be present: Owenia acidula, Hakea leucoptera, Acacia victoriae and Dodonaea angustissima.

Photo 12 - Acacia victoriae low open woodland dominant on a dune slope/plain of pale grey sands 14 km NW of Scrubby Camp Waterhole.

Understorey: Cassia spp. low, very open shrubland.
Common species: Cassia phyllodinea, C. nemophila var. nemophila, C. nemophila var. zygophylla and Rhagodia spinescens.

Ground cover: ephemeral forbland.
Ephemerals: Teucrium racemosum var. racemosum, Enchylaena tomentosa, Salsola kali, Crinum flaccidum, Sclerolaena diacantha, Frankenia uncinata, Morgania glabra, Ptilotus polystachus var. polystachus, Myriocephalus stuartii and Gnephosis foliata.

Also present: very low Eremophila maculata.

(e.g. Photo 11).

Habitat 38: Circular or ovoid interdune type 5 in proximity to minor drainage systems on grey silty clays.

Fringing overstorey: Eremophila bignoniiflora, Acacia stenophylla and Morgania glabra.

Ground cover - dominant: [1]Eragrostis australasica low shrubland.
Common associates: Chenopodium auricomum and Eleocharis pallens.
Interspersed ephemeral forbs and herbs include: Sclerolaena bicornis, S. intricata, S. muricata var. muricata, Maireana schistocarpa, Atriplex spongiosa, A. angulata, A. lobativalvis and A. limbata (chenopods), Calotis hispidula, C. multicaulis, C. porphyroglossa and Calocephalus platycephalus (composites), Marsilea drummondii, Teucrium racemosum var. racemosum, Daucus glochidiatus, Tetragonia tetragonioides, Eriachne aristidea, Alternanthera nodiflora and Frankenia uncinata.

Habitat 39 in land system Dlun

Habitat 39: E.u's Dlun (B)/ Dlun (C) - dune/interdune low, E.s's Dlun (B) b/ Dlun (C) c - dune/interdune low

Habitat 39 in land system Dlun comprises a complex of dunes/interdune lows of very low relief (in comparison to adjacent parallel dunes) resembling numerous small closely associated dunes, which may form extensive features of up to 30 km in length along the the northern and north-eastern margins of some floodouts and swamps.

Overstorey: Acacia spp. - Cassia spp. mixed shrubland.
Common species: Acacia ligulata, A. victoriae, A.oswaldii, A. murrayana, A. tetragonaphylla, Santalum lanceolatum, Atalaya hemiglauca, Cassia nemophila var. nemophila, C. nemophila var. zygophylla, Grevillea striata and Dodonaea angustissima.

Understorey: Maireana aphylla low shrubland.

Ground cover: ephemeral forb-grassland.
Ephemerals: Einadia nutans, Convulvulus erubescens, Tetragonia tetragonioides, Euphorbia tannensis ssp. eremophila var. eremophila, Helipterum moschatum, Aristida contorta, Enneapogon cylindricus, Triraphis mollis, Bulbine alata, Sclerolaena diacantha, Phyllanthus fuernrohrii, Salsola kali, Swainsona phacoides, Zygophyllum howittii, Blennodia pterosperma, Abutilon spp., Ptilotus polystachus var. polystachus, Myriocephalus stuartii, Gnephosis eriocarpa, Eragrostis eriopoda, Haloragis aspera, Mukia maderaspatana, Sida spp. (? S. fibulifera - see Appendix R), Trachymene glaucifolia, Crinum flaccidum and Dentella pulvinata var. pulvinata.

(e.g. Photo 3, p. 53).

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[1]Occasionally, umbrella canegrass Leptochloa digitata may be dominant - this is known to be the case for an interdune near Site 7A (refer to Data Sheets - in a separate volume).

Habitats 40-43 in land systems Ds1-Ds4: Sand plains of very low dunes consisting of complexes of dunes/interdune lows of extremely low relief.

Habitat 40: E.u's Ds1 (B)/ Ds1 (C) - dune/interdune low, E.s's Ds1 (B) b/ Ds1 (C) c - dune/interdune low.

Cassia spp. - Acacia spp. mixed open shrubland.
Common overstorey species: Cassia phyllodinea, C. oligophylla, Hakea eyreana, Cassia nemophila var. nemophila, C. nemophila var. zygophylla, Grevillea stenobotrya, Atalaya hemiglauca, Eucalyptus terminalis, Eremophila longifolia, Acacia tetragonaphylla and A. victoriae.

Ground cover: Triodia basedowii hummock grassland, with interspersed ephemeral herbs and forbs - Swainsona spp. common.

Habitat 41: E.u's Ds2 (B)/ Ds2 (C) - dune/interdune low, E.s's Ds2 (B) b/ Ds2 (C) c - dune/interdune low.

Acacia spp. - Hakea spp. mixed shrubland.
Overstorey dominants: Acacia ligulata, A. victoriae, Hakea leucoptera and H. eyreana.
Others: Acacia oswaldii, A. tetragonaphylla, Cassia nemophila var. nemophila, Owenia acidula, Atalaya hemiglauca and Dodonaea angustissima.

Understorey: mixed low open shrubland.
Shrubs: Eremophila macdonnellii, Zygochloa paradoxa, Maireana aphylla, Enchylaena tomentosa and less commonly Pimelea trichostachya.

Ground cover: ephemeral forb-grass-herbland with Sclerolaena diacantha dominant.
Other ephemerals: Teucrium racemosum var. racemosum, Dissocarpus paradoxa var. latifolius, Ptilotus polystachus var. polystachus, P. atriplicifolius var. atriplicifolius, Atriplex spongiosa, Einadia nutans, Eriachne aristidea, Swainsona phacoides, Eragrostis eriopoda, Sida ammophila, Abutilon otocarpum, Euphorbia tannensis ssp. eremophila var. eremophila, Triraphis mollis, Minuria denticulata, Helipterum moschatum, Aristida anthoxanoides, Haloragis aspera and Salsola kali.

Habitat 42: E.u's Ds3 (B)/ Ds3 (C) - dune/interdune low, E.s's Ds3 (B) b/ Ds3 (C) c - dune/interdune low.

Acacia victoriae low open woodland.
Overstorey - associates of Acacia victoriae: A. murrayana, Atalaya hemiglauca Cassia nemophila var. nemophila, C. nemophila var. zygophylla, Grevillea striata, Eremophila longifolia and Hakea leucoptera.
Also: Amyema preissii parasitising A. victoriae.

Understorey: Zygochloa paradoxa very open hummock grassland.

Ground cover: ephemeral herbland.
Ephemerals: Salsola kali, Myriocephalus stuartii, Abutilon otocarpum, Euphorbia tannensis ssp. eremophila var. eremophila, Sida spp., Eragrostis setifolia, Ptilotus atriplicifolius var. atriplicifolius, and ?Paractaenum novae-hollandiae (see Appendix R for reason for ?).

(e.g. Photo's 12 and 13).

Habitat 43: E.u's Ds4 (B)/ Ds4 (C) - dune/interdune low, E.s's Ds4 (B) b/ Ds4 (C) c - dune/interdune low.

Low (< 30 cm) open ephemeral forbland.
Chenopod sub-shrubs: Atriplex spongiosa, A. angulata, A. lobativalvis, Sclerolaena bicornis, S. intricata, S. diacantha, Salsola kali, Babbagia acroptera and Dissocarpus biflorus var. cephalocarpus.
Also: Frankenia spp.
Occasional species: Chenopodium nitrariaceum and Eragrostis australasica.

Photo 13 - Acacia victoriae low open woodland with Atalaya hemiglauca and Cassia spp. evident on a dune slope/plain of pale grey sands 14 km NW of Scrubby Camp Waterhole.

Herbs: Calotis hispidula, Helipterum strictum, H. microglossum, Plantago varia, Tetragonia tetragonioides, Goodenia lobata, Bulbine alata and Euphorbia spp., and the grass: Eragrostis eriopoda.

Habitat 44 in land system Fcl.

Habitat 44: E.u. Fcl (D) - floodplain, E.s. Fcl (D) dc - channel (major).

Overstorey: Eucalyptus microtheca + Lysiphyllum gilvum + E. camaldulensis var. obtusa tall to low fringing woodland.
The variety of low tree and shrub associates include: Acacia stenophylla, A. salicina, Owenia acidula, Grevillea striata, Santalum lanceolatum,

Photo 14 - Eucalyptus microtheca tall to low fringing woodland around Embarka Waterhole.

Photo 15 - Eucalyptus microtheca - Acacia stenophylla low fringing woodland of a minor channel south of Chillimookoo Waterhole. Still green inside channel after recent floodoing.

Pittosporum phylliraeoides var. microcarpa, Eremophila bignoniiflora, E. longifolia, Atalaya hemiglauca and the mistletoes Diplatia grandibractea and Amyema preissii.

Understorey - often present: Muehlenbeckia cunninghamii + Atriplex nummularia tall to low shrubland.
Lower (< 1 m) associates: Enchylaena tomentosa and Senecio cunninghamii.

Ground cover: ephemeral forbland.
Ephemerals: Lavatera plebeia, Alternanthera nodiflora, Tetragonia tatragonioides, Zygophyllum ammophilum, Marsilea drummondii, Haloragis aspera,

Photo 16 - Eucalyptus microtheca - Acacia salicina - A. stenophylla - Eremophila bignoniiflora low fringing woodland of the Cooper Creek in the vicinity of Narrawalpinna Waterhole (near Site 25). Near floodwater front on 19 ix 83.

Photo 17 - Eucalyptus microtheca + Acacia salicina + A. stenophylla + Eremophila bignoniiflora low fringing woodland with understorey of Muehlenbeckia cunninghamii low shrubland. In the vicinity of Pilalchilpna Waterhole, near Site 25.

Senecio lautus ssp. maritimus, Calotis porphyroglossa, Nicotiana velutina, Einadia nutans, Centipeda minima and Brassica tournefortii.

(e.g. Photo 14).

Habitat 45 in land system Fc2.

Habitat 45: E.u. Fc2 (D) - floodplain, E.s. Fc2 (D) dc - channel (minor).

Eucalyptus microtheca - Acacia stenophylla low fringing woodland.

Over: Enchylaena tomentosa and a variety of herbs as listed for Habitat 44.

(e.g. Photo 15).

Photo 18 - Eucalyptus microtheca + Acacia stenophylla low fringing woodland. Trap line 4 of Site 25.

Photo 19 - Muehlenbeckia cunninghamii tall to low (2-3 m) shrubland of Embarka Swamp.

Habitats 46-47 in land system Fc3.

Habitat 46: E.u. Fc3 (D) - floodplain, E.s. Fc3 (D) dc - channel (major, drier).

Overstorey: Eucalyptus microtheca - Acacia salicina - A. stenophylla - Eremophila bignoniiflora low fringing woodland.
Diplatia grandibractea parasitises E. microtheca.

Understorey - relatively dense: Muehlenbeckia cunninghamii low shrubland. Lower (<1 m) shrubs include: Enchylaena tomentosa and Senecio cunninghamii.

Ground cover: virtually absent apart from low forbland on silty banks and the grass Sporobolus mitchellii with a large amount of litter.
Forbs: Phyllanthus lacunarius and Solanum oligacanthum.

(e.g. Photo 16).

Photo 20 - Muehlenbeckia cunninghamii tall, very open shrubland with scattered patches of Eucalyptus microtheca. Trap line 2, Site 25.

Habitat 47: E.u. Fc3 (D) - floodplain, E.s. Fc3 (D) df - floodout.

Extension of channel edge woodland of Habitat 46 onto adjacent floodout.

Vegetation essentially as for Habitat 46 with tree layer becoming more open at greater distances from the channel.

(e.g. Photo 17).

Habitats 48-49 in land system Fc4.

Habitat 48: E.u. Fc4 (D) - floodplain, E.s. Fc4 (D) dc - channel (minor, drier).

Eucalyptus microtheca - Acacia stenophylla low fringing woodland. Diplatia grandibractea parasitises E. microtheca.

(e.g. similar structure to Photo 18, which is of an adjacent floodout).

Habitat 49: E.u. Fc4 (D) - floodplain, E.s. Fc4 (D) df - floodout.

Eucalyptus microtheca + Acacia stenophylla low fringing woodland. Diplatia grandibractea parasitises E. microtheca.

(e.g. Photo 18).

Habitat 50 in land system Fc5.

Habitat 50: E.u. Fc5 (D) - floodplain, E.s. Fc5 (D) dc - channel (relict).

Small areas only of pale sandy clay rises which represent the collection of wind blown sands and silts around senescent low coolibahs.

Overstorey: Eucalyptus microtheca low open woodland.

Understorey: Enchylaena tomentosa - Muehlenbeckia cunninghamii + Chenopodium nitrariaceum low shrubland.

Ground cover: very sparse - composites and Sclerolaena spp. predominate.

(e.g. Fig. 13).

Habitat 51 in land system Fc6.

Habitat 51: E.u. Fc6 (D) - floodplain, E.s. Fc6 (D) df - floodout (in the vicinity of saline depressions).

Overstorey: Eucalyptus microtheca low, very open woodland.

Ground cover: Halosarcia indica ssp. leiostachya low, very open shrubland. Associates: Enchylaena tomentosa, Atriplex leptocarpa, A. nummularia, A. spongiosa, A. velutinella, Chenopodium nitrariaceum, Sclerolaena intricata, S. diacantha, S. bicornis and numerous dead grass clumps.

Habitats 52-53 in land system Fc7.

Habitat 52: E.u. Fc7 (D) - floodplain, E.s. Fc7 (D) ds - swamp.

Regularly inundated swamps e.g. Embarka Swamp, the most regularly inundated and persistent swamp, which is partly channelled. Such swamps form smaller pockets throughout the Cooper Creek floodplain and have deep cracking clay soils, which are spongy when dry.

Overstorey: Muehlenbeckia cunninghamii tall to low (2-3 m) shrubland.

Ground cover - when inundated: Eleocharis pallens, Marsilea drummondii and Azolla filiculoides - all found in water.

Ground cover - when swamp dries and water recedes: ephemeral herbland. Ephemeral herbs: Myriocephalus stuartii, Helipterum moschatum, Senecio lautus ssp. maritimus, Trigonella suavissima, Calocephalus platycephalus, Nicotiana velutina, Atriplex spongiosa, Calotis porphyroglossa, Haloragis aspera, Tetragonia tetragonioides, Gnephosis eriocarpa, Ixiolaena brevicompta, Daucus glochidiatus, Calotis hispidula, Gnaphalium indicum, Centipeda minima, Epaltes australis and Marsilea drummondii.

(e.g. Photo 19).

Habitat 53: E.u. Fc7 (D) - floodplain, E.s. Fc7 (D) dc - channel (fine drainage lines in swamps e.g. Embarka Swamp).

Overstorey: occasionally lined with Eucalyptus microtheca - Acacia stenophylla trees.

Understorey - dominant: Muehlenbeckia cunninghamii tall to low (2-3 m) shrubland.

Ground cover - when inundated: Eleocharis pallens, Marsilea drummondii and Azolla filiculoides - all found in water.

Ground cover - when dry: ephemeral herbland on drying parts of swamp. Ephemeral herbs: same as for Habitat 52.

Habitat 54-55 in land system Fc8.

Habitat 54: E.u. Fc8 (D) - floodplain, E.s. Fc8 (D) ds - swamp (a flat plain with braided channels - moist, grey, cracking clay soils with silty sections e.g. Tirrawarra Swamp).

Overstorey: emergent Acacia stenophylla parasitised by Amyema miquellii.

Understorey: Muehlenbeckia cunninghamii tall open shrubland. Includes: Chenopodium auricomum.

Ground cover: ephemeral forbland.
Ephemerals: Senecio lautus ssp. dissectifolius, Trigonella suavissima, Lavatera plebeia, Marsilea drummondii, Portulaca intraterranea, ?Medicago polymorpha (refer to Appendix R for reason for ?) and Eleocharis pallens.

Habitat 55: E.u. Fc8 (D) - floodplain, E.s. Fc8 (D) dc - channel (braided channels of the type found in Tirrawarra Swamp).

Vegetation as for Habitat 54 apart from the presence of fringing woodland near channels in which Eucalyptus microtheca is thought to be the dominant tree - more data required.

Habitat 56 in land system Fc9.

Habitat 56: E.u. Fc9 (D) - floodplain, E.s. ÷ Fc9 (D) ds - swamp (parts of floodplains resembling swamps with grey clay soils).

Overstorey: areas of Muehlenbeckia cunninghamii tall, very open shrubland ± occasional patches of Eucalyptus microtheca (emergent).

Ground cover - generally absent or dead: Atriplex spongiosa, A. leptocarpa and Solanum oligacanthum.

(e.g. Photo 20).

Habitat 57 in land system Fc10.

Habitat 57: E.u. Fc10 (D) - floodplain, E.s. Fc10 (D) df - floodout (grey clay soils - appeared not to have been inundated for some time).

Overstorey: areas of Muehlenbeckia cunninghamii tall shrubland.

Ground cover: generally absent or dead - the following species were identified viz. Atriplex nummularia, A. angulata, A. leptocarpa and Solanum oligacanthum.

Habitat 58 in land system Fc11.

Habitat 58: E.u. Fc11 (D) - floodplain, E.s. Fc11 (D) df - floodout (immediately beyond fringing woodland e.g. Habitats 44 and 45).

Photo 21 - Muehlenbeckia cunninghamii low shrubland to low open shrubland in the vicinity of trap line 1 of Site 14, near Chillimookoo Waterhole. Photograph is looking north.

Overstorey: Muehlenbeckia cunninghamii low shrubland to low open shrubland. Also contains: scattered Eucalyptus microtheca, low Chenopodium auricomum shrubs and less frequently C. nitrariaceum.

Ground cover - beneath the shrubs: very open ephemeral herbland. Ephemeral herbs: Atriplex spongiosa, A. angulata, Sclerolaena diacantha, S. intricata, Neobassia proceriflora, Calotis ancyrocarpa and C. hispidula.

(e.g. Photo 21).

Photo 22 - Atriplex nummularia + Chenopodium auricomum low shrubland to low open shrubland west of Chillimookoo Waterhole.

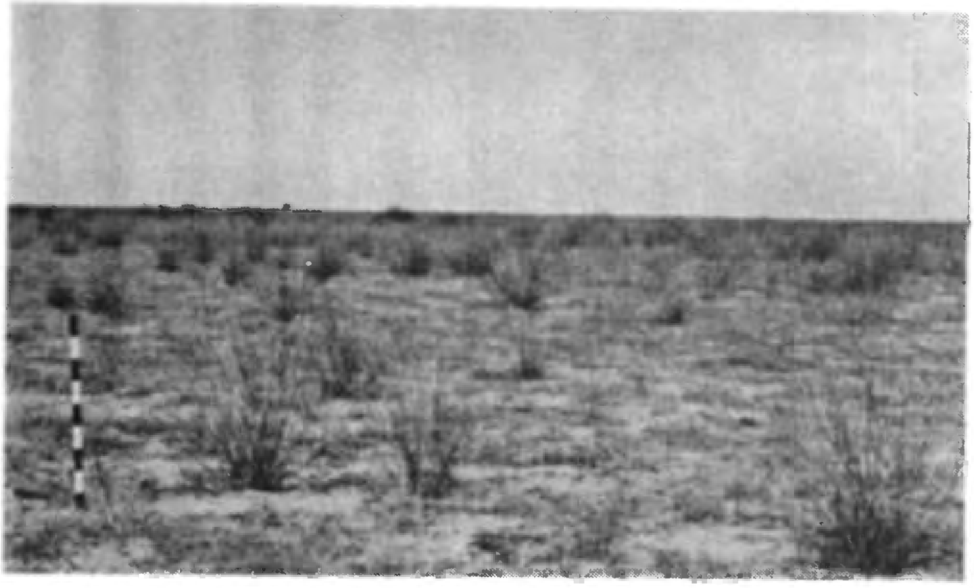

Photo 23 - Eragrostis australasica low open grassland on grey cracking clay soils west of Embarka Swamp

Habitat 59 in land system Fcl2.

Habitat 59: E.u. Fcl2 (D) - floodplain, E.s. Fcl2 (D) df - floodout (e.g. at the extremities of the Cooper Creek floodplain near Site 6).

Overstorey: scattered Eucalyptus microtheca.

Ground cover: Muehlenbeckia cunninghamii low open shrubland interspersed with ephemerals e.g. Atriplex spongiosa, A. angulata, A. velutinella, Salsola kali and Sclerolaena spp.

Habitat 60 in land system Fcl3.

Habitat 60: E.u. Fcl3 (D) - floodplain, E.s. Fcl3 (D) df - floodout.

Photo 24 - Halosarcia indica ssp. leiostachya low open chenopod shrubland with interspersed ephemeral herbs and grasses 2 km NW of Eagle Hawk Waterhole and south of Lake Perigundi.

Overstorey: Muehlenbeckia cunninghamii low, very open shrubland.
Also contains scattered: Eucalyptus microtheca, Acacia stenophylla, Atalaya hemiglauca, Lysiphyllum gilvum and the shrub Enchylaena tomentosa.

Ground cover: very open ephemeral herbland.
Ephemeral herbs: Atriplex spongiosa, Salsola kali, Asperula gemella, Sclerolaena bicornis, Zygophyllum ammophilum and Tetragonia tetragonioides.

(e.g. Site 15).

Habitat 61 in land system Fcl4.

Habitat 61: E.u. Fcl4 (D) - floodplain, E.s. Fcl4 (D) df - floodout (may be indicative of slight saline conditions).

Overstorey: Acacia victoriae low open shrubland.

Understorey: Halosarcia indica ssp. leiostachya with occasional Muehlenbeckia cunninghamii.
Also sometimes present: Cassia nemophila var. zygophylla and Atriplex nummularia.

Ground cover:very open ephemeral forb-herbland.
Ephemerals: Wahlenbergia spp., Craspedia chrysantha, Phyllanthus lacunarius, Salsola kali, Solanum oligacanthum, Tetragonia tetragonioides and Atriplex velutinella.

(e.g. area adjacent to Kudriemitchie Waterhole).

Habitat 62 in land system Fcl5.

Habitat 62: E.u. Fcl5 (D) - floodplain, E.s. Fcl5 (D) df - floodout.

Overstorey: Atriplex nummularia low shrubland to low open shrubland.
Also contains scattered: Muehlenbeckia cunninghamii and Chenopodium auricomum shrubs and Eucalyptus microtheca.

Ground cover - usually confined to micro-depressions: chenopod low (< 30 cm) forb-herbland.
Chenopods: Atriplex lindleyi, A. velutinella, A. spongiosa, A. angulata, Salsola kali, Maireana coronata and Sclerolaena intricata.
Also the herbs: Portulaca intraterranea and Tetragonia tetragonioides.

(e.g. Photo 22).

Habitats 63-64 in land system Fcl6.

Habitat 63: E.u. Fcl6 (D) - floodplain, E.s. Fcl6 (D) df - floodout (e.g. at the extremities of the Cooper Creek floodplain near Site 6).

Overstorey: Atriplex nummularia low open shrubland.
Associates: Muehlenbeckia cunninghamii and Chenopodium auricomum.

Ground cover: chenopod low ephemeral forb-herbland simlar to Habitat 62.

Habitat 64: E.u. Fcl6 (D) - floodplain, E.s. Fcl6 (D) df - floodout (e.g. Fly Lake - extensive habitat example).

Overstorey: Atriplex nummularia low open shrubland.

Ground cover: Atriplex spp. - Sclerolaena spp. ephemeral forbland.

Habitat 65 in land system Fcl7.

Habitat 65: E.u. Fcl7 (D) - floodplain, E.s. Fcl7 (D) df - floodout (e.g. a component of Embarka Swamp - habitat of generally small areal extent).

Overstorey: Eragrostis australasica low open grassland.

Associates: Atriplex spongiosa, A. angulata, Sclerolaena intricata, Solanum oligacanthum, Salsola kali, Tetragonia tetragonioides and infrequently

Atriplex nummularia and Eucalyptus microtheca.

(e.g. Photo 23).

Habitat 66 in land system Fc18.

Habitat 66: E.u. Fc18 (D) - floodplain, E.s. Fc18 (D) df - floodout (e.g. a component of Embarka Swamp and Fly Lake - habitat of generally small areal extent).

Overstorey: Chenopodium nitrariaceum low open shrubland.

Ground cover: ephemeral forbland.
Ephemerals: Salsola kali, Atriplex spongiosa, A. angulata, Plantago varia, Babbagia acroptera and occasional Solanum oligacanthum.

Habitat 67 in land system Fc19.

Habitat 67: E.u. Fc19 (D) - floodplain, E.s. Fc19 (D) dtl - terminal lake (e.g. Coongie Lake as an example of a lake which is more permanently inundated - this area was not surveyed in detail and information is only available on part of its western margin).

Vegetation comprised a predominance of Halosarcia indica ssp. leiostachya with occasional Muehlenbeckia cunninghamii shrubs.

N.B. - the open water of the lake and fringing woodland would likely constitute separate habitats but more data is required to enable such subdivision e.g. details of fringing vegetation zonation.

Habitat 68 in land system Fc20.

Habitat 68: E.u. Fc20 (D) - floodplain, E.s. Fc20 (D) df - floodout (at the extremities of floodplains - clay flats bordering salt lakes e.g. near Site 25 - in the vicinity of Lake Perigundi and salt lakes to the south and west of it).

Halosarcia indica ssp. leiostachya low open chenopod shrubland.

Associates: Cyperus gymnocaulos, Enchylaena tomentosa, Sclerolaena intricata and S. diacantha.
Occasional associates: Muehlenbeckia cunninghamii and Eucalyptus microtheca.

Ephemeral herbs and grasses include: Convulvulus erubescens, Sauropus trachyspermus and Sporobolus mitchellii.

(e.g. Photo 24).

Habitats 69-70 in land system Fc21.

Habitat 69: E.u. Fc21 (D) - floodplain, E.s. Fc21 (D) df - floodout (at the extremities of floodplains - very open clay flats).

Atriplex spp. - Sclerolaena spp. low, very open chenopod shrubland.

Common species: Atriplex spongiosa, A. angulata, A. velutinella, Sclerolaena intricata, S. bicornis, Salsola kali and Frankenia spp.
Herbs also often present: Helipterum strictum, Phyllanthus lacunarius and Senecio cunninghamii.

Bordered occasionally with: Gunniopsis quadrifida, Halosarcia indica ssp. leiostachya, Blennodia pterosperma, Convulvulus erubescens and some Chenopodium auricomum.

(e.g. Photo 25).

Habitat 70: E.u. Fc21 (D) - floodplain, E.s. Fc21 (D) dtl - terminal lake (e.g. ephemeral lakes near Site 14 - see Fig. 12).

Vegetation essentially the same as for Habitat 69.

Photo 25 - Atriplex spp. - Sclerolaena spp. low, very open chenopod shrubland with occasional Chenopodium auricomum on the floodplain of Christmas Creek north of Chillimookoo Waterhole.

Habitats 71-72 in land system Fc22.

Habitat 71: E.u. Fc22 (D) - floodplain, E.s. Fc22 (D) df - floodout (at the extremities of the Cooper Creek floodplain e.g. near Site 6).

Overstorey: scattered *Eucalyptus microtheca*.

Ground cover: ephemeral forbland.
Dominant forbs: *Atriplex spongiosa*, *A. vesicaria*, *A. leptocarpa*, *A. angulata*, *A. velutinella*, *Sclerolaena intricata*, *Salsola kali*, *Calotis hispidula*, *Helipterum strictum*, *Myriocephalus stuartii*, *Solanum oligacanthum*, *Convulvulus erubescens*, *Sporobolus mitchellii* and *Eragrostis australasica*.

Photo 26 - Ephemeral forbland on a floodout north of Karawinnie Waterhole near a trap line of Site 6.

Photo 27 - Dry lake Lake Oolgoopiarie with ephemeral forbland composed of Atriplex spp., other forbs, occasional Eucalyptus microtheca and Enchylaena tomentosa.

Very occasionally the shrubs: Maireana aphylla, M. pyramidata and Enchylaena tomentosa occur.

(e.g. Photo 26).

Habitat 72: E.u. Fc22 (D) - floodplain, E.s. Fc22 (D) dtl - terminal lake (at the extremities of the Cooper Creek floodplain e.g. Lake Oolgoopiarie - see Photo 27).

Vegetation essentially as for Habitat 71 - ephemeral lakes are however, often bordered with Eucalyptus microtheca, Muehlenbeckia cunninghamii and Chenopodium spp.

Photo 28 - Hard grey clay flat between Pilalchilpna and Yalcuma Waterholes dominated by open forbland of Sclerolaena spp. and Atriplex spp.

Habitat 73 in land system Fc23.

Habitat 73: E.u. Fc23 (D) - floodplain, E.s. Fc23 (D) df - floodout (hard grey clay flats e.g. near Site 25 - habitat of generally small areal extent).

Dominant: ephemeral forbland.
Chenopod sub-shrubs: Atriplex sp. aff. eardleyae, A. leptocarpa, A. spongiosa, Sclerolaena intricata and S. ventricosa.

Also occasionally: scattered Muehlenbeckia cunninghamii, Chenopodium nitrariaceum and low Eucalyptus microtheca.

Ground cover: very open forb-herbland.
Forbs and herbs: Solanum oligacanthum, Calotis hispidula, Phyllanthus lacunarius, Teucrium racemosum var. racemosum, Cyperus gymnocaulos and Dentella pulvinata var. pulvinata.

Sometimes on the borders of clay flats: Halosarcia indica ssp. leiostachya low shrubland.

(e.g. Photo 28).

Habitat 74 in land system Fc24.

Habitat 74: E.u. Fc24 (D) - floodplain, E.s. Fc24 (D) dtl - terminal lake (e.g. Lake Marrakoonamooka - extensive lakes of the central Cooper Creek floodplain).

Low ephemeral forb-herbland.
Common ephemerals: Atriplex angulata, A. limbata, A. spongiosa, A. nummularia (occasionally on edges), Sclerolaena intricata, S. bicornis, S. ventricosa, Dissocarpus paradoxa var. latifolius and Salsola kali.
Less common ephemerals: Plantago varia, Goodenia lobata, Calotis hispidula, C. erinacea, Daucus glochidiatus, Frankenia spp., Aristida contorta, Psoralea spp., Calocephalus platycephalus, Euphorbia australis, Eragrostis setifolia, Euphorbia tannensis ssp. eremophila var. eremophila, Sida ammophila and Swainsona phacoides.

(e.g. Photo 29).

Habitat 75-76 in land system Fc25.

Habitat 75: E.u. Fc25 (D) - floodplain, E.s. Fc25 (D) dc - channel (minor channels leading into ephemeral freshwater lakes e.g. northern end of Lake Apachirie).

Ephemeral herbland after channel recently moistened.
Ephemeral herbs: Alternanthera nodiflora, Myriocephalus stuartii, Craspedia chrysantha, Centipeda minima, Epaltes cunninghamii, Frankenia pseudo-flabellata, Heliotropium europaeum, Cucumis melo ssp. agrestis, Portulaca intraterranea, Ludwigia peploides ssp. montevidensis and Gnephosis foliata.

Habitat 76: E.u. Fc25 (D) - floodplain, E.s. Fc25 (D) dtl - terminal lake (e.g. Lake Apachirie near Site 11).

A. Areas which had received floodwaters recently - grey clay soils.

Closed ephemeral herbland.
Ephemerals: Portulaca intraterranea, Senecio lautus ssp. maritimus, Minuria denticulata, Trigonella suavissima, Alternanthera nodiflora, Centipeda minima, Atriplex velutinella, A. spongiosa, Frankenia pseudo-flabellata, Epaltes cunninghamii, Heliotropium europaeum, Craspedia chrysantha, Sporobolus mitchellii and Gnephosis foliata.

B. Areas which had not recently received floodwaters.

Very open ephemeral herbland.
Ephemerals: same species as for A, but mostly dead.

Habitat 77 in land system Fc26.

Habitat 77: E.u. Fc26 (D) - floodplain, E.s. Fc26 (D) dtl - terminal lake (e.g. near Site 14 - smaller ephemeral lakes carrying ephemeral herbland and of a drier nature than Habitat 76).

Ephemeral herbland.
Common ephemerals: Trigonella suavissima, Portulaca intraterranea, Tetragonia tetragonioides, Atriplex spongiosa and a range of grasses.
When dry contains only: Sclerolaena spp. and Atriplex spp.

Habitat 78 in land system Fs1.

Habitat 78: E.u. Fs1 (D) - floodplain, E.s. Fs1 (D) dc - channel (channels of the Strzelecki Creek floodplian - fewer species, narrower and less dense fringing woodland on the edge of the Strzelecki than along the Cooper, with much reduced (or totally lacking a) ground layer).

Overstorey: Eucalyptus microtheca-Lysiphyllum gilvum - Acacia stenophylla low open woodland.
Diplatia grandibractea parasitises E. microtheca.

Understorey - shrubland with common species: Enchylaena tomentosa, Atriplex nummularia, Muehlenbeckia cunninghamii, Chenopodium nitrariaceum and Eremophila bignoniiflora.

Ground cover: very sparse ephemeral forb-herbland.
Forb: Sclerolaena intricata.
Herbs: Tetragonia tetragonioides and Lavatera plebeia.

(e.g. Photo 30).

Habitat 79 in land system Fs2.

Habitat 79: E.u. Fs2 (D) - floodplain, E.s. Fs2 (D) df - floodout (floodout sections which are a very small component of the floodplain e.g. near Site 28).

Overstorey: occasional emergent Eremophila bignoniiflora or Eucalyptus microtheca.

Understorey dominant: Muehlenbeckia cunninghamii - Chenopodium auricomum low open shrubland.

Ground cover - chenopod sub-shrubs: Atriplex spongiosa, Salsola kali, Sclerolaena intricata, S. diacantha, S. costata, Neobassia proceriflora and Babbagia dipterocarpa.
Common herbs and grasses: Calotis hispidula, Zygophyllum howittii, Tetragonia tetragonioides, Helipterum strictum, Calotis porphyroglossa, Aristida contorta and Enneapogon avenaceus.

Habitat 80 in land system Fs3.

Habitat 80: E.u. Fs3 (D) - floodplain, E.s. Fs3 (D) df - floodout (floodout sections of an extensive nature on the Strzelecki Creek floodplain e.g. near Toolache Waterhole - Site 28).

Overstorey which sometimes occurs: Eucalyptus microtheca + Eremophila bignoniiflora low, very open woodland.
Contains: occasional Acacia victoriae.

Understorey - principal component of the Strzelecki Creek floodplain: Atriplex nummularia low open shrubland.
Common associates: Chenopodium auricomum and Muehlenbeckia cunninghamii.
Less frequent associates: Chenopodium nitrariaceum and Eragrostis australasica.

Ground cover: Atriplex spp. - Sclerolaena spp. chenopod low shrubland.

Photo 29 - Dry lake bed of Lake Marrakoonamooka with low ephemeral forb-herbland dominant.

Chenopods include: Atriplex lobativalvis, A. spongiosa, A. velutinella, Maireana coronata, Neobassia proceriflora, Sclerolaena bicornis, S. intricata and Enchylaena tomentosa.
Herbs present: Minuria denticulata, Myriocephalus stuartii, Calotis porphyroglossa, Helipterum moschatum, H. microglossum, H. strictum, Senecio gregorii, Plantago varia, Daucus glochidiatus, Tetragonia tetragonioides, Goodenia lobata, Bulbine alata and Haloragis aspera.
The common grass is Eragrostis setifolia.

(e.g. Photo 31).

Habitat 81 in land system Fs4.

Habitat 81: E.u. Fs4 (D) - floodplain, E.s. Fs4 (D) df - floodout (floodout sections of an extensive but patchy nature on the Strzelecki Creek

Photo 30 - Eucalyptus microtheca - Lysiphyllum gilvum - Acacia stenophylla low open woodland of the Strzelecki Creek near Toolache Waterhole.
View south showing sparse shrub layer and ground cover.

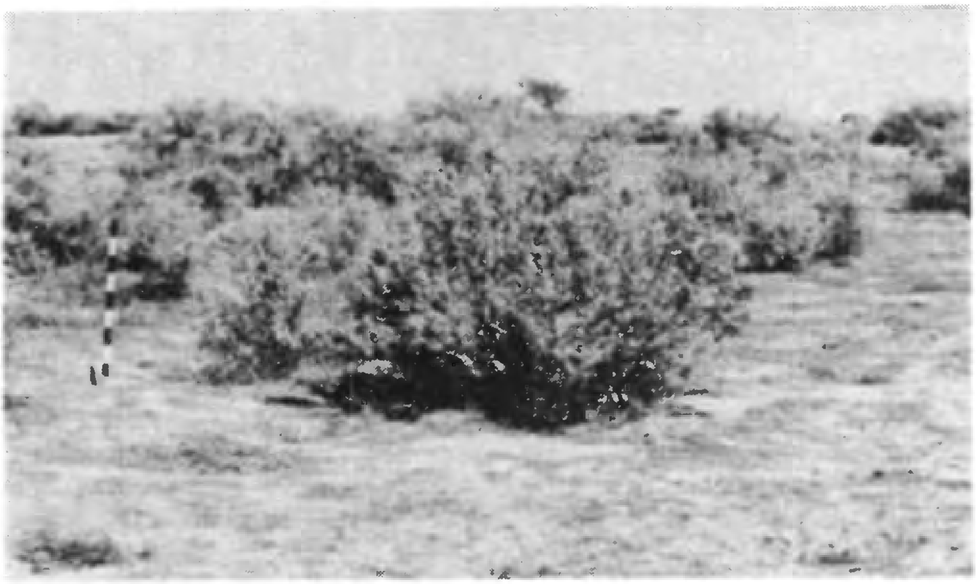

Photo 31 - Atriplex nummularia low open shrubland near Toolache Waterhole, Strzelecki Creek.

floodplain - of a limited species diversity, the ephemerals of which are concentrated in microdepressions).

Eragrostis australasica low grassland.

Chenopods: Atriplex spongiosa, Salsola kali and Sclerolaena intricata. Occasionally: Muehlenbeckia cunninghamii, stunted Atriplex nummularia, Chenopodium nitrariaceum and Enchylaena tomentosa occur.

Herbs: Calotis multicaulis and Tetragonia tetragonioides.

(e.g. Photo 32).

Habitats 82-83 in land system Fs5.

Habitat 82: E.u. Fs5 (D) - floodplain, E.s. Fs5 (D) df - floodout (floodout

Photo 32 - Eragrostis australasica low grassland 16 km NNW of Toolache Waterhole (see Fig. 15 for location).

sections at the extremity of the Strzelecki Creek floodplain with yellow-grey silty clay soils).

Low (< 30 cm) open ephemeral forbland.

Chenopod sub-shrubs: Atriplex spongiosa, A. angulata, A. lobativalvis, Sclerolaena bicornis, S. intricata, S. diacantha, Salsola kali, Babbagia acroptera and Dissocarpus biflorus var. cephalocarpus.
Also present: Frankenia spp.

Herbs and grasses: Calotis hispidula, Helipterum strictum, H. microglossum, Plantago varia, Tetragonia tetragonioides, Goodenia lobata, Bulbine alata, Euphorbia spp. and Eragrostis eriopoda.

(e.g. Photo 33).

Habitat 83: E.u. Fs5 (D) floodplain, E.s. Fs5 (D) dtl - terminal lake (ephemeral lakes of the Strzelecki Creek floodplain with yellow-grey, hard silty clay soils e.g. Big Lake Moonba - see Photo 34).

A. Lake floors.

Low (< 30 cm) open ephemeral forbland.
Chenopod sub-shrubs: Atriplex spongiosa, A. angulata, A. lobativalvis, Sclerolaena bicornis, S. intricata, S. diacantha, Salsola kali, Babbagia acroptera and Dissocarpus biflorus var. cephalocarpus.
Also: Frankenia spp.
Occasional species: Chenopodium nitrariaceum and Eragrostis australasica.
Herbs and grasses: Calotis hispidula, Helipterum strictum, H. microglossum, Plantago varia, Tetragonia tetragonioides, Bulbine alata, Euphorbia spp. and Eragrostis eriopoda.

B. Lake margins.

Gunniopsis quadrifida, Halosarcia indica ssp. leiostachya and low Eucalyptus microtheca may occur.

Habitats 84-85 in land system Fol.

Habitat 84: E.u. Fol (D) - floodplain, E.s. Fol (D) dc - channel (channels of the more significant creek systems - vegetation near waterholes e.g. Mudcarnie Waterhole near Site 4).

Overstorey: Eucalyptus terminalis - E. microtheca - Acacia cyperophylla + Eremophila bignoniiflora + Grevillea striata low open woodland.

Understorey: Leptochloa digitata- Psoralea australasica - Lavatera plebeia + Cassia oligophylla + Enchyleana tomentosa tall closed grass-herbland.

Ground cover: dense ephemeral herb-forb-grassland.
Ephemerals: Echinochloa inundata, Diplachne fusca, Convulvulus erubescens, Glinus lotoides, Psoralea australasica, Cucumis melo ssp. agrestis, Centipeda minima, Calocephalus platycephalus, Polygonum plebeium, Gnaphalium indicum, Nicotiana velutina and Wahlenbergia spp.

Habitat 85: E.u. Fol (D) - floodplain, E.s. Fol (D) dc - channel (channels of the more significant creek systems - vegetation along channels not associated with waterholes e.g. Mudcarnie Creek near Site 4).

Overstorey: Eucalyptus terminalis - E. microtheca - Acacia cyperophylla low open woodland.

Understorey: Cassia oligophylla - C. phyllodinea low open shrubland.

Ground cover: ephemeral forb-herb-grassland (essentially the same species as for Habitat 84 above).

Habitat 86 in land system Fo2.

Habitat 86: E.u. Fo2 (D) - floodplain, E.s. Fo2 (D) dc - channel (channels in more extensive sand plains e.g. Candradecka Creek).

Acacia cyperophylla - Eucalyptus microtheca - Hakea eyreana low open fringing woodland.

Habitat 87 in land system Fo3.

Habitat 87: E.u. Fo3 (D) - floodplain, E.s. Fo3 (D) dc - channel (channels of minor creek systems (type 1) - a small but important component of the Uncoordinated Drainage Dunefield Environmental Subassociation 8.4.4.7)

Overstorey: Acacia victoriae - A. farnesiana + Santalum lanceolatum tall open shrubland.

Ground cover - very sparse cover of ephemerals: Crotalaria smithiana, Myriocephalus stuartii, Atriplex velutinella, Calocephalus platycephalus and Centaurium spicatum.

Habitat 88 in land system Fo4.

Habitat 88: E.u. Fo4 (D) - floodplain, E.s. Fo4 (D) dc - channel (channels of minor creek systems (type 2) - a small but important component of the Uncoordinated Drainage Dunefield Environmental Subassocaition 8.4.4.7)

Overstorey: Cassia phyllodinea - C. oligophylla low shrubland.

Ground cover: dense cover of ephemeral grasses and forbs.
Species may include: Sclerolaena bicornis, S. diacantha, S. intricata, Atriplex spongiosa, A. angulata, A. limbata, A. lobativalvis, Gnephosis foliata, Astrebla pectinata, Eragrostis dielsii, Euphorbia australis, E. tannensis ssp. eremophila var. eremophila, Euphorbia spp., Teucrium racemosum var. racemosum, Crinum flaccidum, Morgania glabra, Centaurium spicatum, Frankenia uncinata, Maireana microcarpa, Calotis hispidula, Marsilea drummondii, Calocephalus platycephalus, Calotis porphyroglossa, Daucus glochidiatus, Tetragonia tetragonioides, Eriachne aristidea, Alternanthera nodiflora and Calotis multicaulis.

Habitats[1] 89-90 in land system Fo5.

Habitat 89: E.u. Fo5 (D) - floodplain, E.s. Fo5 (D) dtl - terminal lake.

Lake floors.

Ground cover: ephemeral forbland.
Ephemerals: Atriplex angulata, A. limbata, A. spongiosa, Sclerolaena intricata, S. bicornis, S. ventricosa, Dissocarpus paradoxa var. latifolius and Salsola kali are likely to occur.
Also likely to be present: Plantago varia, Calotis hispidula, C. erinacea, Daucus glochidiatus, Frankenia spp., Aristida contorta, Psoralea spp., Calocephalus platycephalus, Euphorbia australis, E. tannensis ssp. eremophila var. eremophila, Eragrostis setifolia, Sida ammophila and Swainsona phacoides.

(e.g. Lake Moorayepe).

Habitat 90: E.u. Fo5 (D) - floodplain, E.s. Fo5 (D) dtl - terminal lake.

Lake margins.

Overstorey: Eucalyptus microtheca low open fringing woodland.

Ground cover: ephemeral forbland.
Ephemerals essentially similar to those of lake floors (Habitat 89) with occasional Atriplex nummularia shrubs.

(e.g. Lake Moorayepe).

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[1] Within this land system two habitats are recognised as the ephemeral lake(s) in question are distinct in having a definite presence of fringing woodland, which may not be the case for other ephemeral lakes in the study area - more data is required on these.

Photo 33 - Low (< 30 cm) open ephemeral forbland of a floodout 30 km north of Toolache Waterhole - Atriplex spp. and Sclerolaena spp. predominate.

Habitats 91-94 in land system GPls.

Habitat 91: E.u. GPls (F) - gibber plain, E.s. GPls (F) f - gibber plain.

Gibber plains proper - these contain vast areas of essentially bare ground with a very close cover of gibber fragments over red duplex soils.

(e.g. Photo's 5, 6 and 35).

Habitat 92: E.u. GPls (F) - gibber plain, E.s GPls (F) f - gibber plain.

Gibber plain clay lenses - red duplex soils: this habitat incorporates a very rich flora of ephemeral grasses and forbs, and exhibits a greater diversity

Photo 34 - Low (< 30 cm) open ephemeral forbland of ephemeral lake Big Lake Moonba, which is WNW of Toolache Waterhole.

Photo 35 - Areas of bare gibber, Astrebla pectinata open grassland, very low (< 10 cm) ephemeral ground cover and chenopodiod - caesalpinoid low open shrubland in the vicinity of Site 1. Cairns mark two corners of a 15 m X 10 m quadrat - star stakes mark the other two corners.

than any other habitat within 8.4.4.

Astrebla pectinata open grassland.

Dominant grass: Astrebla pectinata.
Others included: Dactyloctenium radulans, Enneapogon avenaceus, Eragrostis dielsii, Eriachne aristidea and Sporobolus actinocladus.

Chenopods are a very important (ephemeral) component as well. They included: Atriplex spongiosa, Atriplex sp. aff. eardleyae, A. angulata,

Photo 36 - Acacia victoriae tall open shrubland on pale grey sandy soil 14 km south of Pilalchilpna Waterhole.

A. nummularia, A. vesicaria, Chenopodium auricomum, Salsola kali, Neobassia proceriflora, Sclerolaena intricata, S. lanicuspis, Dissocarpus biflorus var. biflorus and Babbagia acroptera.

Other herbs and forbs: Marsilea drummondii, Alternanthera nodiflora, Teucrium racemosum var. racemosum, Gnephosis foliata, Daucus glochidiatus, Calotis porphyroglossa, Dentella pulvinata var. pulvinata, Calocephalus platycephalus, Euphorbia australis, Streptoglossa adscendens, Sida trichopoda, Morgania glabra, Portulaca intraterranea and Psoralea cinerea.

(e.g. Photo 35).

Habitat 93: E.u. GPls (F) - gibber plain, E.s. GPls (F) f - gibber plain.

Gibber plain proper - clay lense ecotones.

Very low (< 10 cm) ephemeral ground cover of composites, grasses and chenopods.

Principal components: Atriplex spongiosa, Enneapogon avenaceus, Salsola kali and Gnephosis foliata.

(e.g. Photo 35).

Habitat 94: E.u. GPls (F) - gibber plain, E.s. GPls (F) f - gibber plain.

Small gutters in gibber plains - these more favoured sites can support an open shrubland.

Maireana aphylla - Chenopodium auricomum - Atriplex nummularia - Cassia helmsii - C. phyllodinea low open shrubland.

(e.g. Photo 35).

Habitats 95-102 at the interfaces between land systems (and zones).

Habitat 95: E.u's Fcl9 (D) - floodplain/ Dpl2 (B) - dune, E.s's Fcl9 (D) dtl - terminal lake/ Dpl2 (B) b - dune.

More permanent terminal lake / sand dune interfaces e.g. Site 11, the western margin of Coongie Lake (c.f. Habitat 67).

Photo 37 - Acacia victoriae low open shrubland 12.3 km north of Toolache Waterhole.

Predominance of Halosarcia indica ssp. leiostachya with occasional Muehlenbeckia cunninghamii shrubs.

Habitat 96: E.u's [1]Fc? (D) - floodplain/ [1]Dp? (B) - dune, E.s's [1]Fc? (D) df - floodout/[1]Dp? (B) b - dune.

Floodout / dune interfaces of pale grey sandy soils e.g. near Site 25.

Overstorey: Acacia victoriae tall open shrubland.

Understorey: Atriplex nummularia - A. leptocarpa - Muehlenbeckia cunninghamii low shrubland.

Ground cover: Haloragis aspera - Nicotiana velutina - Phyllanthus lacunarius very open herbland.

(e.g. Photo 36).

Habitat 97: E.u's [1]Dp? (B) - dune/[1]Fs? (D) - floodplain, E.s's [1]Dp? (B) b - dune/[1]Fs? (D)[1]d? -[1]? floodout or terminal lake.

Dune slope / floodplain interfaces - in some areas bordering floodplains, a convergence of sand dune and floodplain associations was encountered e.g. near Site 28.

Acacia victoriae low open shrubland.

Common associate: Eucalyptus microtheca.
Other shrubs present: Acacia tetragonaphylla, Atalaya hemiglauca and Cassia nemophila var. nemophila.

Herbs present: Euphorbia tannensis ssp. eremophila var. eremophila, Blennodia pterosperma and Crinum flaccidum.

(e.g. Photo 37).

Habitat 98: E.u's Ds4 (B)/ Ds4 (C) - dune/interdune low //[1]Fs?5 (D) - floodplain, E.s's Ds4 (B) b/ Ds4 (C) c - dune/interdune low // [1]Fs?5 (D)[1]d? - 1? floodout or terminal lake.

Sand plain / floodplain interfaces - in some areas bordering floodplains, a

Photo 38 - Acacia victoriae - Grevillea striata + Hakea eyreana low open woodland south of Lake Moorayepe (see Fig. 9).

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[1]More data required.

convergence of sand plain and floodplain associations was encountered e.g. near Site 28.

Vegetation essentially as for Habitat 97.

Habitat 99: E.u's GPls (F) - gibber plain/ Dp6 (B) - dune, E.s's GPls (F) f - gibber plain/ Dp6 (B) b - dune.

Gibber plain red duplex soil / sand dune base interfaces - small areas only occurring as narrow bands along the dune margin e.g. near Site 1.

Overstorey: Eucalyptus microtheca low open woodland.

Understorey: Muehlenbeckia cunninghamii - Chenopodium auricomum - C. nitrariaceum - Santalum lanceolatum - Atriplex nummularia - Maireana aphylla - Enchylaena tomentosa low open shrubland.

Ground cover: ephemeral forb-herbland.
Ephemerals: Einadia nutans, Alternanthera nodiflora, Atriplex spongiosa, A. velutinella, Portulaca intraterranea, Euphorbia spp., Marsilea drummondii, Babbagia acroptera, Sclerolaena intricata, Eragrostis setifolia and Astrebla pectinata.

Habitat 100: E.u's GPls (F) - gibber plain/ Dp6 (D) - dune, E.s's GPls (F) f - gibber plain/ Dp6 (B) b - dune.

Gibber plain deeper, red duplex soils / sand dune base interfaces - e.g. near Site 1.

Overstorey: Acacia victoriae - Grevillea striata + Hakea eyreana low open woodland.

Understorey: Acacia vicoriae (low form = ssp. arida) - Cassia nemophila var. nemophila - C. phyllodinea - Enchylaena tomentosa - Maireana aphylla low open shrubland.

Ground cover: ephemeral forb-herbland.
Ephemerals: Sclerolaena parallelicuspis, S. bicornis, S. lanicuspis, Salsola kali, Atriplex spongiosa, Euphorbia parvicaruncula, Gnephosis foliata and Teucrium racemosum var. racemosum.

(e.g. Photo 38).

Habitat 101: E.u's GPls (F) - gibber plain/ Dunc (B) - dune, E.s's GPls (F) f - gibber plain/ Dunc (B) b - dune.

Gibber plain / uncoordinated drainage dunefield interfaces e.g. near Site 4.

Astrebla pectinata open grassland over ephemeral herbs.

Associates: Atriplex spongiosa, A. angulata, Sclerolaena spp. and composites.
Occasional associates: Cassia phyllodinea and C. oligophylla.

Habitat 102: E.u's GPls (F) - gibber plain // Ds4 (B)/ Ds4 (C) - dune/interdune low, E.s's GPls (F) f - gibber plain // Ds4 (B) b/ Ds4 (C) c - dune/ interdune low.

Gibber plain / sand plain interfaces - tongues of gibber plain in the sand plains of 8.4.4.6 north of Innamincka.

Astrebla pectinata open grassland over ephemeral herbs.

Occasional associates: Cassia phyllodinea and Acacia victoriae.

(Fauna Results...87).

Table 6 – Species of mammal recorded in this survey from Environmental Association 8.4.4.

Families	Species	Observation	Habitats
Endemic species			
Muridae	*Leggadina forresti*	live specimen, in owl pellets	Plain, Dune.
	Notomys cervinus	live specimen	Plain
	Notomys sp. (either *alexis* or *fuscus* or both)	in owl pellets only	—
	Pseudomys australis	live specimen	Plain
	P. hermannsburgensis	live specimen, in owl pellets	Dune / Swale Grassy creek bed Dune / Gibber
	Rattus villosissimus	in owl pellets only	—
Dasyuridae	*Antechynomys laniger*	in owl pellets only	—
	Dasyuroides byrnei	live specimen	Plain
	Planigale gilesi	live specimen	Dune / Swale
	Sminthopsis crassicaudata	live specimen, in owl pellets	Plain edge
	S. macroura	live specimen	Recent dune
	Planigale sp.	in owl pellet (specimen lost)	—
Macropodidae	*Macropus rufus*	recent tracks seen, part skull found	—
Vespertilionidae	*Nycticeus sp.*	live specimen	Arboreal } Open Air
	Nyctophilus geoffroyi	live specimen	Arboreal } Open Air
Introduced species			
Felidae	*Felis cattus*	live specimen	General
Canidae	*Canis familiaris dingo*	live specimen seen	General
	Vulpes vulpes	skull found	—
Muridae	*Mus musculus*	live specimen	General
Equidae	*Equus caballus*	live specimen seen	General
	E. asinus	live specimen seen	General
Bovidae	*Bos taurus*	live specimen seen	General
Camelidae	*Camelus dromedarius*	live specimen seen	General
Suidae	*Sus scrofa*	mandible found	—
Leporidae	*Oryctolagus cuniculus*	live specimen	Dune / Swale

4.4 FAUNA RESULTS

A preliminary list of fauna specimens (mostly derived from data sheet entries) is presented in Appendix O. Invertebrates and fish are presented separately in the text. All species groups are treated in greater detail in the following subsections.

4.4.1 Mammals

Trapping effort is difficult to standardise. However each of the seven sites studied by the consultants was surveyed by using approximately 100 pitfall trap-nights and 500 box trap-nights. The spotlighting and mistnetting effort varied considerably between sites. The total trapping effort is summarised (Table 5).

Table 5 - Total trapping effort.

Trap-nights			Hours spent	
Pitfall traps	Elliot	Sherman	Spotlighting	Mistnetting
713	1799	1479	18.5	19

Nineteen species of mammals were caught or seen within the survey area and a further six were represented by skeletal material only (Table 6). Preferred habitats are indicated in Table 6.

Some species were caught by only one method, whereas others were caught by more than one. Trapping success was characteristically low (Table 7).

Table 7 - Methods by which mammal species were collected in this survey and the trapping success rate.

Species	Pitfall traps	Box traps	Spotlighting	*Mistnetting
Nyctophilus geoffroyi				1
Sminthopsis crassicaudata	3		3	
S. macroura	8			
Pseudomys australis		1		
P. hermannsburgensis	12	7		
Leggadina forresti	2		1	
Notomys cervinus			3	
Mus musculus	3	25		
Planigale gilesi	3			
Dasyuroides byrnei		1		
TOTALS	31	34	7	1
SUCCESS PER EFFORT	4.3%	1.0%	0.4 per hour	-

*In addition four bats of two species (*Nyctophilus geoffroyi*, *Nycticeus sp.*) were caught by one NPWS team.

Table 8 - Species of birds recorded during this survey of Association 8.4.4.

Columns A : Abundance R = rare ; U = uncommon ; MC = moderately common ; C = common ; VC = very common.

Habitats : Aquatic - open = open water bodies ; cover = water bodies with emergent vegetation ; edge = edges of water bodies.

: Woodland - riparian woodland generally

: Shrubland - e.g. of lignum, Atriplex nummularia or samphire - may be a component of woodland.

: Floodplains } preffered components of these may be indicated.
: Dunefields }

: Gibber - includes gibber plain clay lenses and other better vegetated pockets of gibber.

: Seasonal - widespread under favourable conditions only.

B : Breeding denoted by ✓

C : Dependence on (D) vs Independence of (I) Free Water Bodies (? denotes uncertainty).

* Recorded in the North-east but not within 8.4.4.

? Record may be invalid.

‡ Not members of typical bird communities associated with the predominant avian habitats of 8.4.4. i.e. either vagrant and/or rare.

Family	Species	A	Habitats	B	C
Dromaiidae	Dromaius novaehollandiae	U	General	✓	D
Podicipedidae	Poliocephalus poliocephalus	R	Aquatic - open & cover	✓	D
	‡Tachybaptus novaehollandiae	R	Aquatic		D
Pelicanidae	Pelecanus conspicillatus	U	Aquatic - open		D
Phalacrocoracidae	Phalacrocorax carbo	R	Aquatic - open		D
	P. melanoleucos	R	Aquatic - open		D
Ardeidae	Ardeus pacificus	U	Aquatic - edge		D
	A. novaehollandiae	U	Aquatic - edge		D
	Egretta alba	R	Aquatic - edge		D
	Nycticorax caledonicus	R	Aquatic - cover & edge		D
Plataleidae	Plegadis falcinellus	R	Aquatic - edge		D
	Platalea regia	R	Aquatic - edge		D
	P. flavipes	U	Aquatic - edge	✓	D
Anatidae	Dendrocygna eytoni	R	Aquatic - cover & edge		D
	Cygnus atratus	R	Aquatic - open		D
	*‡Tadorna tadornoides	R	Aquatic		D
	Anas superciliosa	U	Aquatic - open & cover	✓	D

Table 8 (cont'd)

Anatidae	Anas gibberifrons	MC	Aquatic - open & cover	✓	D
	# A. castanea	R	Aquatic		D
	A. rhynchotis	R	Aquatic - open		D
	Malacorhynchus membranaceus	U	Aquatic - open & cover	✓	D
	Aythya australis	R	Aquatic - open	✓	D
	Chenonetta jubata	U	Aquatic - edge & cover		D
	?# Oxyura australis	R	Aquatic		D
	Biziura lobata	R	Aquatic - open		D
Accipitridae	Milvus migrans	C	General (woodland)	✓	I
	? Lophoictinia isura	R	Woodland		I
	Hamirostra melanosternon	U	Woodland	✓	I
	Haliastur spherurus	U	Woodland	✓	D
	Aquila audax	MC	General		I
	Hiraaetus morphnoides	U	General	✓	I
	# Circus assimilis	R	General		I
	C. aeruginosus	R	Aquatic - open & cover		D
Falconidae	Falco subniger	U	General (seasonal)		I
	F. longipennis	R	Woodland		I
	# F. hypoleucos	R	Woodland		I
	F. berigora	MC	General (dune)	✓	I
	F. cenchroides	MC	General (dune)		I
Rallidae	Porzana fluminea	R	Aquatic - cover		D
	Gallinula ventralis	U	Aquatic - cover & edge		D
	# G. tenebrosa	R	Aquatic		D
	Porphyrio porphyrio	R	Aquatic - cover		D
	Fulica atra	R	Aquatic - open & cover		D
Gruidae	Grus rubicundus	U	Aquatic - edge		D
Charadriidae	Vanellus miles	U	Aquatic - edge	✓	D
	V. tricolor	R	Floodplain (margin)		D
	Erythrogonys cinctus	R	Aquatic - edge		D
	Chadrius ruficapillus	R	Aquatic - edge	✓	D
	C. melanops	U	Aquatic - edge	✓	D
	Peltohyas australis	U	Floodplain / Gibber	✓	I
Recurvirostridae	Himantopus himantopus	R	Aquatic - edge		D
	Recurvirostra novaehollandiae	R	Aquatic - open & edge	✓	D
Scolapacidae	Tringa nebularia	R	Aquatic - edge		D
	# Gallinago hardwickii	R	Aquatic		D
	* Calidris acuminata	R	Aquatic - edge		D
Glareolidae	Stiltia isabella	MC	Floodplain / Gibber	✓	?D
Laridae	Larus novaehollandiae	R	Aquatic - open & edge		D

Table 8 (cont'd)

Laridae	Gelochelidon nilotica	R	Aquatic-open/Gibber		D
	Chlidonias hybrida	R	Aquatic-open		D
	Hydroprogne caspia	R	Aquatic-open		D
Columbidae	* Columba livida	R	Dwellings		D
	ǂ Geopelia placida	C	Woodland		D
	G. cuneata	C	Woodland/Shrubland (tall)		D
	ǂ Phaps histrionica	R	Dune & Floodplain/Gibber		D
	Ocyphaps lophotes	VC	General	✓	D
Cacatuidae	Cacatua roseicapilla	VC	General (seasonal)	✓	D
	C. sanguinea	VC	General (woodland)	✓	D
Polytelitidae	Nymphicus hollandicus	R	General (seasonal)		D
Platycercidae	Melopsittacus undulatus	C	General (seasonal)		D
	Barnardius barnardi	U	Red gum woodland		D
	Psephotus haematonotus	MC	Woodland	✓	D
	Northiella haematogaster	MC	Woodland/Shrubland	✓	D
	ǂ Neophema bourkii	R	Shrubland (tall)		D
Cuculidae	Cuculus pallidus	R	Shrubland (tall) -General (seasonal)		I
	Chyrsococcyx basalis	U	General (seasonal)		I
Stringidae	Ninox connivens	R	Red gum woodland		I
Podargidae	Podargus strigoides	MC	Woodland		I
Aegothelidae	Aegotheles cristatus	MC	Woodland	✓	I
Apodidae	ǂ Apus pacificus	R	General		I
Alcenididae	Halcyon pyrrhopygia	MC	General (seasonal) -Woodland	✓	I
	H. sancta	R	Red gum woodland		?D
Meropidae	Merops ornatus	MC	General (seasona) -Woodland		I
Alaudidae	Mirafra javanica	U	Gibber/Floodout		I
Hirundinidae	Cheramoeca leucosternum	MC	General (dune)		I
	Cecropis nigricans	C	Woodland	✓	?D
	C. ariel	C	General (woodland)	✓	I
Motacillidae	Anthus novaeseelandiae	C	General (shrubland /gibber)		I
Campephagidae	Coracina novaehollandiae	U	Woodland (Red gum)	✓	I
	ǂ C. maxima	R	Floodplain		I
	Lalage sueurii	MC	General (dune)		I
Muscicapidae	Petroica goodenovii	R	Floodplain (woodland / shrubland)		I
	? Pachycephala rufiventris	R	Woodland		I

Table 8 (cont'd)

Muscicapidae	Colluricincla harmonica	MC	Woodland	✓	I
	Oreoica gutturalis	U	Woodland/Shrubland		I
	Myiagra inquieta	R	Red gum woodland		?I
	Rhipidura leucophrys	VC	General (woodland/ shrubland)	✓	?I
Orthonychidae	Psophodes cristatus	MC	Floodplain (shrubland)		I
	Cinclosoma cinnamomeum	MC	General (dune, gibber)		I
Timaliidae	Pomatostomus ruficeps	MC	Woodland/Shrubland (tall)		I
Silviidae	Acrocephalus stentoreus	R	Aquatic - cover		D
	Megalurus graminea	R	Aquatic - cover		D
	Cinclorhamphus mathewsi	R	Woodland (Red gum)		I
	C. cruralis	R	Grassland		I
Maluridae	Malurus lamberti	C	General (dune/shrubland)		I
	M. leucopterus	VC	General (dune/shrubland)	✓	I
	Amytornis goyderi	U	Zygochloa Dune		I
Acanthizidae	‡ Acanthiza uropygialis	R	Shrubland		I
	?‡ A. chrysorrhoa	R	Floodplain		I
	Aphelocephalus leucopsis	U	General (shrubland)		I
	A. nigricincta	R	Dunefield (dune)		I
Climacteridae	Climacteris picumnus	C	Red gum woodland		?I
Meliphagidae	Acanthogenys rufogularis	U	Woodland/Shrubland (tall)		D
	Manorina flavigula	VC	Woodland		D
	Lichenostomus virescens	MC	Shrubland (dune)		D
	L. penicillata	VC	Woodland		D
Ephthianuridae	Ephthianura tricolor	MC	General (seasonal) -dune -shrubland/grassland		D
	E. aurifrons	U	General (seasona) -shrubland/grassland		D
	Ashbyia lovensis	U	Gibber		I
Dicaeidae	Dicaeum hirundinaceum	R	Woodland/Shrubland (tall)		?I
Pardalotitidae	Pardalotus rubricatus	C	Woodland		I
Passeridae	* Passer domesticus	R	Dwellings		D
Ploceidae	Poephila guttata	VC	General (dune)	✓	D
Grallinidae	Grallina cyanoleuca	C	Floodplain (woodland)		D
Artamidae	Artamus leucorhynchus	C	Woodland	✓	D
	A. personatus	C	General (seasonal)		?D

Table 8 (cont'd)

Artamidae	‡ *Artamus superciliosus*	R	General		?D
	A. cinereus	VC	General	✓	I
Cracticidae	*Gymnorhina tibicen*	C	General (dune)	✓	?I
Corvidae	*Corvus coronoides*	VC	Woodland	✓	D
	C. bennetti	VC	General (dune)	✓	D

Accipitridae *Elanus scriptus* } traces found of former presence.
Tytonidae *Tyto alba*

4.4.2 Birds

During the course of the two field trips by the consultants and the N.P.W.S. training exercise, 121 species of bird were positively identified in 8.4.4 (Table 8). As well, evidence of two species - Letter-winged Kite _Elanus scriptus_ and Barn Owl _Tyto alba_ - having been present in the past was gathered, while the records of Chestnut Teal _Anas castanea_, Blue-billed Duck _Oxyura australis_, Rufous Whistler _Pachycephala rufiventris_ (which have been positively recorded in 8.4.4 previously), Yellow-rumped Thornbill _Acanthiza chrysorrhoa_ (of which there is a previous unconfirmed report in 8.4.4) and Square-tailed Kite _Lophoictinia isura_ should be regarded as tentative and require confirmation by the observers. Four species were recorded in the north-east but not within 8.4.4 during the survey.

The 132 species of bird recorded in the survey are listed in Table 8, and those species found breeding are indicated as is the preferred habitats of all species observed. Species that are not memebers of the typical bird communities associated with the predominant avian habitats of 8.4.4 are indicated - these are vagrant and/or rare.

Bird censusing was conducted in the vicinity of the permanent peg at seven sites. Details of habitats censused and times when censuses were conducted are given in Appendix P. Numerical data genberated by the eight sets of censuses conducted at the seven permanent sites surveyed by the consultants (Sites 1, 4, 6, 14, 23 and 28 and two sets conducted at Site 25) are presented in the appendix, as are density estimates. These estimates are given for the more common species recorded while censusing, and the figures are directly comparable between sites. In Appendix Q, a complete list of birds observed in the vicinity (approximately within 10 km of the permanent peg) is given for the nine permanent sites and some other sites. A qualitative assessment of the abundance of species encountered at the seven sites surveyed by the consultants is also made.

4.4.3 Reptiles

Species in the five families of lizards that occur in Australia and species of snakes from two families were collected. In addition the N.P.W.S. reported a specimen from a third family of snakes. One species of tortoise was recorded (Table 9).

It is indicated whether each species has been collected in the study area previously (Table 9) based on information in the card catalogue and register of the S.A. Museum and on published information. A one word description of the major habitat type in which each species was collected during the survey is also given.

Most species known from Association 8.4.4 were collected during the survey.

4.4.4 Frogs

Five species of frogs were collected in Association 8.4.4 (Table 10). Only one species was collected at more than one site, although two others were heard calling at a second site. In addition, _Litoria caerula_ was reported from Embarka Waterhole (Lawry O'toole, pers. comm.; see also Appendix O).

4.4.5 Fish

Only four species of fish were collected during the survey (Table 11). All were collected in water bodies that either contain water permanently, or for

Table 9 - Species of reptiles collected in Association 8.4.4 during the survey. Status symbols: W = well known from area; F = collected only a few times previously; N: not previously collected in Association 8.4.4
*Species collected or reported by the NPWS but not recorded by Consultants.

Family	Species	Status	Habitats
Typhlopidae	Typhlina bituberculata	W	Dune
Elapidae	Pseudechis australis	W	General
	*Pseudonaja modesta	W	Plain
	*Suta suta	W	Plain
*Boidae	*Aspidites ramsayi	W	Dune
Varanidae	Varanus gouldii flavirufus	W	General
Agamidae	Amphibolurus nuchalis	W	Plain
	A. pictus	W	General
	A. vitticeps	W	General
	Diporiphora winneckei	W	Dune
Pygopodidae	Lialis bourtonis	N	Plain
	*Delma tincta	F	?
Gekkonidae	Diplodactylus byrnei	F	Gibber
	D. ciliaris intermedius	N	Swale
	D. conspicallatus	N	Plain
	D. stenodactylus	W	Dune
	D. tessellatus	W	Plain
	Gehyra variegata complex	W	Arboreal
	Heteronotia binoei	W	General
	Lucasium damaeum	W	Dune
	Nephrurus levis	F	Dune
	Rhynchoedura ornata	W	Swale
Scincidae	Cryptoblepharus platycephalus	W	Arboreal
	Ctenotus brooksii	W	Dune / swale
	C. leae	W	Dune / Swale
	C. regius	W	Dune / swale
	C. schromburgkii	F	Dune / Swale
	C. species	-	Grassy Creekbed
	Egernia inornata	F	Swale
	Eremiascincus fasciolatus/richardsoni	W	Dune
	Lerista labialis	W	Dune / Swale
	Lerista xanthura	F	Dune
	Menetia greyi	W	Plain
	Morethia adelaidensis	W	Plain
	M. boulengeri	W	Plain
	Tiliqua multifasciata	N	Swale
Chelidae	Emydura sp.	W	Aquatic

Table 10 - Data concerning species of frogs collected during the survey of Association 8.4.4.

Species	Location	Number Collected
Ranidella deserticola	Chillimookoo Waterhole	1
Litoria latopalmata	Chillimookoo Waterhole	1
Litoria caerula	*Mundibarcooloo Waterhole Toolache Waterhole	2 one heard calling
Cyclorana platycephalus	4 km south of Lake Moorayepe Embarka Swamp	1 chorus
Neobatrachus centralis	4-5 km S of Lake Moorayepe #15 km west of Lake Etamunbanie	28 1

* Collected by the N.P.W.S. ; # collected outside the study area.

long periods of time following floods, or on floodplains adjacent to such sites. One species (Australian Smelt, Retropinna semoni) was collected at all sites. No fish were collected in Embarka Swamp or in the leading front of the floodwaters SSE of Lake Perigundi.

Table 11 - Fish species collected at each site.

Site	Species	Collection Method
Innamincka Causeway	Retropinna semoni (Australian Smelt) Plectroplites ambiguus (Yellowbelly)	Dipnet Found dead
Scrubby Camp W.H.	Retropinna semoni (Australian Smelt) Nematalosa erebei (Bony Bream) Hypseleotris sp. (Carp gudgeon)	Seine Gill net Seine
Tirrawarra W.H.	Retropinna semoni (Australian Smelt) Hypseleotris sp. (Carp gudgeon)	Seine Seine
Tirrawarra Swamp	Retropinna semoni (Australian Smelt) Nematalosa erebei (Bony Bream) Hypseleotris sp. (Carp gudgeon)	Dipnet Dipnet Dipnet
Chillimookoo W.H.	Retropinna semoni (Australian Smelt)	Seine

4.4.6 Aquatic Invertebrates

A preliminary (and incomplete) list of invertebrate groups recorded in the Cooper was prepared (Table 12). This has since been updated by the E. & W.S. (Appendix W). Some identifications of adult Trichoptera were also made by Alice Wells of the University of Adelaide (Table 13).

4.5 STATE OF THE COUNTRY AT THE TIME OF SAMPLING

4.5.1 General State of the Country

The southern parts of the study area in particular, in the vicinity of the Strzelecki Creek floodplain, had a depauperate vegetation in terms of species composition, condition and density of vegetation. The area appeared to be extremely dry and little ephemeral matter was present. Since the Strzelecki is an overflow channel of the Cooper Creek system, which receives water in only the

Table 12 - Preliminary identifications of some of the aquatic invertebrates collected along the Cooper Creek.

Site	Classification			
Chillimookoo Waterhole	Arthropoda			
		Crustacea	Notostraca	*Triops australiensis*
			Copepoda	
		Insecta	Hemiptera	Notonectidae
			Diptera	Chironomidae
			Coleoptera	Dytiscidae ?
Embarka Swamp	Arthropoda			
		Crustacea	Amphipoda	
		Insecta	Hemiptera	Notonectidae
			Diptera	Chironomidae
			Coleoptera	(larvae)
Tirriwarra Waterhole	Arthropoda			
		Crustacea	Decapoda	*Macrobrachium* sp.
				Paratya sp ?
		Insecta	Hemiptera	Notonectidae
			Diptera	Chironomidae
			Coleoptera	Dytiscidae ?
			Odonata	(larvae)
	Mollusca			
		Gastropoda		(2 species)
Scrubby Camp W.H.	Arthropoda			
		Crustacea	Decapoda	*Macrobrachium* sp.
		Insecta	Hemiptera	Notonectidae
	Porifera			*Heteromorotula* sp ?
Leading edge of flood-waters SSE of Lake Perigundi	Arthropoda			
		Crustacea	Copepoda	

Table 13 - Adult Trichoptera collected in light traps along the Cooper Creek

Site	Species
Chillimookoo Waterhole	*Hellyethira mallaeoforma* Wells
	Triplectides volda Mosely
	Oecetis penchana Mosely
Scrubby Camp W.H.	*Triplectides volda* Mosely
	Oecetis penchana Mosely
	Ecnomus sp.

heaviest floods (Section 2.5.2) or from local runoff, the condition of the land would seem to be typically parched.

Dunefields to the west of the Strzelecki Creek floodplain were in a similar state. They were sparsely vegetated in general - the odd dune carried a good cover of sandhill canegrass Zygochloa paradoxa (÷ 30% cover). Much of the inter-dune corridors was bare and very few interdunes carried groves of wattles Acacia spp. or other small trees.

Only the parts of the Cooper Creek floodplain, which received water as a result of the 1983 flows (Section 2.5.2), exhibited a dense ground cover of ephemerals. Most other vegetation affected by floodwaters had apparently benefited from this influence. The western part of the study area was typically parched, except for the immediate vicinity of the flooded areas.

Heavy rainfall in the north-east part of the study area in May 1983 (Cordillo Downs recorded 100-125 mm of rainfall at this time - Manager's Wife, pers. comm.) ensured the presence of water in waterholes, such as Mudcarnie Waterhole, which would normally have been dry. Rainfall also occurred during the second field trip,which encompassed sites in the northern half of the study area. A relatively dense cover of ephemerals was thus encountered in some areas and the perennial species exhibited apparent luxuriant growth as well. These conditions also brought out the less often encountered species of fauna, which would otherwise have occupied local or regional refugia.

It was fortunate to have found parts of the study area under the influence of later than normal flows of the Cooper Creek and unseasonal rainfall as well during the survey. In more typical years (Section 2.5.1) it would be expected that between September and mid-November (the time of the present survey) the entire study region would have been in a drying off state, so flora and fauna would have been less diverse.

4.5.2 Influences of Herbivores and Man

Apart from the obvious modifications to the land in relation to petroleum development, such as clearing and levelling and levee bank formation for access to Embarka Swamp (Tirrawarra Field) or the widespread shotlines, which will eventually (and for the most part) return to the landscape, the most obvious effects have been in relation to man-controlled and feral herbivores.

Records on data sheets (separate volume) and from other sources show that the area of Sites 7A, 8, 10, 11, 14, 16, 18, 20, 22, 23, 25, 28 and 30 were generally disturbed by moderate to heavy rabbit infestations in recent times. The dunefields near Site 7A were in a poor condition, while numerous warrens or evidence of digging and grazing was recorded on data sheets for Sites 8, 10, 11, 16, 18, 20, 22, some localities near Site 25 and in the area of Site 30. Sites 25 and 28 were obviously affected by stock also and several rabbits were encountered near Site 23.

The effects of rabbits is more obvious in or near dunefields, however the whole area surveyed, where visited, generally exhibited the effects of disturbance. This disturbance was either in the form of complete denudation due to foraging or trampling by herbivores (stock, horses, camels and rabbits) or vegetation was generally of an open nature with the shrub and tree layer more prominent, where a more prominent ground layer was expected. The amount of open space was often in the order of 70%, except where leaf litter was dense or where ephemeral growth had occurred due to rains or river flows.

It is difficult to assess the level of disturbance because there is no example (benchmark) in existence with which to compare existing vegatation that shows the country as it was prior to the land being taken up and stocked. Because of periods of overstocking in the past (Section 2.8), it is probable that no areas have escaped from the influence of herbivores. As reported by workers such as Ratcliffe (1936) and Jessup (1951), the country cannot sustain a regime of continuous grazing without at times being overstocked and hence, suffering the consequences.

Landsat image 104-079 shows some of the worst affected areas as a light yellow-brown hue with some obvious cross-fence contrast in the area of Innamincka.

5. DISCUSSION

5.1 INTRODUCTION

In this section, habitat results will initially be discussed separately from fauna results. An attempt will then be made to unify the assessment of the habitats of 8.4.4 in order to satisfy the perception of these by both the botanist and the zoologist.

5.2 INFORMATION RELATING TO THE ASSESSMENT OF HABITATS

5.2.1 Plant Species

5.2.1.1 Introduction

The following conclusion of Jessop (1982), resulting from the 1975 N.C.S.S.A. survey of the far North-East of South Australia, seems an opportune place to start this discussion on plant species of 8.4.4.

> "The collection of nearly 800 specimens and 277 species has made an important contribution to the known distribution of at least 11 species listed in Specht (Specht *et al.*, 1974) as rare or endangered and useful additions for other species.
>
> No evidence was found on the basis of the lists of species collected in various areas to suggest that any particular area particularly needs protection. However, there is a long list of about 100 species which may be rare or threatened and whose survival in the far north east has not been proved. The possibility that many of these species will not survive in the far north east without deliberate protection cannot be ruled out ".

Specht *et al.*'s (1974) treatise is now largely dated by more recent works, such as that of Leigh *et al.* (1981). Hence some of the conclusions made by Jessop (1982) are no longer valid. These have been further invalidated by more recent collections, in particular from the present survey (as detailed in the following subsections). However, some important information is worthy of note.

A total of 138 species of plant were recorded as rare or threatened in the far North-East by Specht *et al.* (1974; see also Jessop, 1982). And, although many of these are now not considered rare or threatened in an Australia wide context (Leigh *et al.*, 1981 - different criteria used and more information available), the number indicates the extent to which plant species have declined since European occupation of this area of South Australia.

It is probable that few species (if any) have escaped without any interference. Those species that are not consumed by grazing animals because of, for example, inherent poisons (e.g. caustic weed *Euphorbia drummondii*) are likely to be affected in other ways such as trampling of whole plants in the case of smaller species or trampling of root systems of larger species, resulting in death. Mulga *Acacia aneura* may have been eradicated over large areas of 8.4.4 because of ovegrazing and is now considered to be very rare here (Appendix R - p. R49).

68 families, 241 genera and 556 species, subspecies and varieties of plant have been recorded in the study area since the land was taken up last century (Appendix R). At least 50 of these are possibly misidentified so the true

number may be in the order of 500. An additional 125 species is included in the species list for the far North-East (Jessop, 1982), that have not been collected in 8.4.4. Hence the total number of species to have occupied the far North-East may be in the order of 625, contradicting Jessop (1982) who considered it unlikely that the total number would exceed 500.

Of the 556 species, subspecies and varieties, 39 have been determined as very common, 1 very common or uncommon, 53 common, 75 fairly common, 1 fairly common or uncommon, 117 uncommon (4 are possibly misidentified), 3 uncommon or rare, 97 rare (13 are possibly misidentified), 3 rare or very rare, 98 very rare (15 are possibly misidentified) and 66 very rare if not locally extinct (18 are possibly misidentified), while the status of three others remains uncertain (Appendix R). That 384 (69% of) species, subspecies and varieties of plant have a status of uncommon or less, alludes to the extent to which the flora of 8.4.4 alone has been affected since European occupation, let alone the affects on the far North-East. The change in status of species in 8.4.4 since European occupation is discussed in Chapter 6.

What has been stipulated by Jessop (1982) and has been confirmed by collections made this survey is that our knowledge of many species is still inadequate to make emphatic statements on conservation. Subsequent field trips increase this knowledge, often extending known ranges of species previously considered under threat. Comments made here are therefore subject to the nature of the available data, as in this survey, as with many others, coverage of collections was uneven being restricted to more accessible and interesting parts (Section 4.3.1).

Conclusions drawn must therefore be regarded as tentative!

5.2.1.2 Plant Collections This Survey

49 families, 145 genera and 279 species (including 10 distinct subspecies and 17 distinct varieties) of plant were collected in the study area during the present survey (Section 4.3.1; Appendix M).

Of the 49 families Chenopodiaceae (49 species), Asteraceae (37) and Poaceae (33) are most prominent in the collections. Papilionaceae (17) and Mimosaceae (10) are somewhat less prominent.

Atriplex (14), Sclerolaena (13), Acacia (10), Eragrostis (7), Cassia (6) and Sida (6) are the most prominent genera in collections. Only 9% of species belong to the six typically Australian genera of Wood (1959) i.e. Eucalyptus (3 species), Acacia (10), Grevillea (2), Goodenia (3), Hakea (2) and Eremophila (5), indicating that the floristic composition of 8.4.4 is the result of considerable admixing of Australasian floristic elements.

The 279 species of plant represents over half the total number recorded in the study area since the first collections were reported last century by Professor R. Tate (Tate 1889; Section 5.2.1.1; Appendix R). This number is comparable with the number recorded in the 1975 N.C.S.S.A. far North-East survey report (Jessop, 1982 - 277 species), and attests to the range and diversity of habitats in 8.4.4. Only the true gibber lands of the "Cordillo Surface" (see Ludbrook, 1980; also Chapt. 2) are lacking in the study area.

The status of each of the plant species, subspecies and varieties collected this survey has been determined as has the habitat preferences of each (Appendix M). And, as expected those species which are very common tend to be eurytopic (are found in many different habitats), while the less common ones tend to be stenotopic (are found in only one or a relatively small number of habitats), but this is by no means universal.

5.2.1.3 Rare of Threatened Australian Plants

Four species, Goodenia lobata, Frankenia cinerea, Eryngium supinum and channel millet Echinochloa inundata, which are considered threatened or rare by Leigh et al. (1981), were collected. In addition, a record of a fifth species listed by Leigh et al. (1981) i.e. Sclerolaena holtiana, which was recorded on a data sheet but not collected needs checking.

The collection of Goodenia lobata from the SE part of the study area extends significantly the known range of the species, which Leigh et al. (1981) consider to be vulnerable in Australia. That the species, which is restricted to South Australia, may also occur at other localities in 8.4.4 (Appendix R) is of considerable importance as confirmation of this will heighten its conservation status in South Australia and Australia. G. lobata is considered uncommon in 8.4.4 (Appendix R).

A single collection of Frankenia cinerea from the western part of the study area extends the known range of this species, which is considered rare in Australia by Leigh et al. (1981), for a considerable distance. The species, which is otherwise known from the southern and NE Gibson Desert parts of Western Australia and the Nullarbor Plain, S.A. (Barnsley, 1982), is uncommon in 8.4.4 (Appendix R).

The specimen of Eryngium supinum is apparently the first from the study area for the State Herbarium (see Jessop, 1982; also Appendix R), although Black (1943-57) considers the species to occur on flooded ground along Cooper Creek. E. supinum, which is suspected of being threatened or rare by Leigh et al. (1981), is considered uncommon in 8.4.4 (Appendix R) but this may be the only State record of the species and hence, the locality of collection needs adequate protection.

The re-discovery of channel millet Echinochloa inundata near Cordillo Downs Homestead and the discovery of a second population in the central part of the study area indicates that the species is more widespread than originally thought by Specht et al. (1974) and Jessop (1982), at least in South Australia. The species,which Leigh et al. (1981) suspect of being threatened or rare in Australia,is considered fairly common in 8.4.4 (Appendix R).

Because of the above collections, the risk codes of Goodenia lobata and Frankenia cinerea will be modified in the forthcoming revision of Leigh et al. (1981), as follows:

Goodenia lobata Ising 2V/S/22 → 3V/S/22, 25
Frankenia cinerea DC. 3R/W,S/8, 9, 23 → 3R/W,S/ 8, 9, 23, 25,

(Dr. J.D. Briggs, pers. comm.). In addition, it has been recommended to Dr. J.D. Briggs, C.S.I.R.O. Division of Plant Industry, that the risk codes of Eryngium supinum and channel millet Echinochloa inundata be modified in the forthcoming revision of Leigh et al. (1981), as follows:

Eryngium supinum J. Black 3K/S,Q/25, 29, 36 → 3E/S,Q/25, 29, 36
Echinochloa inundata Michael & Vickery
3K/S,Q,N/25, 46, 48, 49 → 3V/S,Q,N/25, [1]36, 46, 48, 49,

subject to information available on the species in South Australia (Appendix R). However, it is noted that other information which may be held by the C.S.I.R.O. Division of Plant Industry regarding the distribution and status of Eryngium supinum and channel millet Echinochloa inundata, may not support these recommendations.

[1]Reference to this species found in a publication referring to region 36 as depicted in Leigh et al. (1981) i.e. Dawson and Boyland (1974).

5.2.1.4 Records of Significance for Other Reasons

38 native plant species were recorded in the study area for the first time during the present survey i.e. Amaranthus grandiflorus, Rhyncharrhena linearis, Ixiolaena brevicompta, bush minuria Minuria cunninghamii, Arabidella procumbens (probably), Atriplex eardleyae, A. lobativalvis, crested goosefoot Chenopodium cristatum, Dissocarpus biflorus var. biflorus, samphire Halosarcia indica ssp. leiostachya, Maireana microcarpa, soda-bush Neobassia proceriflora, Rhagodia gaudichaudiana, red burr Sclerolaena calcarata, S. costata, S. muricata var. muricata, S. parallelicuspis, S. ventricosa, Cyperus cunninghamii, tall flat-sedge C. exaltatus, Euphorbia australis, E. parvicaruncula, Frankenia angipetala, F. cinerea, F. uncinata, Goodenia lobata, Rhynchosia minima, curly mitchell grass Astrebla lappacea, brown-beetle grass Diplachne fusca, jointed nine-awn Enneapogon cylindricus, naked woollybutt Eragrostis eriopoda, handsome love-grass E. speciosa, reverse panic grass Paractaenum novae-hollandiae, round-leaved parakeelya Calandrinia remota, Asperula gemella, Peplidium sp. D. (Fl. C. Aust. p. 331), Pimelea simplex ssp. continua and perennial clatrop Tribulus occidentalis. Frankenia angustipetala, which was listed as endangered in S.A. in 1977 (Jessop, 1977), is uncommon in 8.4.4 (Appendix R).

In addition, although variable groundsel Senecio lautus has been recorded in 8.4.4 previously (Appendix R), the two subspecies, S. lautus ssp. dissectifolius and S. lautus ssp. maritimus, are also recorded for the first time. The collections which confirm the presence of S. lautus ssp. maritimus in the NE are of some interest as it was initially thought to occur only in coastal areas (Mr. D.J.E. Whibley, pers. comm.). Two further species i.e. Sclerolaena holtiana and desert broombush Templetonia egena, which may be new to 8.4.4, remain in doubt due to problems of identification.

A further five species have not been collected in the study area for over 95 years i.e. Calotis ancyrocarpa, desert sneezeweed Centipeda thespidioides, Atriplex lindleyi, Evolvulus alsinoides and Goodenia glauca. They were last reported by Tate (1889).

A number of specimens that were collected show some affinity to presently described species, but also some significant differences and hence require taxonomic examination. They are so named i.e. Blennodia sp. aff. canescens, Atriplex sp. aff. eardleyae, Atriplex sp. aff. holocarpa, Sclerolaena sp. aff. tatei, Cyperus sp. aff. cunninghamii (Fl. C. Aust. p. 508 - a new record for the NE of South Australia), Phyllanthus sp. aff. lacunarius and Goodenia sp. aff. havilandii. All may be new to 8.4.4.

Of the above collections, that of Pimelea simplex ssp. continua is worthy of further discussion. Considered endangered by Specht et al. (1974), it was collected to the west of the study area in 1975 - a collection which was considered significant as the species was,..., " possibly not previously known from further north than Leigh Creek " (Jessop, 1982). P. simplex ssp. continua was encountered at two fairly widely spaced localities in the northern parts of the study area in this survey. It appeared to be associated with gibber areas and is uncommon in 8.4.4 (Appendix R).

All other records included here are in some way significant, particularly that of samphire Halosarcia indica ssp. leiostachya. It seems peculiar that this species, which is common in 8.4.4 (Appendix R), has not been collected in this area previously. Are saline areas of so little interest or do samphires look so much the same that they do not warrant collection? If nothing else, the lack of prior collections of H. indica ssp. leiostachya in 8.4.4, attests to the unevenness of collections generally. And also, the degree of collector bias towards more interesting specimens. Furthermore, it indicates the fragmentary nature of our present knowledge on the distribution of some plant species.

5.2.1.5 Other Species

5.2.1.5.1 Terrestrial Species

An number of collections in the far North-East in 1975 were considered significant by Jessop (1982), including those of the following species: beefwood Grevillea striata, mistletoe Diplatia grandibractea, Frankenia pseudo-flabellata and Pluchea tetranthera. All were collected during the present survey and are discussed below in the light of present knowledge.

Of beefwood Grevillea striata, Boomsma (1981) considered that it was rare in the NE, but Boomsma and Lewis (1980) considered it to be frequently distributed. Collected sporadically in 8.4.4 since it was first reported from the Cooper Creek last century ([1]Tate, 1889), the 1975 collection was apparently the first for the State Herbarium and so was considered significant (Jessop, 1982). During the present survey G. striata was frequently observed. It was found to be locally common in some parts of 8.4.4, where it formed a prominent part of several plant communities (Appendix R; see also Habitat 44, p.64 and Habitat 100, p.86). The species, which has a distribution that encompasses W.A., N.T., S.A., Qld and N.S.W. (Boomsma, 1981; Jessop, 1981), was only considered to occupy the NW of South Australia in Central Australia in 1981 (Jessop, 1981) and is now only considered to occupy the NE of South Australia (Jessop, 1983) as part of its wider ditribution. It is common in 8.4.4 (Appendix R).

Mistletoe Diplatia grandibractea occurs in northern South Australia (Jessop, 1981, 1983). Also reported from the Cooper Creek last century ([1]Tate, 1889), the 1975 collections in the Clifton Hills and Coongie areas were considered significant as the species was not otherwise known from the far North-East (based on collections held by the State Herbarium) apart from a 1960 collection from the Clifton Hills area (Jessop, 1982). The species is common in 8.4.4, appears to be restricted to the southern half of the study area and to be host specific to coolibah Eucalyptus microtheca in this area (Appendix R). Its wider distribution includes several other Australian States (Jessop, 1981).

Frankenia pseudo-flabellata, which was considered endangered in 1974 by Specht et al. (1974), was collected in the Clifton Hills and Coongie areas in 1975 - records which were considered significant by Jessop (1982). Its collection during the present survey confirms its presence in the Coongie area (Lake Apachirie), where it was uncommon. It is uncommon overall in 8.4.4 (Appendix R).

Pluchea tetranthera, also considered endangered by Specht et al. 1974), was collected in the Clifton Hills and Coongie areas in 1975 (records which were considered significant) and the Innamincka area in 1959 (Jessop, 1982). It was collected at two widely spaced localities on the eastern side of the study area during this survey and is considered uncommon in 8.4.4 (Appendix R).

No endangered eucalypts occur in 8.4.4 (Pryor, 1981). The three species which occur here, namely: northern river red gum Eucalyptus camaldulensis var. obtusa, coolibah E. microtheca and bloodwood E. terminalis, are all within their ranges of distribution as mapped by Chippendale and Wolf (1981).

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[1]The authors are curious about the present location(s) of many of the early collections reported by workers such as Tate (1889), which are no longer included in information bases with which the distribution and status of species is determined. A considerable portion are known to be included in the collections of the State Herbarium, but the fate of others e.g. Grevillea striata and Diplatia grandibractea, which were reported from the Cooper Creek by Tate (1889), is uncertain.

In the study area E. camaldulensis var. obtusa is common on the edges of deeper waterholes and lakes. Its distribution is thought to be restricted by the furthest limits of average (annual) flows of the Cooper Creek (Section 2.5.2.6; Appendix R).

E. microtheca is very common and widespread in 8.4.4 (Appendix R), although Boomsma (1981) considers it to be an infrequently distributed species. Coolibah tends to occur further back from waterhole edges and lake margins than northern river red gum, where the latter species occurs, and its distribution indicates that this species is much more tolerant to dessication. It is very common on floodplains and channel edges in 8.4.4 and is also found in the vicinity of saline depressions and on the margins of salt lakes.

E. terminalis is on the southern limits of its distribution in the north-east corner of the study area - it is generally distributed through northern Australia (Chippendale and Wolf, 1981). Bloodwood tends to favour more fertile locations and is considered to be infrequently distributed in South Australia (Boomsma, 1981). This species is fairly common in 8.4.4, commonly bordering channels in the north-east part of the study area (Appendix R).

Many other species are of interest in some way and a proportion are discussed below. Details of all species encountered in 8.4.4 during the course of European occupation, including aquatics/semi-aquatics and naturalised species which are discussed in the following subsections, are included in Appendix R.

Golden billybuttons Craspedia chrysantha has been reported from study area over the years as an apparently common species (e.g. Black, 1917). It is now considered uncommon in 8.4.4 (Appendix R). The very common billybuttons Calocephalus platycephalus is sometimes misidentified as this species and this is one possible reason for past misinterpretations of its status.

Twice collected this survey, Myriocephalus rudallii is considered uncommon in 8.4.4 (Appendix R). It does not appear to have ever been too common and now appears to be locally distributed in the NE part of the study area.

Lepidium muelleriferdinandii is a species of arid Australia and its occurrence in the study area is within its range of distribution as mapped by Hewson (1982b). It is uncommon in 8.4.4 and has only been collected here once before (Appendix R).

Silver cassia Cassia phyllodinea is fairly common in 8.4.4, being confined to the northern half of the study area. Often associated with gibber it is part of a mixed open shrubland community on sand plains in the NE part of the study area (Appendix R; Habitat 40, p.63).

Bean tree Lysiphyllum gilvum, which is very common in the central-eastern Cooper Creek floodplain and locally common along the Strzelecki Creek, is thought to have entered the study area via floodwaters of the Cooper Creek. White (1917b) gives an account of its possible means of entry.

Native orange Capparis mitchellii has been collected a number of times over the years, but was collected only once during the present survey of 8.4.4 so is considered uncommon (Appendix R). Considered to be infrequently distributed by Boomsma (1981), its locality of collection (this survey) is at the southern limits of its range as mapped by Hewson (1982a). C. mitchellii may be under threat in 8.4.4, because its habit and appearance would have made it more liable to collection during this survey if it were more prevalent.

Cotton bush Maireana aphylla, which is widespread, patchy and common in 8.4.4

has only been collected here a few times previously and only in recent times (Appendix R). Considered to increase in abundance with disturbance of saltbush vegetation (Ratcliffe, 1936), communities formed by this species are considered inadequately conserved in South Australia (Davies, 1982). M. aphylla dominates a community which is a component of Habitat 39 (p. 62).

Ulcardo melon Cucumis melo ssp. agrestis is a species of tropical and subtropical areas and is at the southern limits of Australia distribution (see map in Telford, 1982) in 8.4.4. Uncommon in the study area it was found at two widely spaced localities during the present survey (Appendix R).

Frankenia serpyllifolia is one of the more widespread species of this genus in arid Australia (see distribution map in Barnsley, 1982). In 8.4.4, where it has been collected a few times since first collected in 1916, it is presently considered to be uncommon (Appendix R).

Teucrium racemosum var. tripartitum, the uncommon variety of grey germander T. racemosum in 8.4.4, has been collected here only once previously, in 1916. Its locality of collection this survey was near Scrubby Camp Waterhole, while the previous collection was along Strzelecki Creek (Appendix R). This variety appears not to have ever been common in the study area.

The two mistletoes Amyema preissii and Lysiana exocarpi ssp. exocarpi, which are considered common and very common in 8.4.4, respectively (Appendix R), are both within their ranges of distribution as mapped by Barlow (1984). Both species occur on a variety of hosts with the more interesting examples being Cassia phyllodinea as host to Amyema preissii and Muehlenbeckia cunninghamii as host to Lysiana exocarpi ssp. exocarpi (see Appendix R).

Hibiscus krichauffianus, a fairly common species in 8.4.4, has been encountered a number of times previously mostly on the eastern side of the study area (Appendix R). Its close velvety tomentum (Black, 1943-57; Jessop, 1981) is likely a drought adaptation.

Emu apple Owenia acidula was first collected in 8.4.4 from sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982) and has been collected in the study area a few times since. It has been considered rare (Specht et al., 1974), but in 8.4.4, at least, where it often occurs as groves of trees, it is common (Appendix R).

Acacia dictyophleba is one of the more interesting wattles in the study area due to the viscid nature of it leaves and its relative rarity. Restricted to the northern part of the study area, it is uncommon here (Appendix R) and its occurrence in 8.4.4 is in the SE part of its range as mapped by Maslin and Hopper (1982)

Sweet acacia A. farnesiana is another species of interest because of its leaves and relative rarity. The species has characteristic bipinnate leaves and its occurrence in 8.4.4 is as a component of one of three scattered populations in the North-East of South Australia (see Whibley, 1980). It is uncommon in 8.4.4 (Appendix R).

Wakimba Eremophila macdonnellii, which is fairly common in the study area, is one of the smaller members of this genus in arid Australia (Black, 1917, 1943-57; Appendix R). The species forms the dominant component of open shrubland community in the uncoordinated drainage dunefields of 8.4.4 (Habitat 37, p.61).

Crotalaria smithiana appears not to have ever been too common in 8.4.4. It is now fairly common in the north-east part of the study area, but its past distribution included Strzelecki Creek (Appendix R).

Yellow threeawn Aristida anthoxanoides, which was collected twice this survey, is considered fairly common in 8.4.4 and has been collected here only once previously, in 1975 (Appendix R). That it is one of the more palatable species of Aristida (Black, 1943-57), may account for its lack of relative abundance in comparison to other species of the genus in 8.4.4.

Pepper grass Panicum whitei has apparently declined in abundance in the study area since being first collected here in 1916 - collections from which it was formally described (Black, 1917), probably because ..." stock seem to relish it "... (Black, 1917). It is considered uncommon in 8.4.4 (Appendix R).

Ray grass Sporobolus actinocladus, a species of gibber plains, is uncommon in 8.4.4 (Appendix R). It was collected in similar habitat in 1924 (Cleland et al., 1925), the only other prior collection of this species in the study area.

Purple heads Triraphis mollis, first collected in the study area in 1916 (Black, 1917) and now considered common here (Appendix R), is sometimes confused with yellow threeawn Aristida anthoxanoides when the latter has shed its seed.

Hakea eyreana is considered frequent to rare in the extreme NE of South Australia and to become rare to absent further south and west (Boomsma, 1981). It is fairly common in the study area where it was first collected in 1975 and in one part of 8.4.4 it forms a component of a mixed Acacia spp. - Hakea spp. community (Appendix R; Habitat 41, p.63).

Needle-bush Hakea leucoptera is considered rare by Boomsma (1981), but this may be due to the common occurrence of this species as solitary low trees, rather than a true indication of its status. The species is common and reasonably widespread in 8.4.4, but may no longer occur in some areas from which it has been previously reported e.g. Strzelecki Creek,possibly due to disturbance associated with overgrazing (Appendix R).

Dry moss Dentella pulvinata var. pulvinata, which as the common name suggests, exhibits a moss-like appearance, appears to be widespread in 8.4.4. This is reflected in past collections and those made during the present survey. It has been determined, based on collections made this survey, to be fairly common in the study area (Appendix R), however, this may be an understatement due to collector bias as not all collectors will take moss (or moss-like) specimens.

Plumbush Santalum lanceolatum exhibits a widespread disjunct distribution, which encompasses tropical and eastern Australia and a scattered occurrence in the central deserts (see details and map, Hewson and George, 1984). It is common in 8.4.4 and is often solitary, but sometimes occurs as groups of pendulous trees to 3.0 m (Appendix R).

The two closely related species of bluerod Morgania floribunda and M. glabra, are included with the genus Stemodia in Fl. C. Aust. p.328 (Jessop, 1981), as distinction of Morgania ..." at the generic level is untenable " ... according to Barker (1982). Both species are fairly common in 8.4.4 and are located in somewhat different habitats, M. floribunda preferring dunefields (in 3 out of 4 cases), while M. glabra appears to prefer clay soils (Appendix R).

Spiked riceflower Pimelea trichostachya, which is uncommon in 8.4.4, has only been collected in the study area twice previously (Appendix R). It appears to have always been uncommon.

Zygophyllum iodocarpum, which was once considered to be ... " common over the whole country " ... in the area of 8.4.4 (Black, 1917), is now uncommon here (Appendix R).

5.2.1.5.2 Aquatics and Semi-aquatics

A number of aquatic or semi-aquatic species of plant occur in the study area. Free floating plants of Azolla spp. and emergent plants of Aeschynomene indica, Cyperus spp., Eleocharis spp., Marsilea drummondii and Polygonum spp. are listed by Mitchell (1978) as aquatic weeds of Australian inland waters. Some of these species may form local infestations in the more permanent waterholes and lakes in 8.4.4, however, due to the erratic nature of more significant flows along, for example, the Cooper Creek (Section 2.5.2.6), it is unlikely that major flow obstructions will occur. And, in the event of such occurrence(s) effects will be localised and of short duration, as the drying up of water bodies will generally result in death of offending species.

Pacific azolla Azolla filiculoides is the only species of free floating plant to be found in this survey of 8.4.4 and has been collected here previously in 1975 (Jessop, 1982). It is considered common in 8.4.4 (Appendix R). The occurrences of A. filiculoides are generally associated with regularly inundated swamps and more permanent waterholes and lakes (Appendix R). It is common in swamps and less-so in other wetlands.

Budda pea Aeschynomene indica, which grows in various situations (Jessop, 1981), including its role as an emergent plant (Mitchell, 1978), has only been collected in or near water in Association 8.4.4. The first and only other collections of this species in the study area, apart from those made this survey, were in watercourses south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Its collections this survey, from which its status has been determined as uncommon, were from adjacent to wetlands in the central part of the study area (Appendix R).

Cyperus spp. collected in this survey of 8.4.4 include C. cunninghamii, C. sp. aff. cunninghamii and tall flat-sedge C. exaltatus, which are recorded for the first time this survey (Section 5.2.1.4), and spiny flat-sedge C. gymnocaulos. The first three species are uncommon in the study area, while spiny flat-sedge is fairly common (Appendix R). Spiny flat-sedge was found to be locally common on floodouts, on lake margins and channel edges in some parts of Association 8.4.4 and upon wetting by floodwaters of the Cooper Creek a rapid response in the form of fresh green growing points was evident within a day or so.

Two species of spike-rush Eleocharis spp. were collected i.e. common spike-rush E. acuta and pale spike-rush E. pallens. The former species appears to be restricted to the central part of the study area and is uncommon, while pale spike-rush E. pallens is fairly common and more widespread, although it may no longer occur along Strzelecki Creek (Appendix R).

Common nardoo Marsilea drummondii was encountered frequently in this survey of 8.4.4 and so is considered very common here. M. drummondii appears to be most common in swamps, but has declined in abundance during the course of European occupation. The species is now reduced to small locally common patches and may no longer occur along Strzelecki Creek (Appendix R).

Polygonum plebeium also appears to have declined in abundance in 8.4.4, since it was first collected here last century (see Tate, 1889). It now appears to be restricted to the NE part of the study area, where it is fairly common (Appendix R). The collections this survey were in characteristic habitat for the species in Central Australia, which is damp places (Jessop, 1981).

A number of other native aquatic and semi-aquatic species have been collected in Association 8.4.4 in the past and these are included in Appendix R.

5.2.1.6 Naturalised Species

Although disturbance in the study area has, particularly in the better watered regions, been moderate to heavy due to the influence of herbivores and man (Section 4.5; see also Fig. 17, Chapt. 6), only 8 (3%) of the 279 species recorded in this survey are naturalised (Appendix M). Four are recorded for the first time this survey i.e. rough (or prickly) sow thistle Sonchus asper, Heliotropium europaeum, turnip-weed Brassica tournefortii and ?burr medic Medicago polymorpha, and are thought to have been introduced to the study area on vehicles used for petroleum exploration and extraction.

Buckley (1982a) considers the ..." introduction and spread of weeds " ... to be one of the secondary disturbances associated with ... " the extensive track cutting required for geophysical survey and drilling programmes " (Buckley, 1982c); ... " removal of native vegetation and increased sand mobility " ... are the primary disturbances (Buckley, 1982c). Within 8.4.4, naturalised species generally exhibit localised distributions in areas of such disturbance (Appendix R).

The practise of not cleaning exploration vehicles and drilling rigs before entering and leaving field localities is considered to be one of the major reasons for the spread of naturalised species in Association 8.4.4. And, such lack of foresight encourages weed contamination of formerly weed-free areas.

So far the spread of naturalised species has been minimal and there presence already should not deter from the tightening of controls in the future. Buckley (1982c) says that ..." the main requirement for 'environmental hygiene' in uninhabited arid dunefields is to monitor and eradicate weeds, as far as this is possible," ... It would be better, in the first instance, to discourage the practise of giving them a 'free-ride' into these 'uninhabited arid dunefields' by taking adequate preventative measures!

According to Buckley (1982c), the focus of raturalised plant species will tend to be floodplains as these may provide sufficient moisture in times of drought, while naturalised species in dunefields will generally not survive a drought. It is in the nature of naturalised species, at least a large proportion, however, to produce abundant seed and hence, in the long-term, their survival, even in dunefields, is assured i.e. once they have become established.

One of the naturalised species collected in this survey of 8.4.4 was water primrose Ludwigia peploides ssp. montevidensis. This species is aquatic (emergent) and has in some parts of Australia been considered a freshwater weed (Mitchell, 1978). It is not presently considered a problem in the Association 8.4.4.

5.2.1.7 Summary in Relation to Plant Species

Based on floristic composition 8.4.4 can be considered a typically arid area, which is modified to a large degree by the presence and exotic nature of the Cooper Creek. In addition, what is seen today is a legacy of over 100 years of European occupation during which time significant overgrazing has taken place (Section 2.7 and 2.8). It should be apparent therefore that Association 8.4.4 is floristically disturbed. The state of this disturbance is between disturbed natural and degraded natural as defined by Laut et al. (1977).

5.2.2 Plant Communities

5.2.2.1 Introduction

According to Crocker and Wood (1947), the distribution of plant species and communities in South Australia is principally due to edaphic factors with vegetation associations (final species aggregates) apparently relatively young and individual floristic elements characteristically without identical tolerances. Within Environmental Association 8.4.4, however, at least in the vicinity of the Cooper Creek, water is the major determinant of plant species incidence and hence, community composition. Edaphic factors are important but are more important, it appears, along with aspect in the dunefields. Dessication is generally applicable in determining patterns of species and communites (Crocker and Wood, 1947), but is more important in relation to the wetland habitats in the study area than the dryland (predominantly dunefield) habitats.

The majority of previous studies of the vegetation of the far North-East have generally defined only a few (up to 12) broad-scale types of vegetation (e.g. Specht, 1972; South Australian Pastoral Board, 1973; Lewis, 1982). More recent and more detailed studies have defined in greater detail the vegetation types of some parts of the far North-East which relate directly to parts of the Cooper Creek Environmental Association 8.4.4 (Environmental Research and Planning Group, 1980; Social and Ecological Assessment Pty. Ltd., 1982). One of these has resulted in a detailed vegetation map of delineated communities, but relates to a small area only (Social and Ecological Assessment Pty. Ltd., 1982). All studies provide useful and more-or-less detailed accounts of plant communities within the vicinity of 8.4.4 and are therefore necessary background to the present discussion.

Although delineation of broad-scale vegetation types provides a useful summary of vegetations in 8.4.4, they tend to mask the variety of communities within the study area and hence, provide an extremely simplistic overview. Some accounts even tend towards being erroneous, however, this is sometimes a product of attempts at broad generalisations regarding vegetation composition. More detailed treatments such as is accomplished here, are therefore useful in depicting the complexity of plant communities and also in allaying any misconceptions that may have arisen from prior studies.

5.2.2.2 The Plant Communities of Association 8.4.4

With over 500 plant species present in Association 8.4.4 and an array of habitats, which in relation to the far North-East excludes only the true gibber lands of the Cordillo Surface (Section 4.3.7 and 5.2.1), the potential number of plant communities as aggregates of plant species is limitless. The aggregation of plant species into recognisable groupings called communities or associations is however, influenced by many factors. Broadly speaking these factors include those of a biotic nature inherent in individual species, such as degree of habitat specificity or environmental tolerance, fecundity and ability to exclude or outcompete other species. In addition, environmental factors such as, soil nutrient status, salinity and moisture availability will also play a part in determining which species will be able to survive and attain dominance. Consequently, the true number of plant species aggregates or communities is constrained by both biotic and environmental factors.

Within the context of 8.4.4, some 88 different plant communities or plant species aggregates were delineated during the present study on the basis of vegetation survey (Table 14). Recognition of plant communities though depends upon individual perceptions of the floritic composition and patterning of the land surface and so, this number could therefore be reduced or expanded to accommodate personal perceptive differences. Delineation of plant communities, except where fixed boundaries are obvious, always presents problems. The intergrading of one particular group of plant species into another makes necessary the use of arbitrary boundaries. And, if an aggregation of species is relatively small, it may be missed(by accident or design)by one plant geographer, while

Table 14 - Plant communities identified within the Cooper Creek Environmental Association 8.4.4, the habitats within which they occur and the structural position of plant communities within stipulated habitats. Habitats are according to Section 4.3.7 and structural levels are as follows: o - overstorey; u - understorey; gc - ground cover; all - predominant cover.

Plant Community	Habitats and Levels
Eucalyptus microtheca + Lysiphyllum gilvum + E. camaldulensis var. obtusa tall to low fringing woodland	44, o.
Eucalyptus microtheca - Acacia salicina - A. stenophylla - Eremophila bignoniiflora low fringing woodland	46, o; 47, o.
Eucalyptus microtheca - A. stenophylla low fringing woodland	45, all;48, all.
E. microtheca + A. stenophylla low fringing woodland	49, all; + 53, o.
E. microtheca - L. gilvum - A. stenophylla low open woodland	78, o.
E. terminalis - E. microtheca - A. cyperophylla + E. bignoniiflora + Grevillea striata low open woodland	84, o.
E. terminalis - E. microtheca - A. cyperophylla low open woodland	85, o.
A. cyperophylla - E. microtheca - Hakea eyreana low open fringing woodland	86, all.
A. victoriae - G. striata + H. eyreana low open woodland	100, o.
Atalaya hemiglauca - Acacia spp. low open woodland	17, o.
H. eyreana + E. terminalis low open woodland	35, o.
E. microtheca low open woodland	50, o; ?55, o; 90, o; 99, o.
A. ligulata low open woodland	10, o.
A. victoriae low open woodland	42, o.
E. microtheca low, very open woodland	51, o; ÷59, o; ÷70, o;÷72, o.
E. microtheca + E. bignoniiflora low, very open woodland	÷79, o; 80, o.
Areas of Muehlenbeckia cunninghamii tall shrubland	57, o.
M. cunninghamii tall to low shrubland	52, o; 53, o.
M. cunninghamii + Atriplex nummularia tall to low shrubland	44, u.
Acacia spp. tall open shrubland	5, o.
A. victoriae - A. farnesiana + Santalum lanceolatum tall open shrubland	87, o.
M. cunninghamii tall open shrubland	54, u; 55, u.
A. victoriae tall open shrubland	96, o.
Eremophila macdonnellii tall open shrubland	37, o.
Acacia spp. - Cassia spp. tall to low open shrubland	2, o.
Areas of M. cunninghamii tall, very open shrubland	56, o.

Acacia spp. - Cassia spp. - Eremophila spp. mixed shrubland	8, o; 33, o.
Acacia spp. - Cassia spp. mixed shrubland	39, o.
Acacia spp. - Hakea spp. mixed shrubland	41, o.
Enchylaena tomentosa - A. nummularia - M. cunninghamii - Chenopodium nitrariaceum - E. bignoniiflora mixed shrubland	78, u.
Cassia spp. - Acacia spp. mixed open shrubland	40, o.
A. nummularia - Atriplex leptocarpa - M. cunninghamii low shrubland	96, u.
E. tomentosa - M. cunninghamii + C. nitrariaceum low shrubland	50, u.
Atriplex spp. - Sclerolaena spp. chenopod low shrubland	80, gc.
Cassia phyllodinea - C. oligophylla low shrubland	88, o.
M. cunninghamii low shrubland	46, u; 47, u.
Maireana aphylla low shrubland	39, u.
M. cunninghamii low shrubland to low open shrubland	58, o.
A. nummularia low shrubland to low open shrubland	62, o.
E. macdonnellii - Zygochloa paradoxa - M. aphylla - E. tomentosa + Pimelea trichostachya mixed low open shrubland	41, u.
M. cunninghamii - C. auricomum - C. nitrariaceum - S. lanceolatum - A. nummularia - M. aphylla - E. tomentosa low open shrubland	99, u.
M. aphylla - C. auricomum - A. nummularia - C. helmsii - C. phyllodinea low open shrubland	94, all.
A. victoriae (low form = ssp. arida) - C. nemophila var. nemophila - C. phyllodinea - E. tomentosa - M. aphylla low open shrubland	100, u.
Hibiscus krichauffianus - Swainsona rigida - Sida ammophila - Scaevola ovalifolia - Lechenaultia divaricata - E. tomentosa - Ptilotus polystachus var. polystachus low open shrubland	17. u.
Acacia spp. low open shrubland	13, o.
M. cunninghamii - C. auricomum low open shrubland	79, u.
C. oligophylla - C. phyllodinea low open shrubland	84, u.
A. ligulata - Salsola kali ephemeral low open shrubland	18, o; 19, o.
M. cunninghamii low open shrubland	59, gc.
A. nummularia low open shrubland	22, all; 63, o; 64, o; 80, u.
C. nitrariaceum low open shrubland	66, o.
Halosarcia indica ssp. leiostachya low open chenopod shrubland	68, ÷all.
A. ligulata low open shrubland	21, o; 24, o.
A. victoriae low open shrubland	61, O; 97, all; 98, all.

Acacia spp. - *Cassia spp.* low, very open shrubland	34, o.
Atriplex spp. - *Sclerolaena spp.* low, very open chenopod shrubland	69, all; 70, all.
M. cunninghamii low, very open shrubland	60, o.
Cassia spp. low, very open shrubland	37, u.
H. indica ssp. leiostachya low, very open shrubland	51, gc; 61, u; 67, all; 95, all.
Cynanchum floribundum low, very open shrubland	20, all.
Zygochloa paradoxa hummock grassland	1, all; 4, all; 7, all; 9, all; 12, all; 16, all; 32, all.
Triodia basedowii hummock grassland	2, u; 8, gc; ±13, gc; 17, gc; 33, gc; 34, gc; 40, gc.
Z. paradoxa very open hummock grassland	42, u.
Areas of *Z. paradoxa* very open hummock grassland	26, all.
Astrebla pectinata open tussock grassland	92, all; 101, all; 102, all.
Eragrostis australasica low tussock grassland	38, all; 81, all.
Leptochloa digitata low tussock grassland	38 all - see footnote, p. 62.
Eragrostis australasica low open tussock grassland	65, all.
Dense ephemeral herbland/forbland/grassland	84, gc; 85, gc.
Ephemeral forbland/grassland/herbland	41, gc.
Ephemeral forbland/grassland	39, gc; 88, gc.
Leptochloa digitata - *Psoralea australasica* - *Lavatera plebeia* ± *Cassia oligophylla* ± *Enchylaena tomentosa* tall closed grassland/herbland	84, un.
Atriplex spp. - *Sclerolaena spp.* ephemeral forbland	64, gc.
Ephemeral forbland (chenopod)	3, all; 73, all; 79, gc; 89, all.
Ephemeral forbland	5, gc; 6, all; 14, ÷ all; 23, all; 27, all; 31, all; 36, all; 37, gc; 44, gc; 54, gc; 55, gc; ±56, gc; 57, gc; 66, gc; 71, gc; 72, gc; 73, o; 90, gc.
Low ephemeral forbland	10, gc; 46, gc; 47, gc.
Low (< 30 cm) open ephemeral forbland	43, all; 82, all; 83, all.
Very low (< 10 cm) ephemeral forbland	93, all.
Ephemeral forbland/herbland	28, all; 29, all; 99, gc; 100, gc.

Low ephemeral forbland/herbland	± 11, all; 74, all.
Low (< 30 cm) ephemeral forbland/herbland (chenopod)	62, gc; 63, gc.
Very open ephemeral forbland/herbland	2, gc; 21, gc; 24, gc; 61, gc; 73, gc.
Very sparse ephemeral forbland/herbland	50, gc; 78, gc; 87, gc.
Closed ephemeral herbland	76, A, all.
Ephemeral herbland	18, gc; 19, gc; 25, all; 42, gc; 45, gc; 52, gc; 53, gc; 75, all; 77, all.
Open ephemeral herbland	35, gc.
Haloragis aspera - Nicotiana velutina - Phyllanthus lacunarius very open herbland	96, gc.
Very open ephemeral herbland	58, gc; 60, gc; 76, B, all.

another more exacting worker may recognise and detail even small (and possibly insignificant)communities. In the context of this report, the number of plant communites in Table 14 is considered the necessary minimum to enable recognition of the complexity of plant patterning within the Cooper Creek Environmental Association 8.4.4.

It is a common practise in identifying plant communities to identify them in terms of strict structural groupings i.e. woodlands, shrublands, grasslands, forblands and herblands. In this report though, some communities are classified according to more that one structural grouping e.g. low ephemeral forbland/herbland. The purpose here is to signify that the community in question has approximately equal proportions of forbs and herb or forbs and grasses or herbs and grasses or forbs and herbs and grasses. And, in so doing, it will be more easy to correlate faunal usage with these vegetations e.g. usage of grassland components by granivorous birds, when attempting to define a range of habitats which accommodate both the floristic and faunal elements of the biota.

5.2.3 Environmental Subassociations

5.2.3.1 Introduction

The Cooper Creek Environmental Association 8.4.4 is one of the most heterogeneous Environmental Associations in the Lake Eyre Environmental Region 8.4. Delineation of the seven Environmental Subassociations (Section 4.3.2) has proven to be a very satisfactory way of attempting to simplify this inherent complexity. These broad subdivisions have also formed a useful basis from which to select representative survey sites.

5.2.3.2 Environmental Subassociations and Survey Sites

The Cooper Creek Floodplain Environmental Subassociation 8.4.4.1 was the most extensively surveyed regions of the study area. Seventeen sites were studied in relative detail (often with several sub-sites per site), four of which were established as permanent monitoring points for the Association (and Subassociation - Fig. 7; Appendix N). Of the permanent sites (Sites 14, 15, 23 and 25), Sites 14 and 25 are on the main channel of the Cooper Creek near Chillimookoo and Pilalchilpna Waterholes, respectively. Site 15 (near Tirrawarra Waterhole) is situated about half-way along the North-West Branch towards Coongie, and Site 23 is situated on the southern margin of Embarka Swamp. These four premanent sites are ideally suited to continued monitoring with a view to assessment of the ecological implications of flood events along Cooper Creek (as per the Brief - Section 1.2; Appendix A), due to their being located for the most part in major arterial locations.

Two sites were surveyed in the Strzelecki Creek Floodplain Environmental Subassociation 8.4.4.2 i.e. Sites 28 and 30, of which site 28 was established as a permanent site (Fig. 7).

A permanent site was not established in the South-western Dunefields Environmental Subassociation 8.4.4.3. Only one site was surveyed here i.e Site 29 (Fig. 7). Site 29 could be selected as a designated permanent site for 8.4.4.3, but there is a need for a more detailed survey in its vicinity. Selection and surveying of a permanent site in the area of Wancoocha #1 Well Site (a dry well) would be a viable alternative to Site 29. This area is likely to be less disturbed and is known (from a 1:250 000 map held by Delhi Petroleum) to contain an area of undulating dunes (Habitat 39, p. 62) in what is thought to be an atypical location. This isolated expanse of undulating dunes may have developed over an extended period, being added to only when floodwaters of the Cooper Creek have extended this far into the dunefields. On the other hand it may indicate that direct association with floodplains is not a pre-requisite for the formation of such undulating dunes (or lunettes - Dulhunty, 1983), as a flood that extends this far into dunefields would be extreme indeed - more-so than the 1973-4 floods (see LANDSAT image in Douglas, 1980). This area is accessible via a track through the Daralingie Gas Field.

Two sites were selected within the North-western Dunefields Environmental Subassociation 8.4.4.4 i.e. Sites 6 and 10 (Fig. 7). Site 6 was established as a permanent site.

Site 1, a permanent site, was the only site established entirely within the Northern Gibber and Floodplain Environmental Subassociation 8.4.4.5. Further information on 8.4.4.5 was also obtained while surveying Site 4 (Fig. 7).

The sand plains of the North-eastern Dunefield and Floodplain Environmental Subassociation 8.4.4.6 are only known from a single vehicular traverse by the consultants and the results are included in Chapter 4. A detailed survey needs to be conducted in 8.4.4.6.

Two sites were surveyed in the Uncoordinated Drainage Dunefield Environmental Subassociation 8.4.4.7. They were site 7, which was established as a permanent site, and 7A.

Apart from the need for further study in Environmental Subassociations 8.4.4.3 and 8.4.4.6, studies within other Environmental Subassociations provided good detail on habitats and associated fauna. It would be of considerable value to include as potential future survey sites those sites selected previously but not surveyed due to time constraints or inaccessibility i.e. Sites 2, 3, 5, 12 26 and 27. All are considered viable monitoring points. In addition, studies of Site 2, 3, 5 and 27 will provide necessary detail on little known parts of the study area. Sites 2 and 5 are of particular interest because of their location near salt lakes which are not directly associated with the major floodplain environments of the study area. A comparison of results from dunefields associated with salt lakes against dunefields associated with predominantly freshwater habitats (as obtained this survey) would be of interest. Such a comparison should indicate the degree to which some elements of the fauna, in particular mammals and reptiles, are tied to water. These northern dunefields also appear to be less disturbed than those of the south and this should be evident in the results from Sites 2 and 5.

5.2.4 Land Zones

The purpose of recognising land zones in Association 8.4.4 was primarily to provide a very broad assessment of the study area in the context of a hierarchial classification. Direct reference to published geological maps (see Section 1.6) will show the arrangement of land zones i.e. dunefields, floodplains and gibber plains in the study area.

An interesting result emanating from the present survey has been the further recognition of the apparent "attractiveness" to flora and fauna of areas in which two or more land zones coalesce; previously indicated as possibly being the case near 8.4.4 (Reeves, 1982). These interface areas, particular where they are gradational and hence fairly extensive, provide for unusual associations of plants e.g. Habitat 100 (p. 86) and, may be necessary for the continued survival of some fauna species (see Reeves, 1982).

5.2.5 Land Systems

5.2.5.1 Vegetation - Land System Mapping

Mapping of vegetation and/or land systems is difficult without adequate resources. Social and Ecological Assessment Pty. Ltd. (1982) was able to produce such a map at a scale of approximately 1:20 000 scale over an area of 180 km^2 covering Embarka Swamp and the adjacent dunefields - this was made possible due to the provision of colour aerial photography at a scale of approximately 1:20 000 and supporting LANDSAT imagery by SANTOS Ltd. Environmental Research and Planning Group (1980) produced two maps, relevant to Association 8.4.4 - one of the South-western Dunefields and the other of the Cooper Creek Floodplain, each of 1:50 000 scale and covering an area of 64 km^2 - again with specially flown aerial photography, but just prior to the ready availability of LANDSAT imagery. Dawson (1974) also used 1:50 000 scale aerial photography in SW Qld, but didn't utilise his available resources to their fullest potential - he produced only 1:250 000 and 1:500 000 scale maps and because delineation of mapping units was mostly arbitrary it proved difficult to relate these maps to the land surface when flying over his mapping area.

Presently available aerial photography on 8.4.4 (average scale 1:88 000 - see Appendix N) are amenable to broad vegetation - land system mapping (Section 4.3.4.2.1; Fig.s 9-15) as long as perceptable boundaries are adhered to. Detailed vegetation - land system mapping requires as detailed aerial photography (colour if possible) as resources will allow including supporting LANDSAT imagery if the aim is to distinguish finer elements within the broad dunefield, floodplain or gibber plain areas. If the budjet is limiting large scale aerial photography and/or LANDSAT imagery of a number of representative test areas should be obtained and mapped with detailed ground reconnaissance. Extrapolation to wider areas may then be possible. This was not possible during the present survey.

5.2.5.2 Land Systems Identified from Field Data

A total of 55 land systems, mostly floodplain, were recognised in the Cooper Creek Environmental Association 8.4.4 during the present survey. Dawson (1974), recognised 53 land systems in the area adjacent to 8.4.4 in Qld, an area which is thought to be only slightly more complex than the present study area.(Section 1.4).

A general comparison of the land systems of both Association 8.4.4 and the SW Qld study area of Dawson and Boyland (1974) indicates that floodplain land systems predominate within the Cooper Creek Environmental Association 8.4.4, followed by dunefields and with gibber plains being a very minor (although important) component. On the other hand, floodplain, gibber plain and dunefield land systems have more-or-less similar degrees of prominence in SW Qld (see Dawson and Boyland, 1974).

No attempt will be made here to correlate the land systems of the present study area with those of Dawson and Boyland (1974). This must necessarily await such time as Association 8.4.4 is mapped in detail.

5.2.6 Environmental Units and Environmental Subunits

Useage of both the Environmental unit and Environmental subunit categories within the present study produces unnecessary complexity. It would be most useful to combine these two categories as one,so that they have equal rank within the hierarchial classification of 8.4.4. Considering components of floodplains as Environmental subunits, while components of dunefields are considered as Environmental units produces obvious problems and emanates from the failure of Laut et al. (1977) to recognise the internal complexity of floodplain environments. Although we are compelled here to maintain useage of Laut et al.'s (1977) categories, future studies should avoid such complexity by considering components of dunefields and floodplains to have equal rank.

5.2.7 Habitats

5.2.7.1 Habitat(s) - A Definition

A habitat is a biophysical entity i.e. it is comprised of both biological and physical characteristics. The main biological characteristic is vegetation (and associated fauna - not normally considered part of a habitat as it is not fixed and so, can't be mapped), while the physical characteristics are soils/ geology, landform/topography and climate. Climate is an assumed effect, which limits habitat utilisation. All habitats are by definition utilised.

Steen (1971) defines habitat as the:

"natural home or dwelling place of an organism"

In its present form though, this definition is difficult to apply when attempting to achieve the aim of this study in a systematic way. This is because the definition of Steen (1971) is distinctly broad in its application. It needs to be made more specific and hence, needs modification.

Firstly, the reference to 'organism' is implicit in the word habitat so there is no need to state this explicitly. Secondly, the term 'natural' limits the applicability of the definition to purely natural situations. It should be equally valid to call homes or dwelling places of man habitats, even though they may not necessarily be considered natural - the operations of man do not always conform to the laws of nature e.g. man's tendency to order his surroundings, while in nature the tendency is towards disorder. The term natural is therefore best left out of the definition also.

Habitat then is a 'home or dwelling place' (modified after Steen, 1971). Clearly though, this definition needs some qualification as it is still too broad for our purposes. It implies that there is "an area" and that this area "is being utilised".

"An area" can be any area of land surface in its application as the home or dwelling place of a plant or animal. It may also be, for example, the [1]bloodwood apple in its role as the home or dwelling place of an insect. For the purposes of this study, however, interest is centred more on maintaining the bloodwood's presence on 'an area of land surface'. In this way the bloodwood will in-turn provide a habitat for the insect of the bloodwood apple and all other species that rely on the bloodwood in some way.

In this study then, a 'home or dwelling place' is 'an area of land surface'. In order to identify one area of land surface in its application as the habitat of a plant or animal, we need to add qualifiers to the modified definition of habitat which characterise this area of land surface in a way that distinguishes it from other areas of land surface. This can be accomplished on the basis of consistent soils, vegetation and topographic elements i.e. a habitat is 'an area of land surface with consistent soils, vegetation and topographic elements'. A habitat is also (from above) an area 'which is being utilised'. If these two parts are incorporated into one definition of habitat, the resultant definition of habitat is an area of land surface with consistent soils, vegetation and topographic elements, which is being utilised.

The definition above encompasses soils, vegetation and topographic elements. Hence, it enables both biological and physical characterisation of an area of land surface and therefore satisfies the concept of habitat as a biophysical entity. This definition is also based on the assumption that plants and animals (the organisms of prime interest in this study) are utilising the land surface to its fullest extent under the prevailing climatic influences.

The use of only the biological characteristic of vegetation in the above definition of habitat, does not nullify the definition's use in determining the habitat of animals. As, according to this definition the grassland bird, for example, has essentially the same habitat as the grassland plant. Both require the presence of the grassland, the plant for its genesis, while the bird may (if a granivore) require its presence as a food source. The again, another element of the fauna e.g. a scincid lizard may use the grassland for shelter from predators. The grassland is in-turn dependent on the soils, topography and climate (the appropriate combination of these) to enable it to successfully compete for space.

Some animals and plants may be wide ranging and occupy many habitats (may be eurytopic), while others may be restricted in distribution and exhibit habitat specificity (may be stenotopic). It is not possible to devise a definition of habitat apart from the broad definition of Steen (1971), which accommodates all elements of the flora and fauna. If, however, as we have succeeded in doing here, we devise a definition of habitat which enables identification (and mapping - potentially at least) of all habitats in use by organisms in terms of fixed (at least in the short term) biophysical features, all we need then do is monitor the use of these habitats by the organism(s) of interest. In essence, we have developed a basic communicable framework with which to identify and monitor habitat useage by organisms.

In Chapter 2 (Section 2.3), a statement was made to the effect that habitats are analogous to land units. This analogy is verified in the following subsections. A related problem is also discussed.

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[1]A species of insect in causing an assumed 'irritation' of the bloodwood *Eucalyptus terminalis* causes the bloodwood to produce a localised growth or gall, the 'bloodwood apple', in which the female insect is entombed for her entire adult life. A small aperture, which she can block with the end of her abdomen to exclude ants, is her only contact with the outside world (Conservation Commission of the Northern Territory, pers. comm.).

5.2.7.2 Habitats vs Land Units

5.2.7.2.1 Habitats vs Land Units - The Effect

The analogy between habitats and land units can be verified if the two modified definitions of:

habitat - an area of land surface with consistent soils, vegetation and topographic elements, which is being utilised, and

land unit - an area of land surface with consistent soils, vegetation and topographic elements and some potential for utilisation

are compared.

The obvious parallel between these two definitions is in the consistency of soils, vegetation and topographic elements, which are used to characterise an area of land surface. A habitat is different from a land unit only in the matter of utilisation i.e. a habitat is utilised (it is assumed - Section 5.2.7.1) to its fullest extent under the prevailing climatic influences, while a land unit has some potential for utilisation (Section 2.3.7).

In fact, the definition of land unit used above contradicts the useage of Dawson (1974), who considers and describes land units in terms of landform, geology, soils, vegetation and land utilisation. Dawson's (1974) concept of land unit in recognising utilisation is essentially the same as the above concept of habitat. The definitions used in this report, however, retain the land unit as a concept which is applied only in land use planning, while the concept of habitat is applied only where land is already in use by native flora and fauna.

Whether the land surface is classified according to land units or habitats therefore depends on the purpose of a particular project. If we are to plan for the utilisation of the land surface then our interest is in its potential for utilisation and hence, it would be classified accordingly in terms of land units. If, on the other hand, the interest is in land under utilisation by particular elements of flora and fauna, then the land surface would be classified in terms of habitats.

Furthermore, because both definitions subscribe to a consistency in soils, vegetation and topographic elements, the areas of land surface dealt with should be identical. And, this will be reflected in subsequent habitat and land unit maps, which should also be identical.

It has been shown previously in this report (Section 4.3.4.1) that habitat (and therefore land unit) mapping is not yet feasible in 8.4.4, because of aerial photograph limitations and budgetary limitations to the number and duration of field trips. Australian National Parks and Wildlife Service (1980), say that land units in Kakadu National Park were too small to map at the scales used in previous C.S.I.R.O. studies of the area of Kakadu (i.e. by Christian and Stewart, 1953; Story et al., 1969; Story et al., 1976). And, Graetz et al.(1982), say that fine scale habitats may be inappropriate as there are unlikely to be enough resources to achieve these. Only the Forestry, Fisheries and Land Conservation Branch of the Department of the Northern Territory appears to have successfully produced land unit maps using standard map sheets at a scale of 1:50 000 (see Australian National Parks and Wildlife Service, 1980).

Certainly available aerial photograph scales, particularly of remote areas including Association 8.4.4, are too small to allow for production of habitat or land unit maps. Also, there is insuffecent monies available with which to adequately ground-truth such maps in the event that it is possible to reach this stage - in regard to 8.4.4, this would require specially flown aerial photography and detailed ground reconnaissance.

The aim in identifying habitats (or land units) is to properly manage our natural resources. In order to do so, sufficient monies need to be made available for fine scale resource mapping that resolves the level of the plant and animal. Due to continued restrictions on monies for research (e.g. The Advertiser, October 8th, 1984 - p. 24), there is a need to re-direct available resources towards projects with specific purposes in mind e.g. habitat mapping of a particular area for the purpose of future mapping of that area. Projects such as the present one are of little more than literary value if they are not adequately supported through to completion.

5.2.7.2.2 Habitats vs Land Units - The Result

The realisation that one area of land surface may be classified as habitat or land unit or both alludes to a problem which has affected the country and its biota since the arrival of European man - the problem of not realising the habitat role of an area of land surface for which land use is being planned, and therefore usurping this habitat role when the planned land-use is instigated. In opening up a new area, if we adhere to the assumption that the organisms are utilising this area to its fullest extent under the prevailing climatic influences (Section 5.2.7.1), then any additional land-use must result in deterioration in the land and displacement or extinction of the resident biota. Land-use conflicts related to multiple use of the same area of land surface must be taken into account in any plan of land management.

Without adequate regard for the consequences of instigated land-use, the land and its biota are brought into a state of disequilibrium and so, the original habitat occupants suffer or the land surface suffers or less frequently, the 'new' utiliser suffers. This depends on the resilience of each component and the degree of disequilibrium. Within Environmental Association 8.4.4, although it is an arid ecosystem with inherent high resilience (Social and Ecological Assessment Pty. Ltd., 1982), the extent to which change has been brought about by sustained and often haphazard land use practises is everywhere evident. In the past in 8.4.4, during exploration (Section 2.7) and settlement (Section 2.8), habitats have been virtually ignored due to the primary concern being utilisation to gain a return from the land. The deterioration of the habitat value of the land(as has occurred)was inevitable with such a doctrine in mind and has resulted in the decline and probable extinction of some species of the flora and fauna, with very few (if any) floristic and faunal elements unaffected.

5.2.7.3 The Range of Habitats in Environmental Association 8.4.4

5.2.7.3.1 Habitats Recognised Prior to the Present Survey

The following ..." habitat description "... by Environmental Research and Planning Group (1980), details the broad range of habitats identified in a study area which encompassed a large part of the present one:

> " Six major and three minor habitats for vertebrate fauna were identified, based on vegetation mapping and field inspection. The separation of habitat types is somewhat arbitrary since most integrate or overlap with each other. However, the following offer quite distinct environments and appear to correspond with preferred or exclusive habitat of certain indigenous species:-
>
> (a) Sandridge and sandplain desert. The most extensive habitat covering most of the southern half and parts of the remainder of the study area. There is a good deal of variability within the desert dune system. The pale dunes on the western half of the study area are dominated by

[1]Dune Canegrass (Zygochloa paradoxa). On the eastern side of the Strzelecki Creek, the red dunes have a mixed assemblage of Whitewood (Atalaya hemiglauca), Spinifex (Triodia basedowii) and other perennials and ephemerals of deep sands.

The inter-dune flats that are infrequently flooded have some clay alluvium added to the sand and support a covering of Old Man Saltbush (Atriplex nummularia). Further from watercourses, ephemeral saltbushes and grasslands are commoner than perennial shrublands on the flats.

(b) Riparian woodland occurs along the margins of the main channels of the Cooper and Strzelecki Creeks and their major waterholes. The principal tree species are River Red Gum(Eucalyptus camaldulensis) and Coolibah (E. microtheca). Lignum is common in the understorey with many other grass and herbaceous species.

(c) Swamps with Lignum or Swamp Canegrass (Eragrostis australasica) occurring in patches throughout the study area on alluvial flats and in flood-outs between dunes.

(d) Cracking clay flats ("crabhole" or gilgai soil similar to the Channel Country further north-east into Queensland). This habitat is very sparsely vegetated with low chenopod shrublands or acacia wooded and is patchily distributed in the north-east of the study area along the Cooper floodplain and predominant in the Fly Lake-Coongie Lake area in the north-west sector of the study area.

(e) Gibber plains or stony desert. Very sparsely vegetated with ephemerals, low shrubs and Mitchell Grass (Astrebla pectinata) and dissected by effluent stream channels lined with Minaritchie (Acacia cyperophylla) and Gidgee (A. cambagei). This habitat occurs in patches amongst sandplain desert in the south-eastern quarter of the study area and extensively in the tableland country of the north-east. Here it occurs adjacent to

(f) Rocky scree slopes, cliffs and caves of the mesas of the duricrusted tablelands (in the area north of Innamincka).

Minor habitats

(g) Artesian swamps, both natural and artificial, i.e. around bores. Extensive reedbeds of Typha sp. and sedges occur in isolated patches throughout the study area.

(h) Temporary, shallow waters. Flooded claypans, accumulations of rainwater in roadside borrow pits etc. are seasonally common and widespread in the study area.

(i) Artificial habitats. Certain species exploit the man-made microhabitats created by rubbish dumps, road works, buildings and other constructions."

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[1]Environmental Research an Planning Group (1980) use capital letters at the beginnings of common names of plant and animal species, however in this report lower case letters are used for plant species while for animal species capitals are used. This is because common names for plant species frequently vary from State to State, whereas common names for animals are generally the same from State to State. Until such time as a standard list of common names for plants is compiled, the use of lower case letters for common names of plants is considered appropriate.

Within Environmental Association 8.4.4 all habitats recognised by Environmental Research and Planning Group (1980) were encountered this survey, apart from the red dunes east of Strzelecki Creek (part of major habitat (a), which is outside of 8.4.4), major habitat (f) and minor habitat (g). Rocky scree slopes, cliffs and caves (of major habitat (f)) are largely outside the scope of 8.4.4 within the bounds defined in Section 2.2, although small mesas with accompanying rocky scree slopes may be encountered west of the duricrusted tablelands north of Innamincka. These small occurrences represent remnants of a former widespread, Tertiary, now much dissected plateau (Wopfner et al., 1974; Laut et al., 1977). Artesian swamps (of minor habitat (g)) are not known to occur within 8.4.4 and extensive reedbeds of *Typha* sp. which characterise such habitats have not been recorded in the present study area. Bores and associated drains were encountered, but within the study area these did not form swamps and the charcateristic vegetation of these artificial habitats mostly comprised ephemeral herbs and forbs.

The study of the Cooper Basin area by Environmental Research and Planning Group (1980), is the only study to detail specific habitats within a large part of the present study area (albeit a broad assessment). Dawson and Boyland's (1974) extensive survey of South-west Queensland is a useful comparative work, which details land units (analagous to habitats - Section 5.2.7.2.1) adjacent to 8.4.4. The available resources of this survey by Dawson and Boyland (1974) could have been better spent on land unit mapping rather than land sysytem mapping as was accomplished.

Summarily, the broad assessment of Environmental Research and Planning Group (1980), alludes to the approximate equal divisions in 8.4.4 of wetland and dryland habitats. Detailed assessments of these habitats is provided by Dawson and Boyland (1974) for regions adjacent to 8.4.4 with habitats similar to 8.4.4. And, by the present survey. It should be evident from all studies, however, that in an average season a major part of the area covered by the present study and also in adjacent regions constitutes dryland habitat, except for deeper waterholes and lakes along the major watercourses. During periods of rain or flood, this predominantly dryland region can be transformed into extensive areas of wetland, which may persist for days, weeks or (very infrequently) months, depending on the nature of the season, before again drying to a generally parched state. The habitats in the region are not static but dynamic and so, habitat assessments must be flexible enough to account for this dynamicity. In the following detailed assessment of the range of habitats in 8.4.4 an attempt is made to account for this dynamicity.

5.2.7.3.2 The Range of Habitats in the Cooper Creek Environmental Association 8.4.4

5.2.7.3.2.1. Introduction

As a result of the present survey of the Cooper Creek Environmental Association 8.4.4, 102 habitats have been identified within the bounds of the study area (Section 4.3.7) i.e. within the context of a hierarchial classification. This number excludes artificial (man-made) habitats. Dawson and Boyland (1974) describe 93 land units (≑ habitats) for the area adjacent to 8.4.4 in Queensland.

In a number of cases in the present study a problem has emerged which emanates from the attempt in this report to integrate the Environmental areas of Laut et al. (1977) with the land subdivisions of Dawson (1974) i.e. in order to arrive at a hierarchial classification of 8.4.4, which is compatible with the 'Western Arid Region' study of Dawson and Boyland (1974). This problem arises when defining land systems and in the further subdivision of these into habitats. Habitats essentially become land system specific and although some may be very similar to habitats within other land systems, they are recognised as separate entities within a hierarchial classification of 8.4.4 e.g. Zygochloa paradoxa hummock grassland dominated dune crests and upper slopes.

Dawson and Boyland (1974) allay the problem by considering all duplicate land units as the one land unit and hence, they recognise fewer land units. The problem with recognising single unifying habitats within the present hierarchial classification is that it leads to complex cross-linking within the hierarchy and therefore, stifles the attempt at communicating its virtues.

Furthermore and more importantly, information may be lost during the process of simplification. In Zygochloa paradoxa hummock grassland dominated dune crests and upper slopes, for example, not one habitat in which Zygochloa paradoxa hummock grassland is dominant is totally identical. These habitats differ in exhibiting different numbers and kinds of floristic associates, although they are still unified by the presence of Zygochloa paradoxa as the dominant. If interest is centred on a species that is specific to only one of these Zygochloa paradoxa habitats within a particular land sysytem e.g. the occurrence of Scaevola depauperata (Habitat 32, p. 59 in land system Dunc), then simplification removes the identity of this particularly important habitat. It may not be considered appropriate to develop habitat classifications, which are dictated by the woes of individual species. However,when considering conservation measures related to species such as Scaevola depauperata,conserving Zygochloa paradoxa hummock grassland habitat may not necessarily conserve Scaevola depauperata if this species is specific to only some areas of Zygochloa paradoxa dominated hummock grassland. A similar case can be made for keeping the identity of such habitats if fauna species are also habitat specific.

Certainly, a simplified habitat classification also has its virtues and would comprise a list of plant communities (e.g. Table 14) with accompanying detail about the soils and topographic aspects on which particular habitats are developed (see habitat definition - Section 5.2.7.1). All information for such a simplified scheme can be found in this report (Sections 4.3.4.2, 4.3.5, 4.3.6, 4.3.7 and 5.2.2). Table 14, includes information on habitats which are duplicated in any way.

In the remainder of this report, however, the classification of habitats as detailed in Section 4.3.7 will me maintained.

5.2.7.3.2.2 Inadequately Conserved Habitats

Further study within 8.4.4 should delineate few additional habitats other than those already indicated to be present (see footnotes - Section 4.3.7), but not studied this survey, namely: additional claypan and salt lake habitats. Of the habitats already identified (Section 4.3.7) a number are considered inadequately conserved inSouth Australia in the present National Parks and Wildlife Service park system i.e. in accordance with their characteristic plant communities as as detailed by Davies (1982).

Davies (1982) considers Eucalyptus microtheca low woodland, which in 8.4.4 dominates in floodout and channel habitats generally on grey cracking clay soils (Habitats 44, p. 64; 45, p. 66; 46, p. 67; 47, 48 & 49, p. 68; ± 53, p. 69), to be inadequately conserved in South Australia; Priority 14 - reasonably or excellently conserved interstate. Habitats dominated by E. microtheca low woodland are widespread in the study area in wetland areas associated predominantly with the major drainage systems.

Atriplex nummularia low shrubland dominated floodout habitats of grey cracking clay soils are also thought to be inadequately conserved in South Australia (Priority 13: poorly conserved or not conserved interstate or only occurs in South Australia - Davies, 1982). In 8.4.4 this habitat is represented by Habitat 62 (p. 72). Atriplex nummularia also predominates within particular structural levels of Habitats 22 (p. 57), 63, 64 (p. 72) and 80 (p. 77) in the form of low open shrublands. In addition, the species is a codominant or subdominant component of particular structural levels within Habitats 44 (p. 64), 78 (p. 77), 94 (p. 84),96 (p. 85) and 99 (p.86) in the form of either low shrubland or low open shrubland on floodouts or in the case of Habitat 96, on a dune/floodout interface of pale grey sands.

Maireana aphylla low shrubland of undulating dunes with red clayey sands (Habitat 39, p. 62), is also regarded as being inadequately conserved in South Australia (Priority 13 - Davies, 1982). Apart from its presence in Habitat 39, M. aphylla is also a codominant component of particular structural levels of communities on dune slope/interdune low (Habitat 41, p.63), gibber plain gutter (94, p. 86), gibber plain red duplex soils/ sand dune base interfaces (99, p. 86) and gibber plain, deeper red duplex soils/ sand dune base interfaces (100, p. 86) habitats in 8.4.4. Ratcliffe (1936), however, considers M. aphylla to be at least a partial increaser species, replacing bladder saltbush Atriplex vesicaria in areas south of 8.4.4 where the latter species has been overgrazed. If similar replacement occurs within the present study area with overgrazing (yet to be proved), then even though M. aphylla low shrubland dominated habitat is indequately conserved, designation of a reserve(s) to include habitats dominated by this species would be superfluous.

Chenopodium auricomum low shrubland is considered to be inadequately conserved in South Australia (Priority 13 - Davies, 1982), but in 8.4.4 the species forms no distinct broadly definable habitats as low shrubland. Particular structural levels within Habitats 69 (p. 73), 79 (p. 77), 94 (p. 84) and 99 (p. 86), however, contain C.auricomum generally as the codominant component of low open shrubland communities on floodouts of the Cooper (Habitat 69 - floodout border) and Strzelecki (79) Creeks; gibber plain gutters (94) and gibber plain red duplex soils/sand dune base interfaces (99). In some parts of the study area C. auricomum may dominate in small areas within habitats dominated by other species, but due to overgrazing, seemingly with a preference for this species (over some of its associates), its role in such habitats is less evident (e.g. see Photo 22, p. 70 and Photo 25, p. 74 for examples of habitats with severely degraded specimens of C. auricomum present). Consequently, where areas of C. auricomum shrubland predominate in the study area, even though these areas are generally small, particular attention is warranted in regard to conservation measures.

Chenopodium nitrariaceum low shrubland, which is considered to be inadequately conserved in South Australia (Priority 13 - Davies, 1982), does not occur as a distinct habitat in 8.4.4. Only in the understorey of Habitat 50 (relict channels, p. 68) does it occasionally occur as the subdominant component of a low shrubland community. C. nitrariaceum does form part of a mixed shrubland community in the understorey of Habitat 78 (p. 77), however otherwise occurs in the study area only in low open shrubland dominated habitats. Habitat 66 (p. 73), comprising areas of Chenopodium nitrariaceum low open shrubland as the dominant in the overstorey on floodouts of grey cracking clays, appears to occur only in small parts of the study area. Habitat 99 (p. 86), in which C. nitrariaceum is codominant in the understorey of a low open shrubland community at a gibber plain red duplex soils/sand dune base interface is also not extensive.

Astrebla pectinata open tussock grassland of gibber plain clay lenses (Habitat 92, p. 82), gibber plain/ uncoordinated drainage dunefield interfaces (101, p. 86) and gibber plain/sand plain interfaces (102, p. 86) is also inadequately conserved in South Australia (Priority 13 - Davies, 1982). The diversity of species encompassed within gibber plain clay lenses makes this habitat particularly noteworthy. South Australian National Parks and Wildlife Services' purchase of the Dalhousie lease area and the subsequent designation of this area as a park (Visual Media, 1984) is of importance in considering the conservation status of gibber plain habitat in South Australia. According to Laut et al. (1977 - see the Bagot Environmental Association 8.3.27) this area contains a large area of gibber associated with floodplain, however the vegetation cover is somewhat different to that in 8.4.4 and so the particular types of gibber habitats within the study area may still warrant protection. This is likely to be the case as the gibber areas of 8.4.4 form a complex association with dune and floodplain elements in the study area i.e. a relatively unique landform complex not common elsewhere in South Australia (Section 1.4.4).

The occurrence of Eragrostis australasica tussock grassland, which is considered inadequately conserved in South Australia (Priority 13 - Davies, 1982), encompasses three habitats recognised in 8.4.4. Habitats 38 (p. 62) and 81 (p. 78) comprise E. australasica low tussock grassland of, circular or ovoid interdunes of grey silty clay in the vicinity of minor drainage lines and grey cracking clay floodouts, respectively, while Habitat 65 (p. 72) comprises similar floodout habitat to that of Habitat 81, but with a more open plant community as the dominant i.e. E. australasica low open tussock grassland.

In addition to the above habitats, a number of others are thought to be inadequately conserved (see Priority 13 and 14 listings in Davies, 1982). These generally encompass low shrubland and ephemeral (forbland and herbland) communities on clay to sandy clay soils of floodouts and interdunes in which Atriplex spp. and Sclerolaena spp. are frequently an important component. However, other significant habitats for which the dominating communities have not previously been documented and consequently, for which conservation status has not been determined comprise entirely non-chenopodioid components (e.g. Habitats 75 and 76, p. 76). These also warrant consideration when designating areas worthy of conservation.

5.2.7.3.2.3 Other Significant Habitats

Only a small proportion of the communities within identified habitats of Environmental Association 8.4.4 have been documented previously (Davies, 1982), at least in the manner of the detailed subdivisions applied in this report (see Table 14). Lignum Muehlenbeckia cunninghamii, for example, forms 8 distinct types of shrubland habitat within 8.4.4 on the basis of subdivision according to height and degree of open-ness i.e. from areas of M. cunninghamii tall shrubland through low shrubland, low open shrubland to low, very open shrubland (Table 14), while in previous studies it has been referred to as only M. cunninghamii shrubland or dense swamp shrubland to 3 m tall (Davies, 1982). In addition, of those documented previously for other parts of South Australia some have not been included as occurring in the part of the North-East relevant to 8.4.4 (Davies, 1982).

Notable ommissions include Habitats 84 (p. 80 - channel edge) and 100 (p. 86 - gibber/dune interface) in which Grevillea striata may be a prominent component. Also the Hakea eyreana dominated (as either dominant or codominant) habitats (35, p. 60; 40 & 41, p. 63; 86, p. 80; 100, p. 86) of dune or sand plain. Habitat 87 (p. 81 - channel edge) in which Acacia farnesiana is codominant, may also be relatively unique.

Eremophila macdonnellii dominated habitat as is present in 8.4.4 (see Habitat 37 - circular or ovoid interdune type 4), has not previously been documented in the capacity of a distinct community. E. macdonnellii has been recorded as an occasional codominant in tall open shrubland of dune slopes and crests to the NW of 8.4.4, where it occasionally forms groves (Lewis, 1982), however, the lesser detail of the study by Lewis (1982) has resulted in none of these groves being accorded the status of distinct communities. Some of these grove occurrences may be analogous to the occurrence of E. macdonnellii in Habitat 37, but further data is required to confirm this. If similar groves of sufficient extent occur in the study area, these would constitute an additional dune crest and upper slope habitat. E. macdonnellii is also codominant in the understorey of Habitat 41 (p. 63) of Association 8.4.4, which is pale to yellow sand plain.

The sand plains of Habitat 40 (p.63) carry an unusual combination of species with Cassia phyllodinea and C. oligophylla prominent. Distinct communities formed by these two species have not, it appears, been documented previously either, and in 8.4.4 they are encompassed by part or all of Habitats 88 (p. 81) and 84 (p. 80) - both habitats encompass particularly diverse and interesting communities in the vicinity of channels. C. phyllodinea is also prominent in Habitats 94 (p. 84), in which C. helmsii is also codominant, and 100 (p. 86), in which Acacia victoriae ssp. arida is codominant. Habitats 94 and 100 both encompass gibber plain areas. C. phyllodinea is also somewhat prominent in the understorey of Habitat 37.

Saline habitats encompassing Halosarcia indica ssp. leiostachya as the dominant community have also not been documented previously within 8.4.4 or the North-East (see Davies, 1982). This species occurs in 8.4.4 as either low shrublands (Habitat 68, p. 73) or low, very open shrublands (51, p.68; 61, p. 72; 67, p. 73; 95, p. 84) in the capacity of ground cover, understorey or predominant cover (Table 14) and may also form fringing vegetation in other habitats (e.g. Habitat 14, p. 54). The habitats encompassed by this species generally comprise floodouts and salt lakes, and less frequently claypans.

The habitats detailed above and the communities they encompass also warrant particular attention when considering areas to be designated for the purposes of conservation.

5.2.7.3.2.4 General Discussion of the Range of Habitats in Environmental Association 8.4.4

That Environmental Association 8.4.4 is one of the most heterogeneous in the Lake Eyre Environmental Region 8.4 (Section 5.2.3.1) is borne out by the range of habitats identified within its bounds. The 102 habitats detailed in this report (Section 4.3.7) represent the range of habitats evident during a period in which the study area was being influenced by later than normal flows of the Cooper Creek and unseasonal rainfall as well (Sections 2.5.2 and 4.5).

Exceptional seasons, emanating from level 3 flood of the Cooper Creek (Section 2.5.2.6) and/or extended periods of local rainfall, with their consequent luxuriant growth enable the expression of all available variability within structural levels of the vegetation. So, total habitat diversity is only really evident at such times and for the period that the water persists after such events. This is of little value here though as such events generally occur with a periodicity of 40-60 years in the case of level 3 floods of the Cooper (Section 2.5.2.6) and infrequently in regard to extended periods of local rainfall (Section 2.5.1.1). Summarily, it should be evident that habitat availability during exceptional seasons may be far different from habitat availability during average seasons, although at particular times during such exceptional seasons fewer habitats may be evident due to the proportion which are totally inundated.

For-the-most-part during average seasons, fewer communities would be evident, as at such times many of the ephemeral species are largely represented by dried remnants or seed and would therefore be indistinguishable with regard to community composition - only the hardier Atriplex spp. and Sclerolaena spp. remain, whereas during periods of rain or flood non-chenopodioid species will predominate in some areas while chenopods of Atriplex spp. and Sclerolaena spp. (generally) will predominate in others. Hence, the range of habitats identified on the basis of distinguishing plant communities can vary according to the nature of the season, both locally and in the watershed of the Cooper Creek upstream in Queensland.

A vast proportion of the habitats identified on the basis of distinguishing plant communities are however, fixed. These include all the dryland and the majority of wetland habitats i.e. those habitats characterised by perennial vegetations, which are evident during exceptional seasons and which also persist through the driest periods. It is the habitats identified on the basis of predominating ephemeral cover which vary in regard to number and type.

Concomitant with seasonal changes affecting the range of habitats is the accompanying expansion or reduction in aerial extent of the fixed habitats. Dune slopes adjacent to floodplains e.g. Habitat 24 (p.58), may be partly inundated at times and so, the extent of the particular floodplain habitat will be expanded, while the extent of the adjacent dune slope will be reduced. Therefore, apart from water being the major factor determining the distribution of vegetation in a large part of Environmental Association 8.4.4 (Section 1.4), the range and areal extent of habitats evident at any one time is also primarily determined by its availability.

The nature of many habitats is also due to a large extent to past disturbance by stock and rabbits (Section 2.8) and so, they are not truely representative of the potential of an area of land surface under prevailing climatic conditions (see Habitat definition - Section 5.2.7.1). Some habitats may be good examples of the current state of the land, but are far short of the ideal situation that existed prior to stocking. Few (if any) areas exist today which are truely representative of the pre-European state of the country. Hence, it is difficult to assess the quality of current habitats.

5.2.7.3.2.5 Summary in Relation to the Assessment of the Range of Habitats

As with the floristic nature of Association 8.4.4 (Section 5.2.1.7), the habitats are also in a disturbed natural state. However, that a large number of habitats in the study area are dynamic and so, can be transformed from parched areas of land surface to luxuriant habitats within a short space of time should be clearly evident. The inclusion of new ephemeral growth and the rapid response of perennial vegetation to increased moisture availability changes habitats remarkably.

The range of habitats documented in this report ecompass fixed, accessible areas of land surface studied during a period of approximately five weeks field work in the latter half of 1983. This field work was accomplished during an above average season. Consequently the range of habitats documented is greater than would normally be expected.

Habitats have been assessed on the basis of predominating vegetation cover. Open water areas which are frequently of short duration and associated aquatic plant communities have been excluded from the previous discussion. However, these are discussed in detail later in this report (see Section 5.4 and Chapter 8).

5.3 FAUNA

The fauna associated with the range of habitats in Association 8.4.4 are discussed below.

5.3.1 Mammals

5.3.1.1 Significant Collections

All twenty-five species of mammals recorded in the study area are known to occur in the region. Nevertheless some species have been collected very rarely, if at all, in recent years. Two warrant particular mention. The Plains Mouse *Pseudomys australis* has been collected in South Australia on a number of occasions but only at four localities since 1940 (Watts and Aslin, 1981). None of these collections were in Association 8.4.4 and, as far as is known, no collections of the species have been made in South Australia since 1969. A single male *P. australis* was collected in the middle of Lake Marrakoonamooka. *P. australis* exhibits large increases in numbers following good seasons and is reduced to very low numbers at other times (Finlayson, 1939; Watts and Aslin, 1981). The area in which this animal was collected was still drought stricken and presumably represents a small isolated pocket of *P. australis* that would act as a nucleus of expansion during a favourable season. Despite the drought conditions, the floor of the lake contained large numbers of seeds and the animal in question was reproductively active

The second significant find was that of Byrne's Marsupial Mouse *Dasyuroides byrnei* about five kilometres south of Lake Moorayepe on Pandie Pandie Station. This species occurs commonly in south western Queensland but collections from South Australia are rare in recent years (Watts and Aslin, 1974). A specimen was taken by National Parks and Wildlife Service on Cordillo Downs Station in the early 1970's (Watts, pers. comm.) but that is the only recent record. However the habitat in which the specimen was collected is typical of that preferred by the species and the location is within the known range of the species (Strahan, 1973). Previously it has been collected as far south as Killalpaninna on the Cooper Creek in South Australia (Wood Jones, 1923). Nevertheless it is reassuring to know that the species is still extant in Association 8.4.4. One specimen was caught in a trap and a second located in a spotlight.

5.3.1.2 General Comments about the Rodents

Forrest's Mouse *Leggadina forresti* was collected at two widely separated localities (Lake Marrakoonamooka and about four kilometers south of Lake Moorayepe). This species is not found in large numbers anywhere and has a wide distribution, including all of Association 8.4.4 (Watts and Aslin, 1981; Strahan, 1983).

The Sandy or Desert Mouse *Pseudomys hermannsburgensis* appeared to be undergoing an increase in numbers on Pandie Pandie and Cordillo Downs Stations. Unlike southern stations (e.g. Clifton Hills, Gidgealpa, Innamincka) these areas had received good rainfall in recent months as indicated by the growth of grasses and ephemeral herbs. Breeding in the species is triggered by good rainfall (Finlayson, 1941; Watts and Aslin, 1981) and many of the females collected were pregnant or lactating. Some juvenile individuals were also caught. The absence of collections south of these two stations has probably resulted from reductions in numbers due to drought. The suggestion that the species does not occur, or is rare, east of the Stuart Highway (Finalyson, 1961; Watts and Aslin, 1981) is not supported by these collections.

Long-haired Rat *Rattus villosissimus* has been collected in Association 8.4.4 on several occasions in recent years (Watts and Aslin, 1974, 1981) and its absence from collections this survey, although disappointing, probably merely reflects a contraction in numbers with drought conditions (Finlayson, 1939; Watts and Aslin, 1981).

Water Rat Hydromys chrysogaster was not recorded on this survey. However it has been reported from the Cooper within Association 8.4.4 on a number of occasions (e.g. Finlayson, 1939; Watts and Aslin, 1981) and was described as particularly common along the Cooper near Coongie Lakes in 1975 (Watts and Aslin, 1981; Forrest, 1982).

House Mouse Mus musculus was collected in many widely separated localities by the consultants and N.P.W.S. and can be assumed to be distributed throughout 8.4.4. At present its numbers are moderately low but large increases have been recorded in the region in the past (Finlayson, 1933, 1939).

Fawn Hopping Mouse Notomys cervinus is well known and widespread in gibber plain and claypan areas of the north east of South Australia, including Association 8.4.4. Skulls of either Dusky Hopping Mouse N. fuscus or Desert Hopping Mouse N. alexis or both were found in owl pellets from Toolache Waterhole on the Strzelecki Creek. Both species have been recorded in 8.4.4 (Aitken, 1968; Watts and Aslin, 1981) although not commonly. Unfortunately the age of the owl pellets is not known, except that they also contained the remains of House Mouse Mus musculus and Rabbit Oryctolagus cuniculus and must therefore have been deposited in the last hundred years.

5.3.1.3 Notes on Other Native Mammals

Live specimens of four species of Dasyurid marsupial were collected. Byrne's Marsupial Mouse Dasyuroides byrnei has been mentioned. The Sminthopsis species (Fat-tailed Dunnart S. crassicaudata and Stripe-faced Dunnart S. macroura) are well known and have been recently collected in Association 8.4.4 (Finlayson, 1933; Watts and Aslin, 1974; Forrest, 1982; James, 1982). Gile's Planigale Planigale gilesi is known from Association 8.4.4 (Strahan, 1983) although not often collected. The widespread localities in which it was collected within the study area reflect the use of pitfall traps, the only method by which it was collected. P. gilesi was originally collected from and thought to be confined to, sedges associated with water (Aitken, 1972). However none of the specimens collected in Association 8.4.4 was collected near sedges or water. The major environmental feature associated with the specimens collected was cracking clay soil which supports the preferred habitat description of Strahan (1983). It is probable that the species is common and widespread on grey cracking clay soils in the study area. The remains of Jerboa or Hopping Marsupial Mouse Antechinomys laniger were found in owl pellets at Toolache Waterhole but no live specimens were collected. Although not common in the north east of South Australia (Watts and Aslin, 1974) this species is often associated with Fawn Hopping Mouse Notomys cervinus (Philpott and Smyth, 1967; Watts and Aslin, 1974) which was collected in this survey. A. laniger has been collected near the study area recently (Forrest, 1982).

No kangaroos were seen during the survey but tracks and droppings were found at two sites and the partial skull of a Red Kangaroo Macropus rufus at one of these sites. M. rufus is the only species known in the area and has never been common (Finlayson, 1936; James, 1982). Although the population was thought to have increased with the placement of watering points for domestic stock (Finlayson, 1961) no evidence of this was seen in Association 8.4.4.

Although only two species of bats were caught on the survey others are known from Association 8.4.4 and species other than those collected were heard calling. The species collected (Lesser Long-eared Bat Nyctophilus geoffroyi and Little Broad-nosed Bat Nycticeius greyi) are well known from the region (Reardon, 1983). Other species recorded in or near to the study area (Finlayson, 1961; Environmental Research and Planning Group, 1980) include: Gould's Wattled Bat Chalinolobus gouldii, Pied Wattled Bat Chalinolobus morio, Little Brown

Bat Eptisicus sp. and White-striped Mastiff Bat Tadarida australis.

Brush-tailed Possum Trichosurus vulpecula was reported to be common on the Cooper Creek in Association 8.4.4 (Finlayson, 1936) but no evidence of this species has been noted recently. Although little effort was made to search for possums on this survey lack of recent records place the status of the species in the study area in question.

5.3.1.4 Introduced Species

Rabbits, or evidence of previous infestations, were noted at all sites except the gibber on Pandie Pandie Station. However, the rabbit population now appears to be low compared to the recent past, as evidenced by the large number of unoccupied warrens and the line of faeces marking a previous high water mark in some floodplain areas where rabbits are now absent (e.g. near Mudcarnie Waterhole). Concommitant with the small number of rabbits was low populations of dingoes and cats. Only three cats and not more than ten dingoes were seen on the trip. The gut of one cat contained a lizard (Byrne's Gecko Heteronotia binoei). No foxes were seen, but a skull was found at Toolache Waterhole. Fox numbers are probably always low in the study area (Thompson, 1983). The recent decline in the number of rabbits has probably resulted in foxes being outcompeted and preyed upon by dingoes.

Domestic cattle and horses were seen throughout the area. Some stations had no cattle, because of their recent removal in the Brucellosis and Tuberculosis Eradication Programme, but evidence of previous occupation (faeces and skeletons) was obvious. Feral horses were also seen in a number of places and a camel and donkeys were seen. Camel tracks were evident at almost all sites visited.

The mandible of a pig was found at Toolache Waterhole. As the Strzelecki Creek is now dry, it is probable that pigs no longer occur there because of their dependence on free water (Strahan, 1983). However, pigs should be expected to occur along the Cooper, although no evidence of them was seen.

5.3.1.5 General Comments

Many species of mammals of central Australia are characterised by large fluctuations in population numbers (Finlayson, 1939) reflecting fluctuations in the weather (Watts and Aslin, 1981). The study area had undergone severe drought conditions prior to the survey. The northern stations (Pandie Pandie and Cordillo Downs) had experienced rain with resultant luxuriant growth of grasses and ephemeral herbs prior to the survey. This was reflected in the results by the capture of more individuals of certain species at these places than further south (e.g. Pseudomys hermannsburgensis - 19 at Pandie Pandie and Cordillo Downs compared to none further south in similar habitat). No inference about the condition of the land, other than that caused by drought, can be attributed to these results and increases in these species in suitable habitats further south should be expected after rainfall. The location of possible remnant populations of some species (e.g. Pseudomys australis) in the drought affected area supports this conclusion. The dasyurids appeared to be thinly but evenly distributed throughout the study area in suitable habitat, indicating that they are less sensitive to such environmental purtebations.

Some of the species collected in this survey have specific habitat requirements, whereas others are found in many different habitats. The fidelity to one habitat type of a species is important for considerations of conservation of that species. Several species were confined to gibber habitats (Dasyuroides byrnei, Notomys cervinus) and only one was confined to the Cooper floodplain.

Planigale gilesi is confined to grey cracking clay soils which occur on floodplains in the study area. When floodplains are inundated this species takes refuge in nearby dunes, as evidenced by the capture of one specimen on the dune flat adjacent to Embarka Swamp, which was full of water. Two species not collected in this survey are restricted to the Cooper. They are Hydromys chrysogaster which lives in and about the water and Trichosurus vulpecula which inhabits the northern river red gums along the Creek.

5.3.2 Birds

5.3.2.1 Introduction

Including the results of the present survey, 185 species have been recorded in Association 8.4.4 (Appendix S). This number includes 12 species regarded as typical of the study area, but not recorded this survey (Table 15),

Table 15 - Species that are typical of the predominant avian habitats of 8.4.4, which were not recorded this survey.

Family	Species	*Habitats
Phalacrocoracidae	Phalacrocorax varius	Aquatic - open
	P. sulcirostris	Aquatic - open
Plataleidae	Threskiornis aethiopica	Aquatic - edge
	T. spinicollis	Aquatic - edge
Phasianidae	Coturnix novaezelandiae	Grassland
Turnicidae	Turnix velox	Grassland
Otidae	Ardeotis australis	Grassland
Recurvirostridae	Cladorhynchus leucocephalus	Aquatic - open & edge
Scolopacidae	Calidris feruginea	Aquatic - edge
Strigidae	Ninox novaeseelandiae	Red gum woodland
Muscicapidae	Microeca leucophaea	Red gum woodland
Pardalotidae	Pardalotus striatus	Red gum woodland

*Refer to Table 8 for habitat details.

and the following six species, whose records require confirmation by the observers: Square-tailed Kite Lophoictinia isura (which is recorded for the first time this survey), Wandering Whistling-Duck Dendrocygna arcuata, White-browed Babbler Pomatostomus superciliosus, Weebill Smicrornis brevirostris, Yellow-rumped Thornbill Acanthiza chrysorrhoa and Grey Butcherbird Cracticus torquatus (Appendix S). In addition, 27 species that have not been recorded in 8.4.4 previously, possibly occur here as vagrants (Table 16).

Table 16 - Species of bird which have not been recorded in 8.4.4 previously, but possibly occur here as vagrants judging by records in adjacent regions.

Family	Species
Ardeidae	Ardea picata Pied Heron (see Storr, 1980)
	Ardeola ibis Cattle Egret
Phasianidae	Coturnix australis Brown Quail
Pedionomidae	Pedionomus torquatus Plains-Wanderer

Table 16 (Cont'd)

Rallidae	Rallus philippensis Buff-banded Rail
Charadriidae	Charadrius mongolus Mongolian Plover C. veredus Oriental Plover
Scolopacidae	Tringa glareola Wood Sandpiper (see Badman and May, 1983) T. brevipes Grey-tailed Tattler Calidris canutus Red Knot C. melanotos Pectoral Sandpiper C. subminuta Long-toed Stint (see Badman and May, 1983)
Glariolidae	Glareola maldivarum Oriental Pratincole
Laridae	Chlidonias leucoptera White-winged Tern
Columbidae	Columbia livia Feral Pigeon
Cuculidae	Chrysococcyx osculans Black-eared Cuckoo (see Cox,1982)
Tytonidae	Tyto longimembris Eastern Grass Owl (see Cox, 1976)
Coraciidae	Eurystomus orientalis Dollarbird
Maluridae	Stipiturus ruficeps Rufous-crowned Emu-wren (see *1)
Acanthizidae	Acanthiza iredalei Slender-billed Thorhbill Aphelocephala pectoralis Chestnut-breasted Whiteface (*2)
Meliphagidae	Lichmera indistincta Brown Honeyeater (see Matheson,1981a) Grantiella picta Painted Honeyeater (see Matheson, 1981b) Certhionyx niger Black Honeyeater (see Ford, 1978) C. variegatus Pied Honeyeater (see White, 1917a)
Ephthianuridae	Ephthianura crocea Yellow Chat (see Black et al., 1983)
Cracticidae	Cracticus nigrogularis Pied Butcherbird (see Walford,1983)

*1 - Parker et al. (1978); *2 - Cox (1982).

The number of species of bird recorded in this survey of Association 8.4.4 (128 species - Section 4.4.2) is analogous to the number recorded in the 1975 N.C.S.S.A. survey of the far North-East (131 species - Cox, 1982). Time-span of the observations and the number of personnel involved differed, however. Regardless of this, the approximate proportions of wetland to dryland species is similar in both and, like the plant results (see Section 5.2.1), reflects the similar diversity of habitats within 8.4.4 and the wider North-East.

The total number of birds that have been reliably recorded in Association 8.4.4 (179 species - Appendix S) is also similar to the total number recorded in the "southern and western Lake Eyre Drainage" region, that part of the North-East which is predominantly to the west of 8.4.4, apart from the Lower Cooper (173 species - Badman, 1979). The proportions of wetland to dryland species is again similar to both areas.

Summarily, it would appear that the diversity of avifaunal habitats within Association 8.4.4 are generally representative of the North-East, apart from the general lack of extensive gibber habitat. This is reflected in the results which are discussed in detail in the following subsections. It will be further apparent, however, that the diversity of species expected within such an array of habitats was not realised - a trend which has persisted in the North-East generally over the last decade.

5.3.2.2 Significant Records

The records of significance are detailed below. Records requiring confirmation are preceded by a (?).

Plumed Whistling-Duck Dendrocygna eytoni has been recorded in the study area for some 120 years since first being recorded at Lake Hope in October, 1863 (Parker, 1980a). It is however, rarely reported in South Australia. Association 8.4.4 is within a favoured part of its range (the North-East). D. eytoni has been recorded previously from other localities along the Cooper and was seen in large numbers along the Strzelecki in 1976 (Cupper, 1983). Small groups were seen at Embarka Swamp and Coongie Lake during the present survey.

(?) Blue-billed Duck Oxyura australis has been recorded three times previously from the Cooper Creek in 8.4.4 (e.g. Badman, 1979), but is considered to be a rare visitor here (Appendix S) and is uncommon overall in South Australia. The record from Embarka Swamp during the present survey requires confirmation by the observers.

(?) Square-tailed Kite Lophoictinia isura. The report of this extremely rare species from Tirrawarra Waterhole is probably invalid. The species has not been reliably recorded in the study area (or wider North-East) previously, although there has been the occasional claim. Association 8.4.4 is within the recorded range of distribution of the species as mapped by Pizzey (1980) and although, as stated by Pizzey (1980), these maps are of a general nature, such maps occasionally lead to erroneous reports, where the observers do not have access to detailed knowledge of the species or the region in question.

Grey Falcon Falco hypoleucos is a nomadic species that is rarely recorded in South Australia, however, Association 8.4.4 is within a favoured part of its range (the North-East). There are a handful of records from along both the Cooper and Strzelecki Creeks in 8.4.4, with an indication of breeding along both creeks. The species was recorded twice this survey along both the Cooper and Strzelecki by Officers of the N.P.W.S.

Inland Dotterel Peltohyas australis is an intriguing arid adapted wader with uncertain taxonomic relationships (e.g. MacLean, 1973) - a downy chick collected this survey (Specimen 1161, Appendix O) is of significance. The occurrence of the species is largely tied to local rainfall (Badman and May, 1983). It is uncommon in 8.4.4 due to the paucity of gibber, its favoured habitat.

Latham's Snipe Gallinago hardwickii. The four birds seen at Embarka Swamp in this survey by L.P. Pedler is the only record of the species from Association 8.4.4 and the second for the North-East (recorded in 1982 - Pedler, unpubl. data).

Flock Bronzewing Phaps histrionica is a species that has declined throughout its central-northern Australian range since European settlement. It was formerly abundant in 8.4.4 at times e.g. large numbers breeding at Lake Hope in 1863 (Parker, 1980a), but in recent times the records only include: 11 near Patchawarra Bore (Cox and Pedler, 1977), a record from the Cooper (R.A.O.U. ATLAS) and a probable sighting near Lake Moorayepe (this survey). P. histrionica may occasionally irupt to become more widespread (Appendix S).

Bourke's Parrot Neophema bourkii is a rare visitor to the study area and the wider North-East. The four previous records of the species in Association 8.4.4 are supplemented by the records of several groups along and to the north of the Cooper this survey (Appendix S).

Fork-tailed Swift Apus pacificus was recorded in the study area (and North-

East) for the first time this survey. The 100 birds seen flying south near Lake Moorayepe on October 31, 1983, in heavily overcast conditions and light rain (after 25 mm of rain in the previous 24 hours), were presumed to be on passage (Appendix S).

Eyrean Grass-wren Amytornis goyderi. Only recently rediscovered, this species' distribution and status is presently being documented. Several new locality records were made during the present survey (Appendix S - only two previous records in 8.4.4), and valuable study material was collected for the S.A.Museum. (Specimens 1162 ♂ and 1163 ♀ and 1180 - Appendix O). The species is widely distributed throughout 8.4.4 wherever there are dunes clad with Zygochloa paradoxa

(?) Yellow-rumped Thornbill Acanthiza chrysorrhoa. The report of A. chrysorrhoa from the vicinity of Tirrawarra Waterhole during the present survey is the second unconfirmed report of the species from the Upper Cooper in 8.4.4 (Appendix S). It has been reliably reported from the north, south, east and west of the study area, but apparently not within in it. Its occurrence here in riparian woodland would not be surprising.

5.3.2.3 Other Species of Importance

Pacific Heron Ardea pacifica is generally uncommon, although widespread on most waters in Association 8.4.4 when conditions are favourable. During the wet period between 1973 and 1980 the species was often encountered, but numbers were low during the drier period since. A. pacifica is known to breed at Coongie (McGilp, 1931a).

Glossy Ibis Plegadis falcinellus, although often absent e.g. 1974, 1975, 1976 and 1980 (when bird observers were in the region), occurs in large concentrations on the Cooper in some years e.g. 1973 (Rix, 1974), 1979 and 1982 (Pedler, unpubl. data). Concentrations regularly occur at Coongie (Rix, 1974; Mr & Mrs L.P. Pedler, pers. comm.). The species bred to the NW of Association 8.4.4 in 1930 (Reese, 1930b), and is uncommon to rare overall in the study area (Appendix S).

Pink-eared Duck Malacorhynchus membranaceus is generally moderately common to abundant in Association 8.4.4, but is occasionally absent. This highly nomadic species breeds regularly along the length of the Cooper (e.g. Glover, 1957; Rix, 1974; this survey) and frequents all waters in the study area when they are available.

Hardhead Athya australis is generally uncommon on most waters in the study area, but becomes common at times along the Cooper (see Badman, 1979). Breeding has been recorded at Coongie (Rix, 1974) and birds were preparing to breed at Embarka Swamp in 1983 (this survey). This species has declined rapidly in parts of south-eastern Australia (Frith, 1979).

Black-breasted Buzzard Hamirostra melanosternon is an uncommon breeding resident of tree lined watercourses in Association 8.4.4. The study area is within the central part of the species' range (the North-East) in South Australia. H. melanosternon breeds along the lengths of the Cooper and Strzelecki Creeks (e.g Condon, 1969; Dr D.J. Baker-Gabb in litt.; this survey) and is probably most common along the Upper Cooper in northern river red gum woodland.

Brolga Grus rubicundus is generally uncommon and relatively widespread in the study area, occuring in along the Cooper and in the districts to the north, where it frequents bore drains, lakes, swamps, waterholes and their surrounds. A species, which is considered to be threatened in South Australia (S.A. National Parks and Wildlife Act, 1972-81), its large size makes it an obvious target for hunters, one of the reasons for its general decline throughout the rest of its

South Australian range (Reid and Vincent, 1979).

Gull-billed Tern Gelochelidon nilotica is uncommon to rare in Association 8.4.4 and sometimes absent (e.g. 1975 - Cox, 1982; 1982 - Pedler, unpubl. data). The species is regularly recorded on the Cooper, and has been recorded on the Strzelecki (White, 1917a) and the gibber near Site 1 (this survey). It has not yet been observed to breed in the study area.

Mallee Ringneck Barnardius barnardi, Red-rumped Parrot Psephotus haematonotus and Bluebonnet Northiella haematogaster are also of importance. Distinctive populations of these species are generally confined to the North-East of South Australia (Environmental Research and Planning Group, 1980), with most records from the Cooper and Strzelecki and lakes to the north in Association 8.4.4 (Appendix S). The preferred habitat of these species is mostly riparian woodland of northern river red gum and coolibah. Barking Owl Ninox connivens is a species of the same habitat. It regularly inhabits areas of red gum woodland along the Upper Cooper (Parker, 1977).

Banded Whiteface Aphelocephala nigricincta is generally uncommon and widespread within Association 8.4.4, with scattered records from along the Cooper and Strzelecki and to the north (Appendix S). A. nigricincta prefers sandy habitats other than the regular sandhill canegrass Zygochloa paradoxa hummock grassland dominated dunefields i.e. where shrubby vegetation is prominent.

Gibberbird Ashbyia lovensis is uncommon in Association 8.4.4 due to the paucity of gibber. However, the records of the species in the study area (Appendix S) indicate a widespread occurrence here in low numbers. Apart from gibber, it is also encountered less frequently on bare flats within 8.4.4 and the wider North-East (Parker, 1980a). This species is of considerable taxonomic and ecological significance (e.g. see Schodde, 1982).

5.3.2.4 Notes on Other Species of Importance Not Recorded This Survey

Darter Anhinga melanogaster is generally an irregular and apparently non-breeding visitor to Association 8.4.4 (and the wider North-East), although present in large numbers in some years e.g. 1975 (Cox, 1982). There was 100+ in the Coongie district in August, 1979 (Reid, unpubl. data). The species is confined to the Cooper, which is the only area in South Australia besides the Murray and Lakes where the species can be encountered in good numbers. It is uncommon in 8.4.4.

Freckled Duck Stictonetta naevosa is uncommon in Association 8.4.4 (Appendix S) and is known to breed along the Cooper in South Australia (Mr S.A. Parker, pers. comm.), which is thought to represent part of the breeding stronghold of the species in Australia (Parker and Braithwaite, in prep.; contra Frith, 1979). The most recent and accurate population estimate numbers the Freckled Duck at about 12 000 (Martindale, 1983 - R.A.O.U. Newsletter No. 56).

Australian Bustard Ardeotis australis is generally uncommon to rare in Association 8.4.4, although records are widespread. The species, which favours well grassed flats, has bred in 8.4.4 previously (R.A.O.U. ATLAS) and increases in abundance in good seasons to be moderately common. A. australis is a threatened species which has declined in the North-East generally (contra Environmental Research and Planning Group, 1980), due to illegal hunting which is having a marked effect on this (and other) species, particularly in the Coongie district.

Night Parrot Geopsittacus occidentalis is a species which appears to have never been abundant. The few collections and records within Association 8.4.4 (Appendix S) attest to this. Most recently G. occidentalis was encountered in the vicinity (east of) Lake Perigundi (4 seen in June, 1979 - Parker, 1980a) in lush samphire Halosarcia indica ssp. leiostachya and semi-succulent Sclerolaena intricata floodplain habitat (Reid and Vincent, 1979; Habitat 68, p. 73) after it was presumed to be extinct (e.g. Environmental Research and Planning Group, 1980). Other habitat in which the species has been encountered in the past includes Triodia basedowii hummock grassland dominated interdunes (Environmental Research and Planning Group, 1980; and see Section 4.3.7 for relevant habitats). Listed as rare in South Australia (S.A. National Parks and Wildlife Act, 1972-81), the main causes of its near extinction are attributed to predation by foxes and feral cats and environmental degradation due to stock grazing. It is considered to be very rare in Association 8.4.4 (Appendix S) and until essential research is carried out to determine aspects of its life history for the purposes of developing management strategies, its position can only be described as precarious.

Grey Grasswren Amytornis barbatus is an extremely localised species (see the distribution map - Pizzey, 1980). The species, which was recorded for the first time in 1967 (see Cox, 1982), was recently recorded at Embarka Swamp by Mr I.A. May (Joseph, 1982), where its status needs to be ascertained. Previously in 1975, six pairs were encountered to the NW of the study area (Cox, 1982) in similar preferred habitat of lignum Muehlenbeckia cunninghamii swamp (c.f. Habitat 52, p. 68).

5.3.2.5 General Comments

In contrast to the majority of other elements of the larger fauna of Association 8.4.4 (Mammals - Scetion 5.3.1; Reptiles - Section 5.3.3), the birdlife of the study area is much more dependent on the wetland than the dryland (predominantly dunefield) habitats.

Of the 179 species that are relaiably recorded in 8.4.4 (Appendix S), over one-third (66 = 37%) of the species are waterbirds. This is a very high proportion considering the location of the study area in a truly arid are, comprised of two extensive deserts (Sturt's Stony Desert and Strzelecki Desert) interspersed with floodplain features emanating predominantly from the Cooper Creek.

By contrast, only 17 (=12.5%) of the 137 species recorded in the North-West of the State (north of the Great Victoria Desert and west of the Stuart Highway) by Close and Jaensch (in press) and, 36 (=28%) of the 127 species recorded in the vicinity of Roxby Downs (in a 3 700 km^2 study area) by Reid (1982) are waterbirds. These lower proportions of waterbirds are primarily due to the lower diversity of wetland habitats within these latter areas, particularly the North-West of South Australia.

The higher proportion of waterbirds in Association 8.4.4 is evidence of the importance of the study area's rich wetland habitats to the birdlife of the region. Most significant of these wetlands are largely confined to the Upper Cooper, where some of the water bodies are virtually permanent. Strzelecki Creek rarely flows, and often floods along the Cooper are of insufficient strength to flow to its lower reaches (see Average Flows - Section 2.5.2.6), while the permanent bore streams are largely outside of 8.4.4.

The 125 species listed in Tables 8 (species not preceded by an ✢, and excluding any of the six doubtful records listed in Appendix S) and 15 comprise the "typical" avifauna of Association 8.4.4. Most were recorded during the present survey. And, of the species not reliably recorded some are waterbirds while the remainder are species that are thought to be winter visitors. Brown Goshawk Accipiter fasciatus, Australian Hobby Falco longipennis, Southern Boobook Ninox novaeseelandiae, Red-capped Robin Petroica goodenovii, Rufous Whistler Pachycephala rufiventris, Grey Fantail Rhipidura fuliginosa, Striated Pardalote Pardalotus striatus and Mistletoebird Dicaeum hirundinaceum belong in the latter category. Most of the other species not listed in Tables 8 or 15, but known from 8.4.4 (see Appendix S) are vagrants or rare visitors to the region when conditions are favourable i.e. generally after heavy local rainfall or following a major flooding event along the Cooper.

Apart from a characteristic and rich community of birds that are associated with the riparian woodland habitats (coolibah Eucalyptus microtheca dominated woodland along the Strzelecki and Lower Cooper, and northern river red gum E. camaldulensis var. obtusa and E. microtheca dominated woodland along the Upper Cooper), the dryland bird fauna of Association 8.4.4 is lacking in diversity and is slightly impoverished. The Upper and Lower Cooper are therefore of dual importance in the study area in providing significant habitat for the large number of waterbirds (many of which breed here) and also in supporting a large variety of dryland birds in the fringing woodland habitats. A number of species are largely confined to the northern river red gum woodland fringing the near-permanent wetland habitats of the Upper Cooper e.g. Mallee Ringneck Barnardius barnardi, Barking Owl Ninox connivens, Jacky Winter Microeca leucophaea, Restless Flycatcher Myiagra inquieta and Brown Treecreeper Climacteris picumnus. Species that are typical of these woodlands generally are indicated in Tables 8 and 15.

Birds associated with four other dominant habitat types in Association 8.4.4 are also listed in Tables 8 and 15. The woodland habitat is obviously much richer than the other dryland habitats.

A feature of the woodland bird communities generally is the dominance of parrots and pigeons (see Appendix S) i.e. granivorous birds which are assumed to regularly require water. A high population density of these birds can only be maintained along the creeks, around waterholes and soaks, at least in dry conditions. In addition, a number of species are restricted to these woodlands because of nesting/roosting requirements i.e. all parrot species, Southern Boobook Ninox novaeseelandiae, Barking Owl N. connivens, Australian Owlet-nightjar Aegotheles cristatus, Tree Martin Cecropis nigricans, Grey Shrike-thrush Colluricincla harmonica, Crested Bellbird Oreoica guttaralis and Striated Pardalote Pardalotus striatus, which commonly nest in hollows, and Tawny Frogmouth Podargus strigoides, Fairy Martin Cecropis ariel, White-breasted Woodswallow Artamus leucorhynchus, Black-faced Woodswallow A. cinereus, Australian Magpie-lark Grallina cyanoleuca, Australian Raven Corvus coronoides and most of the raptores. Furthermore, Yellow-throated Miner Manorina flavigula, White-plumed Honeyeater Lichenostomus penicillatus and the two species of pardalote (Pardalotus rubricatus and P. striatus) are eucalypt foraging specialists and so are restricted to woodlands for this reason.

Most of the species commonly found in dune and gibber habitats are insectivorous and so are assumed to be free of the need to drink. Population densities in these habitats are generally low, except following heavy rainfall when a large influx of non-resident species and sustained breeding of the local population can markedly increase bird numbers.

There are several other habitat types with associated bird communities that are not included in Tables 8 or 15. Bare (or substantially so) floodplains, upon which ephemeral communities predominate only after rains or flooding, cover a large part of the Cooper (and probably Strzelecki) floodplain(s) and appear to attract very few species of bird when ephemeral communities are absent. Australian Pratincole Stiltia isabella, Richard's Pipit Anthus novaeseelandiae, and Occasionally Cinnamon Quailthrush Cinclosoma cinnamomeum and Gibberbird Ashbyia lovensis will occur in this habitat. It is not known, however, what proportion of this habitat is natural and what proportion is a product of past grazing regimes. This habitat may have been more diverse, both floristically and in an avifaunal sense, prior to European settlement.

Interdune corridors also occupy a large area in Association 8.4.4, but do not support a characteristic bird community. Generally, few birds are found in the interdune areas apart from Richard's Pipit Anthus novaeseelandiae and Cinnamon Quailthrush Cinclosoma cinnamomeum. Doubtless, birds of the dunes forage for a time in the interdunes, but the presence of other species in interdune corridors depends on the character of the interdune. If the surface of the interdune is somewhat akin to gibber, species typical of gibber habitat may occur or if there are clumps of low and tall shrubs (e.g. Acacia spp., Atalaya spp., Hakea spp.), species typical of shrubby habitats may occur. Horsefield's Bronze-Cuckoo Chrysococcyx basalis, White-winged Triller Lalage sueurii, Variegated Fairy-wren Malurus lamberti, Singing Honeyeater Lichenostomus virescens, Crimson Chat Ephthianura tricolor and Black-faced Woodswallow Artamus cinereus are typical of such shrubby habitats, which are scattered sparingly throughout 8.4.4 in interdune corridors on some dune slopes and on floodplains well back from channels.

A small group of opportunistic species inhabit the ephemeral grasslands (often as grassed areas within other habitats, such as on dunes) that occur following heavy local rainfall. The species include Stubble Quail Coturnix novaezelandiae, Little Button-quail Turnix velox, Australian Bustard Ardeotis australis, Bush Thick-knee Burhinus magnirostris, Richard's Pipit Anthus novaeseelandiae and Brown Songlark Cinclorhamphus cruralis.

As stated earlier, the dryland bird fauna of Association 8.4.4 is slightly impoverished. Perhaps the Weebill Smicrornis brevirostris is the most notable absentee from the region. This species has a very wide distribution throughout the drier parts of Australia wherever eucalypts occur. Its absence from the coolibah Eucalyptus microtheca and northern river red gum E. camaldulensis var. obtusa woodland habitats is therefore surprising.

There are two characteristically Australian groups that are poorly represented in Association 8.4.4 i.e. the Acanthizidae and Meliphagidae (after Condon, 1969). The thornbills, Sericornis species (after Schodde, 1975) and Weebill Smicrornis brevirostris belong to the former group, while the honeyeaters comprise the second family. Apart from the Yello-throated Miner Manorina flavigula, White-plumed Honeyeater Lichenostomus penicillatus and Singing Honeyeater L. virescens, which are common, and the surprisingly scarce Spiny-cheecked Honeyeater Acanthogenys rufogularis, no other species of honeyeater appears to regularly inhabit the study area. The paucity of honeyeaters probably reflects the lack of mallee eucalypts and the lower prominence of Eremophila species in the region since European settlement (see White 1917b).

5.3.2.6 Effects of Flooding

Aside from the obvious effects of periods of readily available water on the floristic biota and other elements of the fauna, flood events along the Cooper and Strzelecki (Section 2.5.2) and other watercourses in Association 8.4.4 are thought to have a profound effect on the population dynamics of the birdlife of the region. No systematic study of the phenomenon has ever been documented, however. Only anecdotal remarks have been recorded in the literature. A long-term study covering the full cycle of a flood event along any of the watercourses in Association 8.4.4, but particularly of the Cooper Creek, would therefore be of considerable benefit.

Waterbirds appear to react very quickly to flood events. During the four days spent at Site 25 in 1983 (this survey), the flood front of the Cooper (from a moderately above average flow i.e. Level 1 Flood - Section 2.5.2.7), was observed to slowly cover an extensive, bare floodout. On the first day as the floodwaters were lapping at the edge of the plain, a single Pacific Heron Ardea pacifica was the only waterbird seen. Over the next three days many individuals of 13 species were seen feeding on the floodout.

Perhaps these "early" species follow the floodwaters in from Queensland each year and then disperse widely with the spreading tide. There numbers and distribution is therefore directly dependent on the intensity of the flood event(s), and they would therefore represent the proportion of birds which exhibit a rapid response to flooding. Their life-cycles may be largely tied to the regular flooding which occurs along the Cooper.

Other more nomadic species would have to first locate the flooded areas. Hence, the response time of nomads would be somewhat longer. The remainder of species would largely represent the resident population.

In regard to how nomads locate flooded areas, little is known about the ability of animals to sense iminent rain or flood or their ability to "smell" water, except that it occurs. Braithwaite (1981) says: "The floodplains of inland rivers provide the singularly most important habitat for waterfowl in Australia. There tends to be flooding somewhere in Australia each year. Presumably with the known ability of waterfowl to leave drought areas and to find habitat elsewhere the effect of drought on their populations is thereby ameliorated though to what extent this may occur is not knwon. The occurrence of such movements is known mostly from anecdote and there is only speculation as to how birds might find flood areas as they are created ". Carrick (1962) on Ibis species says that they tend to avoid arid areas, however, vagaries is Australian rainfall cause major shifts in distribution. Although Ibises are not regarded as nomadic (in a strict sense), they do exhibit major shifts in distribution (see Carrick, 1962) and hence,may provide a clue to the general shifts in distribution of all migrants including the nomads. Ibis species shifts may be tied in with the regular cycles of the weather patterns (Carrick, 1962), and other species may follow suite, however, till detailed studies are carried out this still remains as speculation.

Perhaps the response lag by some species, particularly nomads, may be one of the reasons for the lower than expected numbers of birds recorded in the last decade (e.g. Cox, 1982; Section 5.3.2.5), particularly as many surveys appear to have been during the months of May, July and August - August appears to be the month when floodwaters from average flows along the Cooper reach their farthest limits, so species exhibiting a response lag may not arrive until September. These species may also depart rapidly after most waters have dried up, which for some shallow lakes appears to take just a few days (Mr L.W. Best, pers. comm.). Birds, particularly if they are non-breeding visitors, may be departing again in late September-early October and so later surveys e.g. late October-early November (this survey) will also not record their presence. If a response lag does in fact occur with some species then there is a need for ornithologists to visit the area at other times of the year e.g. during September and in the months after summer rains, which appear to occur fairly regularly.

The breeding cycles of many species are tied in to the ordered pattern of changing water level associated with the rise and fall of flood waters (e.g. see Frith, 1977 for an analysis of the correlation between the timing of breeding in duck species and changing water levels). During a period of drought or after a succession of dry years with small flows, the Cooper may become largely dry along its course in Association 8.4.4. Under such conditions, as occurred in 1981-82, waterbirds become scarce and are concentrated on the few remaining water bodies, while the majority of species vacate the region. Concomitant with the next flood event, a large influx of birds occurs the magnitude of which is dependent on conditions elsewhere in Australia and the intensity of the flood event locally. It has been speculated above that this influx occurs firstly from "early" species following the floodwater front and from the regional resident population. Later, the more nomadic species, which appear to exhibit a response lag that may be dependent on individual species' abilities to find flood areas, add to the influx. The numbers are then further bolstered by in-situ breeding.

Only long-term monitoring will determine whether the above speculation is correct. Similarly, it is unknown whether there is a continued interchange between the wetlands of the Cooper Creek region and other watered regions in Australia or if individuals largely remain in the region until unfavourable conditions again force the majority of species to depart.

Not only are waterbirds favourably affected by a flood event. The dryland bird communities of riparian woodland and floodplain habitats must also benefit greatly. Firstly, the widespread availability of water means that water-dependent species (about one-half of arid land birds - Schodde, 1982) can disperse widely. Secondly, the flush of new growth following inundation results in flowering, fruiting and seeding of many species of plant, with an accompanying dramatic rise in the invertebrate population. Increased food is therefore available for nectarivores, granivores, insectivores and all birds in general. It is thought that many of the key plants of the floodplains e.g northern river red gum Eucalyptus camaldulensis var. obtusa, coolibah E. microtheca and lignum Muehlenbeckia cunninghamii, rely substantially on inundation for their regeneration, and so in the long-term, the dryland birds are very dependent on flood events.

Therefore after a large flood event, a dramatic increase in the number of dryland birds on those parts of the floodplains that have received water can be expected due to breeding and influxes from outside the region. The Channel-billed Cuckoo Scythops novaehollandiae was referred to as the "flood bird" by Samuel White in the 19th century due to its habit of arriving in districts generally after a flood. Reese (1924, 1927) made similar observations of the species to the NW of Association 8.4.4 this century. Brown Songlark Cinclorhamphus cruralis and Orange Chat Ephthianura aurifrons, two species which were recorded at Embarka Swamp during the present survey, would not be found in dry lignum habitat.

The degree to which dryland birds react to flooding events cannot be properly evaluated due to the lack of documentation. Approximately 35% of species occurring in Association 8.4.4 need to drink water regularly, and so the numbers of dryland birds would be expected to increase if:

- water was a limiting resource beforehand,
- species were capable of breeding at the time of the flood, and
- if an influx of nomadic species is also possible. Schodde (1982) presents a summary of data indicating that about 30% of desert inhabiting birds can breed opportunistically (at any time of the year) with the onset of favourable conditions; other species are fairly seasonal in their breeding regimes (generally exhibiting spring and often autumn peaks), while he asserts that few species will breed in mid-winter. The time of a flood is therefore of likely importance in determining the level of breeding that dryland birds undertake after a particular flood event. As most flows along the Cooper occur in the autumn-winter period, it would appear that birds capable of breeding in early spring would be most advantaged in a normal season. Aseasonal conditions would therefore advantage other species.

Local rainfall probably also has a marked effect on the population dynamics and breeding cycles of dryland birds. The effect of local rainfall may be much greater than that of flooding events, a subject that is seemingly of increasing interest to arid zone ornithologists as formerly widely held beliefs are currently being challenged and revised (see Schodde, 1982). A great deal more research is needed to investigate the interplay between flooding events and local rainfall on breeding cycles in Australia's arid land birds.

Table 17 - Species of reptiles previously recorded from Association 8.4.4 but not collected during this survey. Symbols as in Table 9 (opposite p. 89)

Family	Species	Status	Habitat
Typhlopidae	*Typhlina endotera*	F	Sand
Elapidae	*Pseudonaja nuchalis*	F	General
Agamidae	*Amphibolurus isolepis gularis*	F	Swale
	Tympanocryptis tetraporophora	W	Plain
Pygopodidae	*Pygopus nigriceps*	F	?
Scincidae	*Ctenotus stauchii*	F	?

Table 18 - Species of reptiles previously recorded from just outside Association 8.4.4 and reasoably expected to occur in this area.

Family	Species
Elapidae	*Demansia psammophis*
	Oxyuranus microlepidotus
Varanidae	*Varanus tristis*
Agamidae	*Lophognathus gilberti*

Flood events along the Cooper and Strzelecki and other watercourses in Association 8.4.4 can therefore cause a marked change in the composition of the birdlife of the region. Waterbirds in particular can react very quickly to the widespread filling of wetland habitats. A considerable amount of breeding habitat is created (if only for a short period) as shallows lakes and swamps are inundated, and so breeding of a great number of individuals of many species is facilitated. Dryland birds, vegetation and other species of fauna also benefit from flood events.

5.3.2.7 Summary in Relation to Birds

Generally, the birdlife was not abundant or diverse. The effects of the recent harsh drought (in which the Cooper dried almost completely) was probably the major contributing factor; the vegetation and landscape were observed to be in a poor state, despite the occurrence of several heavy falls of rain in parts of the study area during the months prior to the survey. Even in the parts of the Cooper holding water (after the recent flooding event - Section 2.5.2.7), the diversity of waterbirds was lower than expected.

5.3.3 Reptiles

Most species known from Association 8.4.4 were collected during the survey (Table 9). However, some species known from the study area were not collected (Table 17) and others, though not collected in Association 8.4.4, may be reasonably assumed to occur here because they have been collected in similar habitats nearby (Table 18).

Few of the species are restricted to the floodplain. Turtles of Emydura sp., being aquatic, are restricted to the watercourses and are probably concentrated in the permanent waterholes during droughts. The only South Australian record of the Centralian Water Dragon Lophognathus gilberti was made from the Cooper at Innamincka (Houston, 1978), which is just outside the study area. Considering the habitat requirements of the species its distribution is likely to extend into Association 8.4.4 and more extensive searches should be made to confirm its presence along the Cooper Creek.

The Sand Goanna Varanus gouldii flavirufus was noted throughout the region and was very abundant in some areas. Elapid snakes were surprisingly rare. The consultants had the opportunity to follow the advance of the floodwaters across a large expanse of cracking clay floodout. The large numbers of predatory birds following the water (Section 5.3.2.6) presumably took small vertebrates as they were forced from their burrows. However large snakes should have been relatively immune from these predators, but none were seen.

The Woma Aspidites ramsayi was not collected by the consultants, but one was reported by the N.P.W.S. Womas are well known from the area and possible tracks were noted at two sand dune sites.

A few species not previously recorded in Association 8.4.4 were collected. However all were expected to occur in the region because they have been collected in similar habitats nearby. The most significant record was the Centralian Bluetongue Tiliqua multifasciata. This specimen represented the second collection of the species in South Australia and the first in Association 8.4.4. The collection locality (Mudcarnie Waterhole, Cordillo Downs Station - near Site 4) lies close to the southern limit of the distribution of the species.

The Western Taipan Oxyuranus microlepidotus was not seen in the study area and specimens collected previously are from outside the area. However, descriptions of large snakes given by SANTOS Ltd. employees in the area include O.

microlepidotus, which they easilty distinguished from the King Brown Snake Pseudechis australis.

5.3.4 Frogs

Three of the five species collected (Table 10, p. 89) represent significant specimen locality records for South Australia. Litoria latopalmata has only been collected at Gidgealpa Waterhole in the mid 1970's (Tyler, 1978) and Green Tree Frog Litoria caerula at Gidgealpa Waterhole (Tyler, 1978) and Lake Coongie (Thompson, unpubl. data). Ranidella deserticola is assumed to occur to the NW of Association 8.4.4 (in the Diamantina) in South Australia because it has been collected within 10 km of the border in Queensland. It was first collected in South Australia north of the study area (Brooks, 1980) and was first taken in the Cooper Creek system in this State at Coongie Lakes in April, 1981 (Thompson, unpubl. data). The locality at which L. latopalmata and R. deserticola were collected in the present survey (Chillimookoo Waterhole - near Site 14) is about 60 km north-west of Gidgealpa Waterhole and 35 km south-west of Coongie Lakes. The records are significant because they indicate that these species may occur throughout the Cooper Creek system in South Australia in suitable habitat.

Green Tree Frog Litoria caerula has been reported from widely separate localities in the north-east of South Australia but none of the records were supported by specimens (Tyler, 1966) until 1976 (Tyler, 1978). Specimens collected at Mundibarcooloo Waterhole on the Strzelecki Creek about 125 km SSW of Innamincka and heard calling at Toolache Waterhole about 45 km morth of Mundibarcooloo confirm the reports of this species from the Strzelecki Creek. At Toolache the waterhole was dry and the animal was heard to call on two occasions only, from inside a hollow coolibah Eucalyptus microtheca branch about 45 cm in diameter and about two metres above the ground. At Mundibarcooloo, where a small shallow pool of water remained, they were not heard to call but they emerged at night to feed around the water.

While at the gibber site (Site 1) on Pandie Pandie Station 131 points (33 mm) of rain was recorded at the nearby homestead. The gibber was flooded and Water-holding Frog Cyclorana platycephalus began to call. One was caught in a pitfall set in a clay lens (Habitat 92, p. 82) on the gibber plain proper. This locality is significantly north of the known range of the species (Tyler, 1978). C. platycephalus was also heard calling on several nights at Embarka Swamp on Gidgealpa Station. The swamp had recently been flooded. Trilling Frog Neobatrachus centralis also emerged with the rainfall on Pandie Pandie. They were commonly caught in pitfall traps set on the dune and on the dune/gibber interface at this site. It appeared as though their refugia were in the dunes and they moved to the gibber, where pools of water had formed, after rains. No breeding activity was observed and none of the N. centralis was heard to call. One specimen was found some distance away (15 km west of Lake Etamunbanie - WNW of Association 8.4.4 and Site 1) also on gibber with dunes nearby.

The two species known to occur in the region, but not collected during the present survey, Marbled Frog Limnodynastes tasmaniensis and Red Tree Frog Litoria rubella, have been recently collected in Association 8.4.4 (Thompson, unpubl. data) and failure to locate them during the present survey is not regarded as significant in terms of their conservation ststus.

5.3.5 Fish

Some effort was put into collecting fish, but it was less intense than that for other groups of vertebrates, and for aquatic invertebrates because, unlike these groups the fish fauna is well known (Glover and Sim, 1978 ; Glover, 1979 - sixteen species of fish are known from the Cooper Creek, Table 19). Added to

Table 19 - Species of fish previously collected from the Cooper Creek. (Modified from Glover and Sim 1978 ; Glover, 1979).

Family	Species	Common Name
Clupeidae	Nematolosa erebei	Bony Bream
Retropinnidae	Retropinna semoni	Australian Smelt
Plotosidae	Neosilurus argenteus Neosilurus hyrtlii Neosilurus sp.	Central Australian Catfish Haytyl's Catfish
Poeciliidae	Gambusia affinis	Mosquito Fish
Melanotaeniidae	Melanotaenia tatei	MacDonnell Ranges Rainbow Fish
Atherinidae	Craterocephalus eyresii	Lake Eyre Hardy Head
Centropomidae	Ambassis castelnaui	Western Chanda Perch
Serranidae	Plectroplites ambiguus	Yellowbelly
Teraponidae	Bidyanus bidyanus Terapon unicolor Hephaestus welchi Scortum hillii Scortum barcoo	Silver Perch Spangled Perch Welch's Perch Barcoo Perch
Gobiidae	Hypseleotris sp.	Carp Gudgeon

this was the recent (1983) flooding of the Cooper. Central Australian fish use floods such as this for dispersal (Glover and Sim, 1978a) and are more thinly spread. They also breed during floods and the number of Australian Smelt Retropinna semoni at each site suggests that this species had already expanded in numbers. It was the only species collected at Chillimookoo Waterhole, which was dry only six months earlier.

A collection of dead Yellowbelly Plectroplites ambiguus was made just outside the study area adjacent to the causeway at Innamincka (included in Table 11, p. 89). These specimens were juveniles and were found in, and had presumably been killed by, stagnating (?polluted) water. As well as juvenile P. ambiguus, young Bony Bream Nematalosa erebei, were also collected at two localities, indicating that both species had reproduced recently.

5.3.6 Aquatic Invertebrates

Preliminary analysis of samples of aquatic invertebrates taken from representative waterholes and swamps along the Cooper, the leading edge of floodwaters SSE of Lake Perigundi and a puddle on the side of the Strzelecki Track (Tables 12 and 13; Appendix W), indicate a typical freshwater invertebrate fauna. Further collection is required to ascertain the diversity of this fauna. Once the checklist of the freshwater invertebrates of South Australia being prepared by the E. & W.S. is available the ability to determine the diversity of this fauna should be enhanced.

5.3.7 Summary in Relation to Fauna

It is only in the last decade that the more detailed and intensive surveys of the wide range of fauna have been undertaken in the region of Association 8.4.4 (i.e. 1975 - Foale, 1982; 1980 - Environmental Research and Planning Group, 1980; 1983, this survey). And, although intensive studies of individual species or groups have taken place throughout the years since the first collections were made during the Sturt expedition of 1845 (e.g. Forshaw, 1981 - on the Night Parrot

Geopsittacus occidentalis), the number of these studies has also increased in recent years.

Mammals and birds have been reasonably well documented, however, reptiles, frogs, fish and aquatic invertebrates have been left virtually untouched until the 1970's. In the preceding subsections each group has been treated in more-or-less detail depending on the amount of previous work undertaken and the additional data collected during the present survey.

Because of the detail of the preceding discussion it is only necessary to reiterate the need for more detailed study of the more inaccessible parts of the study area and, indicate some aspects of the physical environment which are little understood. The dunefields and their salt lakes to the north of the Cooper flood-plain in 8.4.4.5 are hardly known, and because of their general isolation they are likely to carry some of the more cryptic species and those in general that evade areas of human activity or stock grazing. Extensive areas of samphire are likely so it may be that the Night Parrot Geopsittacus occidentalis, if it does in fact favour habitat dominated by this species and semi-succulent bassias, will be encountered here under favourable conditions such as after a heavy summer rain. Mrs J.B. Paton (pers. comm.) on a camel expedition through this area in May, 1980, made some valuable ornithological records e.g. Singing Bushlark Mirafra javanica and Grey Honeyeater Conopophila whitei. As mammals and reptiles have a preference for the drier habitats, particularly the dunefields, they to should be found in more abundance in this area.

Of the physical environment, it is possible that relationship between phases of the moon (Section 2.6) and trapping times will prove of significance with the detailed analysis of the data. At present it appears that the two significant mammal trappings of species which have been very rarely collected in recent years i.e. Plains Mouse Pseudomys australis and Byrne's Marsupial Mouse Dasyuroides byrnei, were made during the last phase of the moon (the moon is absent for the first half of the night when animals are thought to be most active in their search for food), indicating that these species may have the ability to evade traps under normal moon light conditions. The best times to trap for these species in particular may therefore be during periods of the last phase of the moon.

The effect of salinity although considered to have a negligible effect on the Cooper generally (Johnson, 1980 -Section 2.4) is still little understood. Stagnating (?polluted) water was evident in the eastern and western parts of the study area, and near the Innamincka Causeway was thought to have been responsible for the death of a number of juvenile Yellowbelly Retropinna semoni (Section 5.3.5), during the present survey. Innamincka area in particular is an area of higher than normal salinity due the nature of the strata (marine) of the groudwater horizon and so, more detail is needed on salinity variation at particular localities and the effects of this on the aquatic fauna e.g. such areas may form a barrier to migration of fish species, which therefore could only migrate when floodwaters are of sufficient strength to carry them through such areas.

On aquatic species generally there is a paucity of information on how particular species or groups survive through the drier periods, particularly in relation to the invertebrate fauna. Hynes (1970) says that: " faunas of temporary streams are comprised of six main groups.

1. Species which survive in pools despite high temperatures and low oxygen concentrations....

2. Species which survive by burrowing down into the substratum....

3. Species with eggs that survive long periods of drought....

4. Species which reinvade from elsewhere, usually downstream, as soon as the water returns....

5. Species which occupy pools or damp parts of the river bed only during the dry period or its early stages....

6. A few species which appear to be highly specialised inhabitants of temporary waters....".

It would be of interest to learn more about the nature of the Cooper system in regard to its inhabitant fauna i.e. to know what proportion of the fauna falls into each group of Hynes (1970), and in what way the Cooper differs from the other watercourses in Association 8.4.4 that do not contain permanent waterholes or lakes.

Concomitant with the general decline in status of the flora of Association 8.4.4 since European settlement (Section 5.2.1.7) the fauna has also suffered. The combined effects of pastoralism, petroleum exploration/extraction and tourism has resulted in a generally depleted fauna, with a number of formerly abundant species now extinct or nearly so in this part of South Australia.

5.4 HABITATS, FLORA AND FAUNA

5.4.1 Introduction

In the preceding discussion, habitats in relation to flora and habitats in relation to fauna are treated somewhat differently. This is not to say that there is any intrinsic difference between the habitats of particular elements of the flora and fauna in Association 8.4.4. Rather, the difference is in the perception of these habitats in the view of a botanist as opposed to the view of a zoologist. Floristic elements and faunal elements both use the same land surface in fulfilling their habitat requirements, however, they use that land surface in different ways.

At any one time there may be particular species of plants and animals on a specific area of land surface, which can be recognised on the basis of consistent soils, vegetation and topographic elements (see Habitat definition - Section 5.2.7.1). If these plants and animals frequent this area of land surface with some degree of permanence (plants) or regularity (animals) then it may be considered to constitute their habitat. Some animals and plants may frequent a range of these habitats, whilst others may only frequent one or a few. It is not the purpose here to convey the individual habitat requirements of a particular species of plant or animal. What we purport to do, however, is to document the range of habitats available to organisms based on a readily applicable definition of habitat. And, where possible, identify the incidence of particular species in these habitats.

At this stage, due to the paucity of data on many species, it would be pragmatic to impose a strict set of habitats for use by both botanists and zoologists. The best we can hope to accomplish is to attempt to correlate the habitat requirements of plants and animals, as they become known, with a uniform set of defined habitats and, continue to modify this habitat set as deficiences are recognised. Deficiencies may be recognised from either a botanical or a zoological standpoint . As, the eventual aim is to produce an inventory of habitats available to both plants and animals and, therefore amenable to utilisation by both botanists and zoologists.

In order to achieve this aim, it would be advantageous to analyse the different perceptions of habitats of flora and fauna evident during the present survey. Appendix M indicates the habitats within which individual plant species were encountered i.e. the perception of habitats from a botanical standpoint, whilst Table 6 (Mammals), Tables 8 and 15 and Appendix S (Birds), and Tables 9 and 17 (Reptiles), indicate the habitats within which elements of the larger fauna were encountered i.e. the perception of habitats from a zoological standpoint. Frogs (apart from the Water-holding Frog Cyclorana platycephalus and Trilling Frog Neobatrachus centralis - Section 5.3.4), fish and aquatic invertebrates are largely confined to the wetlands of Association 8.4.4, but refer to individual subsections pertinent to these groups for more details.

A comparative analysis of these different perceptions of habitat should enable the elucidation of the similarities and differences between the individual perceptions of habitat and also, the deficiencies within each or which are common to both. Moreover, a similar comparison between the habitats identified during the present survey and those recognised previously should provide a sound basis for the development of a uniformly acceptable habitat inventory.

5.4.2 The Habitat of Plants and Animals in Association 8.4.4

The habitats of Association 8.4.4 can be essentially divided into two distinct groups i.e. dryland and wetland habitats. Dryland habitats are generally fixed, although their areal extent may vary during exceptional seasons due to partial inundation (Section 5.2.7.3.2.4). Wetland habitats, however, have both a fixed (perennial vegetation dominated) component and a variable (ephemeral vegetation dominated or aphytal) component. In fact, most wetland habitats are extremely facile and only have temporary tenuous rigidity following rains or flooding when they become transformed into more-or-less luxuriant areas of land surface (Section 5.2.7.3.2.4).

It is the nature of the season which determines the degree of expression of habitat potential. And, this dynamicity in habitats of the study area which makes complete habitat resolution impossible in the short-term. Hence, only long-term monitoring can elucidate the full range of habitats in Association 8.4.4.

So far in this report wetlands have been largely ignored, except in referring to the habitats of, for example, birds as 'aquatic' (open, cover and/or edge - Table 8, opp. p. 88) or similarly of reptiles as 'aquatic' (see Table 9, opp. p. 89). Also, in delineating habitats identified on the basis of plant communities, emphasis has been on fixed, accessible areas of land surface studied during a period of approximately five weeks field work in the latter half of 1983 (Section 5.2.7.3.2.5). So, open water habitats e.g. dominated by the free floating hydrophyte Pacific azolla Azolla filiculoides, which are frequently of short duration have been excluded.

An attempt has been made previously in this report to separate wetland habitats in broad terms (Section 4.3.4.2.2) using the assumption that definable vegetation types could be correlated with specific frequency of inundation. This has been indicated to be the case from available data, but the relationship is much more complex than originally thought (Section 2.5.2.6). In addition, the lack of data on most floodplains in Association 8.4.4 means that although some correlation may be possible between frequency of inundation and vegetation types along the Cooper Creek, it is not yet possible for the Strzelecki and other floodplains in the study area.

Before proceeding with the development of preliminary aspects of what is hoped to be a uniformly acceptable habitat inventory, this would be an opportune point to discuss and classify wetland habitats of the study area based on available information. It should then be possible to correlate the different perception of habitat with a baseline inventory of wetland and dryland habitats and to modify this inventory if (or when) the need arises. Classification of wetlands of the Cooper Creek Environmental Association 8.4.4 is a requirement of Section (2) of the Brief for this project (Appendix A).

5.4.2.1 Wetland Habitats of Association 8.4.4 - A [1&2] Classification

5.4.2.1.1 Introduction

At its driest, following an extended drought (as occurred in 1982 - Section 2.5.1), the Cooper Creek Environmental Association 8.4.4 may be totally devoid of surface water, except for waters derived or captured by artificial means i.e. by dams and bores. This is after the annual flow along the Cooper Creek has ceased and evaporated (or infiltrated) and which, in 1982, reputedly resulted in the normally permanently inundated Coongie Lakes also becoming dry. The study region at such times would comprise essentially dryland habitat.

At the other extreme, in the event of a Level 3 Flood of the Cooper, as occurred in 1974 (Section 2.5.2), which is accompanied by well above average local rainfall (also in 1974, when rainfall at Innamincka, for example, was nearly six times average - Appendix D), the Cooper Creek Environmental Association 8.4.4 may be comprised of up to 75% wetland habitat. This is when all floodplains are inundated, along with salt lakes and claypans within dunefields and gibber areas. Much of this wetland habitat may be of short duration e.g. entire (shallow) lakes were seen to turn from various states of inundation to totally dry apart from fresh ephemeral growth within the time span of several days following the 1983 flow of the Cooper Creek (Mr L.W. Best, pers. comm.). Other areas of wetland habitat, due to their greater depth, may hold water for several years after significant flooding and then may remain dry for decades unless replenished by other flows or local rainfall.

A comparison of the two extremes above will show that wetlands are indeed "... a rapidly changing, dynamic situation ..." (Cowling, 1978) in Association 8.4.4. And, any pertinent attempt at their classification must take account of the extremes of variability of wetland habitats in the study area. Another factor to consider is how to properly define wetland habitats. The definition of habitat, as an area of land surface with consistent soils, vegetation and topographic elements, which is being utilised (Section 5.2.7.1), is readily applicable when considering generally dryland areas, however, there may be some difficulty in in applying this definition to wetlands. This clearly needs some discussion.

Before proceeding with the development of a wetland classification and

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[1] Two separate, additional attempts are being made by officers of the Department of Environment and Planning to classify wetland habitats in the study area. In one of these, LANDSAT imagery is being employed to classify wetland habitat (mostly on the basis of vegetation) in the Coongie Lakes (test) area, with the capacity to classify up to 24 units. This classification is then to be used in order to monitor the changes in the amount of habitat available to waterfowl (by analysis of scenes to give the type of vegetation community on the floodout areas of the creek and lakes, and the area of each community inundated at the time of each of four scenes - as near as possible to the dates: 15th April 1983, 30th September 1983, Mid January 1984 and Mid May 1984) and to relate these changes to stream flow in Coopers Creek as gauged at the Nappa Merrie station. In the second study, an attempt is being made to classify wetland habitats according to waterfowl usage (on the basis of aerial waterfowl counts). On the completion of both studies an attempt will be made to determine whether there is any correlation between them. Both studies are however restricted to the Cooper, whereas the present classification applies to the whole of 8.4.4

[2] During the development of any classification, there is a need to field test during the developmental stages. This was not possible due to time constraints during the present survey and must therefore await a future field trip(s).

discussing the applicability of the habitat definition to wetlands, a review of relevant literature is in order.

5.4.2.1.2 Background to the Wetland Classification of Association 8.4.4

Wetlands fall into two major categories i.e. lotic environments (running waters) such as rivulets, streams or creeks and rivers, and lentic environments (standing bodies of water) such as lakes, ponds and pools (Bayly and Williams, 1973). Lotic environments generally exhibit unidirectional flow (with associated biota adapted to such flow), considerable fluctuations in flow rate, relatively unstable bottom areas and generally coherent shore regions (due to the presence of riparian woodland or other stabilising vegetation), linear morphology, relative shallowness and, as a rule, greater turbidity, O_2 concentration and terrestrial/aquatic interchange than lentic environments (Hynes, 1970; Bayly and Williams, 1973). Lentic environments may or may not be a component of lotic environments and hence, will either be open (have an outlet or give rise to a lotic system) or closed (there is no outlet at any time), are usually relatively stable, with a concentric zonation of stabilising vegetation, concentric morphology and relatively low turbidity, O_2 concentration and terrestrial/aquatic interchange. The majority of lentic environments are relatively shallow due to their being the focus of past or present cycles of sedimentation, but their depths depend on the nature of inundation. Pools within major channels will generally be flushed out during more significant flows, whereas those within more minor channels will (or may) not. The depth of claypans (and salt lakes) will depend on their susceptibility to wind action and their location relative to sources of sediment supply.

The main morphological parameters of streams and rivers (lotic systems) are maximum and minimum depth, width of actual water surface, width at bank-full discharge, surface area, cross-sectional area, water volume, extent of shoreline, mean (transverse) slope, shoal (shallow) area, longitudinal gradient, and discharge (all self-explanatory terms - Bayly and Williams, 1973). Width, mean depth and mean velocity vary as a power of discharge, so wetlands will be altered by changes in flow regime (Hynes, 1970), and as a consequence the variability of wetlands, particularly flow dependent wetlands, will depend on the variability of flows. Wetland classification schemes in arid areas subject to flood must consider this factor of variability (Hynes, 1970).

Hynes (1970), says: " It is quite possible that the concept of stream order (as part of an analysis of drainage patterns) may prove to be of considerable value in biological studies if only to serve as an objective way of classifying watercourses ". Such a classification depends on the amount of time water actually flows along channels (Hynes, 1970), which is an important consideration in the present study.

Standing bodies of water (lentic systems) are made up of several parts. The open water areas of such lentic environments are termed the limnetic region, while the bottom areas are termed the benthic region. The benthic region of a lake, pond or pool is comprised of littoral (near shore area) and profundal (bottom area) parts.

In classifying wetlands in general, the amount of time water actually remains in lotic or lentic systems is of prime importance. Evaporation rate in relation to surface area and depth of a particular wetland habitat determines the duration of such a wetland i.e. once it has achieved its maximum water level under the prevailing source of the water. The evaporation rate in Association 8.4.4 (in the order of 3 958 mm - Section 1.1), results in the majority of wetlands being short-lived apart from the deeper waterholes and lakes (Section

2.5.1.2).

When considering wetland habitats in their role as habitat for plants and animals, there is no need to consider those wetlands which are so short-lived that there is insufficient time for a biota to develop within their bounds. Only biologically applicable wetlands (see Hynes, 1970) are considered in this study.

" Several schemes of wetland classification have been proposed ... and local systems for specific areas varying both in size and complexity have been developed ... . Such systems took account of combinations of water regime, salinity, plant species and their abundance and cover, and ratios of emergent vegetation to open water. Most classifications recognise problems associated with the variety of water regimes, and physical and chemical factors which may occur. However, wetlands have usually been classified by the predominant plant community, even though small, less abundant communities may be more important to the ecology of waterbirds using the wetlands." (Corrick and Norman, 1980). Corrick and Norman (op. cit.) provide a succinct summary of previous wetland classifications albeit somewhat biased in favour of their subject of interest which is waterbirds. They, in fact, assigned wetlands " ... to categories, based on their water requirements and salinity and subcategories were established using vegetational differences ".

In a more recent treatise, Cowardin (1982) used a hierarchial structure to classify wetland habitats, because of the " ... difficulty of defining such attributes as salinity, permanence, and water depth ... " and the need for " ... supplemental data, such as bottom contour maps and sample data gathered over time ... ". Cowardin (op. cit.) started with ecosystems i.e. marine, estuarine, riverine, lacustrine and palustrine, divided these into subsystems " ... according to traditional hydrologic characteristics, such as subtidal, intertidal, or littoral and limnetic ", and further divided subsytems into classes that " ... are defined by life form of the vegetation, where it is present, or the composition of the substrate, where vegetation is absent ". Additional corollary information, such as water regime (e.g. saturated, regularly flooded, seasonally flooded), water chemistry (e.g. fresh-acid, oligosaline, mixohaline), soil (organic vs mineral) and dominance type (plant dominant(s)) is included when classifying an individual wetland.

This latter classification scheme, although thorough, is lacking in that there are no singularly descriptive terms that summarise the classificatory information. Corrick and Norman (1980) show the value of such terminology e.g. flooded river flats or herb-dominated shallow freshwater marshes, which are easily understandable and therefore readily communicable.

A combination of both schemes would be a viable proposition. It would then be up to the user whether he or she wishes to be purely descriptive (as Corrick and Norman, 1980) or to use single defined terms (as Cowardin, 1982). Both systems have their merits and are reasonably compatible. In the present study, however, we are limited by the requirements of the Brief.

In conclusion and most importantly, " ... classifications label places, they do not produce information " (Freyer et al., 1978 in Cowardin, 1982), so the success of a classification scheme is dependent on the availability of the appropriate data to fit the classification (Cowardin, 1982).

5.4.2.1.3 Requirements of the Brief in Relation to Wetlands

Section (2) of the Brief for this project (Appendix A) requires the following in relation to wetlands:

" Classification of wetlands within the Cooper Creek Environmental Association having regard for areal extent, permanence, depth and associated flora and fauna ".

At this point it is appropriate to discuss the applicability of the habitat definition (Section 5.2.7.1) to wetlands. If it is found to be inappropriate a modified definition is likely necessary. It should then be possible to classify the wetlands of the study area as per the Brief.

5.4.2.1.4 Wetland Habitat(s) - A Discussion of the Applicability of the Habitat Definition

The definition of habitat, as an area of land surface with consistent soils, vegetation and topographic elements, which is being utilised (Section 5.2.7.1), should, if it is valid, apply equally well to wetland and dryland habitats. But, does it in fact do so?

Corrick and Norman (1980), recognise wetlands as simply " ... areas temporarily or permanently inundated ". Briggs (1981), carries this a little further by recognising a depth aspect i.e. " Wetland is an imprecise term that usually describes land permanently or temporarily covered by up to two metres of water ". Taking these two definitions together, it should be evident that wetlands are essentially definable areas of land surface submerged to a depth of up to 2 m for some part of their existence. This implies that wetlands have an areal extent, limitations to depth, and a comparable degree of permanence, all of which are physical measurable attributes and of prime importance in most wetland classifications; of secondary concern are the biotic attributes of associated flora and fauna of wetlands, with most consideration usually given to the former because it is fixed in the landscape (at least in the short-term).

Wetlands are definable areas of land surface. Definable in terms of soils, vegetation and topographic elements, and are utilised as recognised by the habitat definition. The habitat definition though is lacking in that it does not account for the presence (temporary or otherwise) of water.

Cowardin (1982), for example, says that: " Wetland refers to a portion of the continuum from terrestrial to aquatic sites ", which has traditionally " ... been defined in terms of <u>hydrology</u>, soils and vegetation ". Cowardin (op. cit.) goes on to use a United States Fish and Wildlife Service (FWS) definition i.e. " Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water ", and, " ... must have one or more of the following attributes:
(1) at least periodically the land supports hydrophytes (... those plants growing in water or wet soil (Sculthorp, 1967 in Cowardin, op. cit.) ... . FWS is developing a national list of hydrophytes ...);
(2) the substrate is predominantly undrained hydric soil (... those soils wet enough to support hydrophytic vegetation ... . the Soil Conservation Service is developing a national list of hydric soils ...);
(3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year ". In addition, " ... permanently flooded areas below the limit of wetland are termed deepwater habitats ... " (Cowardin, op. cit.).

The habitat definition therefore requires modification to account for the presence of water in wetland habitats.

5.4.2.1.5 Wetland Habitat(s) - A Definition

A deficiency has been recognised in the preceding subsection in relation to the inability of the habitat definition (Section 5.2.7.1) to account for the presence of water in wetland habitats. According to Briggs (1981), wetlands usually comprise lands covered by shallow, non-tidal water. A maximum depth of 2 m is indicated by Briggs (op. cit.) to be the usual depth limit to wetlands. Including this depth aspect, and the aspect of temporary or permanent inundation (Corrick and Norman, 1980; Briggs, 1981; Cowardin, 1982) a viable definition of wetland habitat is an area of land surface with consistent soils, vegetation and topographic elements, which is being utilised, and, which is temporarily or permanently inundated by up to 2 m of water.

Having defined wetland habitats and accepted the habitat definition (Section 5.2.7.1) as being generally applicable to dryland areas, there is still one area of land surface not accounted for in either definition. This area is that covered by waters deeper than 2 m i.e. deepwater habitats.

5.4.2.1.6 Deepwater Habitat(s) - A Definition

Cowardin (1982) considers "... permanently flooded areas below the limit of wetlands ... " as deepwater habitats, but very few (if any) deepwater areas in the arid zone are permanently inundated. Most deepwater areas in the arid zone carry water through a number of seasons after significant rains or flooding or are regularly replenished by river flows, such as occurs along the Cooper. Others, however, are only temporary. Deepwater habitats are therefore temporarily or permanently inundated by greater than 2 m of water. A revised definition of deepwater habitat as an area of land surface with consistent soils, [1]vegetation and topographic elements, which is being utilised, and, which is temporarily or permanently inundated by a greater than 2m of water, may therefore be an acceptable definition for general application to Australian inland waters.

According to Cowardin (1982), the " ... separation of wetlands from deepwater aquatic habitats with which they are frequently associated " does " not make sense ecologically ". In support of Cowardin's (op. cit.) contention, it is noted that the term wetland has often been applied as a collective term for water bodies, which are (according to the definitions above) comprised of both wetland habitat and deepwater habitat. Notwithstanding this, there appear to be a number of species of bird, for example, which actually prefer 'deeper waters', such as Australian Grebe *Tachybaptus novaehollandiae*, Hardhead *Athya australis* and Musk Duck *Biziura lobata* (Environmental Research and Planning Group, 1980; this survey), so there is some ecological sense in maintaining the separation of wetlands from deepwater habitats (*contra* Cowardin, op. cit.). What may be warranted, however, is a revision of the depth of water at which separation of wetland habitats from deepwater habitats is made. The 2 m depth division (see Briggs, 1981) appears to be an arbitrary choice, and in maintaining its application in this study we are merely conforming with what appears to be a generally accepted characteristic used to define wetlands. Surely, rather than recognising a mandatory depth separation of 2 m, it would be more appropriate to use a depth which has some ecological bearing e.g. the maximum depth at which rooted vegetation occurs within a particular water body.

5.4.2.1.7 Wetland Habitats of Association 8.4.4 - A Classification

The wetlands of Association 8.4.4 are an integral part of the Lake Eyre Drainage Basin. They are predominantly ephemeral in nature, with more permanently inundated areas restricted to those parts of the Cooper Creek influenced by average annual flows (Section 2.5.2.6). Low annual rainfall, high rainfall variability and high evaporation rate makes local runoff an irregular, short-lived, unpredictable, but important influence. Still, floods of various intensity

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[1]Vegetation of deepwater habitats comprises free floating hydrophytes.

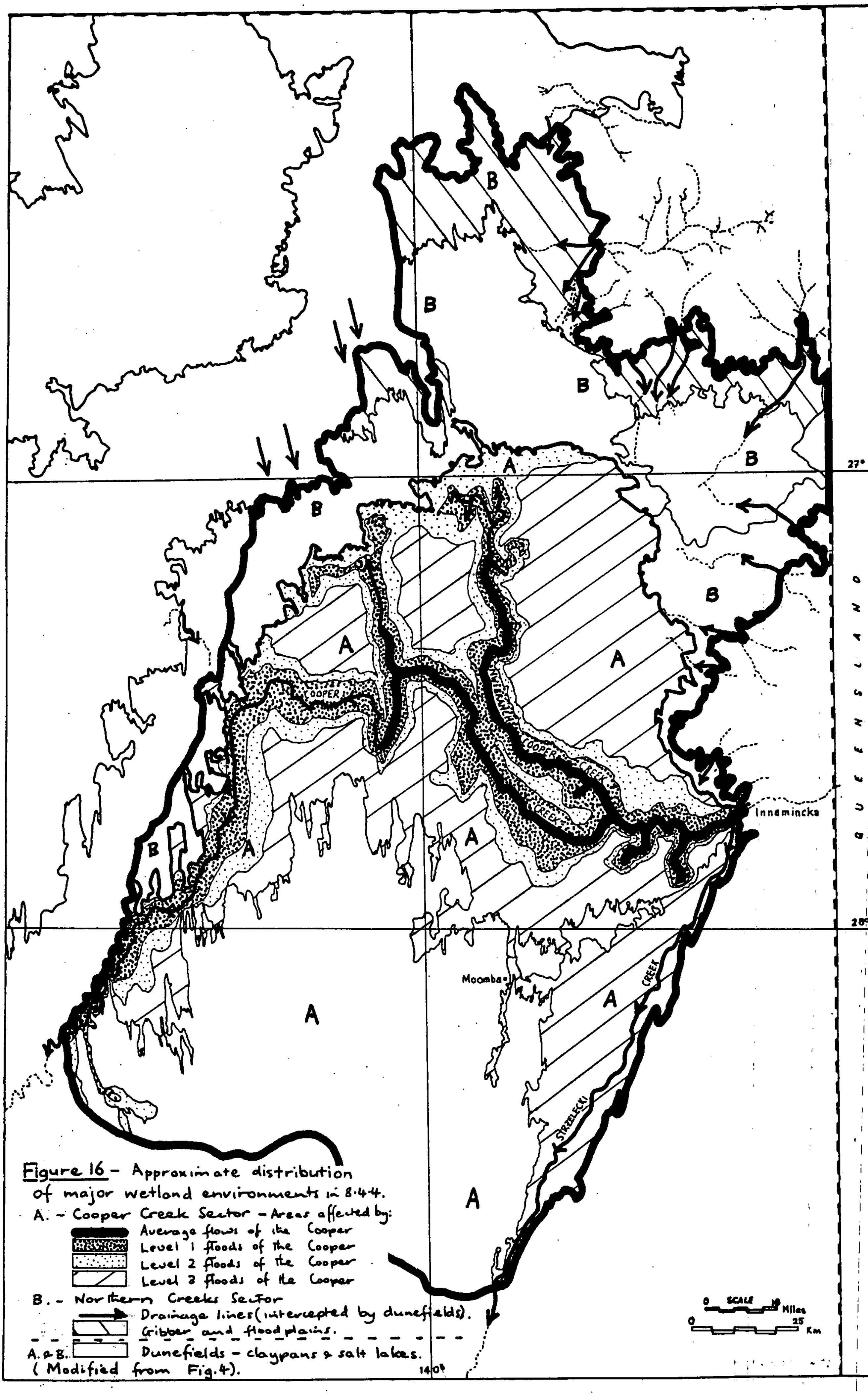

Figure 16 - Approximate distribution of major wetland environments in 8.4.4.

A. - Cooper Creek Sector - Areas affected by:
- Average flows of the Cooper
- Level 1 floods of the Cooper
- Level 2 floods of the Cooper
- Level 3 floods of the Cooper

B. - Northern Creeks Sector
- Drainage lines (intercepted by dunefields).
- Gibber and floodplains.

A. & B. Dunefields - claypans & salt lakes.
(Modified from Fig. 4).

along Cooper Creek are the prime determinant of wetland location, extent and degree of permanence in a large part of the study area. Basinal shape and depth of wetlands is, however, only influenced by the more intense floods, which bring about landscape change in the essentially soft rock environment.

Pending a detailed analysis of stream order as part of an analysis of drainage patterns, which may be useful for classification purposes (Hynes, 1970), initial broad subdivision of the study area is only possible at this stage (Fig. 4, opp. p. 13). If this is carried one step further to include the four classes of flow identified for the Cooper Creek (and its distributaries), the one class for the Strzelecki (Section 2.5.2.6), and general information about other parts of the study area, it is possible to delimit the approximate distribution of major wetland environments in Association 8.4.4 (Fig. 16).

The wetlands generally are confined to intermittent or episodic streams and associated floodplains, claypans and salt lakes within dunefields, clay lenses and gutters in gibber plains, ubiquitous temporary pools, and artificial waters, such as dams and bore streams. These wetland areas apparently comprise all areas that are inundated for any period, however, the distinction has been made previously (Section 5.4.2.1.6) between wetland habitats and deepwater habitats with which they are frequently associated (Cowardin, 1982). A broad division of the land surface can therefore be made in terms of dryland habitats, wetland habitats and deepwater habitats. This division is made solely on the basis of depth of water i.e. the division between dryland and wetland habitats is the air/water interface, while the division between wetland and deepwater habitats is made at a water depth of 2 m.

Depth is one of the three physical component parameters of the Brief for this classification. The other two are areal extent and permanence. The classification used here consists of a primary classification based on these three physical attributes, with further subdivision based for the most part on associated flora, which is the common trend in classifying wetlands (e.g. Corrick and Norman, 1980; Cowardin, 1982), and additional input based on associated fauna (as per the Brief).

The three physical attributes of wetlands, namely: areal extent, permanence and depth are somewhat related. Areal extent, which for the purposes of this report is defined as the maximum areal extent as determined by the normal confining limits of a particular [1]water body, is inversely related in a general way to the physical attribute of permanence i.e.

$$\text{permanence (p)} \propto \frac{1}{\text{areal extent (a.e.)}} \qquad \ldots\ldots\ldots\ldots\ldots(1).$$

In real terms, with all other factors equal, this means that the larger, more extensive water bodies (that have a greater surface area open to evaporation) tend to be more short-lived (ephemeral) in a relative sense than smaller water bodies. Depth, on the other hand, which is defined as the maximum depth possible within the normal confing limits of a particular water body, is related directly to permanence i.e.

$$\text{permanence (p)} \propto \text{depth (d)} \qquad \ldots\ldots\ldots\ldots\ldots(2).$$

This means that the deeper water bodies tend to be more permanent.

It is not really feasible though to take these physical attributes in isolation, as it is the combined effects of areal extent and depth which determines the permanence of a particular water body. If (1) and (2) are combined, the following Water Body Permanence Relationship is arrived at i.e.

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[1]A water body comprises wetland habitat and, where it exists, adjacent deepwater habitat.

$$\text{permanence (p)} = k \cdot \frac{\text{depth (d)}}{\text{areal extent (a.e.)}} \qquad \ldots\ldots\ldots\ldots(3)$$

where k is a constant for a particular water body. The constant k takes into account the shape of a particular water body e.g. channel (linear) vs lake (concentric), and the nature of other factors which may influence its degree of permanence, such as the presence of fringing vegetation which may impede wind derived or evaporative water losses.

The essential features of the Water Body Permanence Relationship (3) enable the prediction of permanence e.g. deeper, smaller water bodies will be more permanent, while shallow, extensive water bodies will be less-so. This relationship only describes the duration of particular water bodies that have received sufficient water to ensure that they are filled to capacity. However, the water in water bodies of Association 8.4.4 may be derived from either local runoff only or from both local runoff and river flows. In addition, some water bodies are regularly inundated, whilst others are only very infrequently inundated. Hence, the permanence of a particular water body will depend not only on areal extent, depth and the factors taken into account in the constant k (above), but also the nature and regularity of receipt of water.

Water bodies in Association 8.4.4, range in areal extent from very small, through small, medium and large to very large, in permanence from extremely ephemeral, through very ephemeral, ephemeral and semi-permanent to near-permanent, and, in depth from very shallow, through shallow, moderately deep and deep to very deep. As there is little accurate quantitative data available on the study area in relation to areal extent, permanence or depth, the attribute descriptors used in the preceding sentence will be employed as the basis for the primary classification of wetlands of Association 8.4.4. The attribute descriptors used for areal extent and depth are viewed in a relative sense, whereas the attribute descriptors for permanence are defined as follows:

extremely ephemeral (÷ least frequently inundated) - subject to inundation from local runoff only.

very ephemeral (÷ least frequently inundated) - subject to inundation from Level 3 Floods of the Cooper and local runoff only; or in the case of other floodplains in the north of 8.4.4, subject to inundation from flows emanating from elevated areas of the Cordillo Surface outside the study area or more rarely from overflows of the Diamantina River, and from local runoff.

ephemeral (÷ less frequently inundated) - subject to inundation from all classes of flow, except average annual flows and Level 1 Floods of the Cooper and local runoff.

semi-permanent (÷ frequently inundated) - subject to inundation from all classes of flow, except average annual flows, of the Cooper and local runoff.

near-permanent (÷ most frequently inundated) - subject to inundation from all classes of flow of the Cooper and local runoff.

In addition to the above, other terms, such as linear or concentric in relation to areal extent may be applied.

Associated flora and fauna are also included as part of the secondary classification. Briggs (1981) defines wetland vegetation as " ... vegetation in shallow, non-tidal water and on land subject to inundation ... ". Wetland vegetation therefore comprises all vegetation found within the normal confining limits of water bodies. The nature of this vegetation is described in the classification as appropriate. In relation to associated fauna, such as birds " ... some wetlands receive more useage than others but most species use a variety of wetland types " (Corrick and Norman, 1980). The same is true for most of the water dependent fauna, so only general statements can be made about associated fauna unless specific data are available. These data are included where appropriate.

Large areas of land surface in the study area have the potential to comprise both wetland and dryland habitat and to a lesser extent deepwater habitat. Where this information is available it is included within the classification.

Taking all the preceding information into account, the wetlands habitats of Association 8.4.4 are classified as follows:

Wetland Habitat 1: Dryland equivalent - Habitat 3 in land system Dp1; clay flats in interdunes.

Small, extremely ephemeral, very shallow clay flats in interdunes.

Bare or with ephemeral forbs (see Habitat 3, p. 51); fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 2: Dryland equivalent - Habitat 11 in land system Dp4; claypans in interdunes.

Small - large, extremely ephemeral, shallow claypans in interdunes.

Ephemeral forbs and herbs (see Habitat 11, p. 54) or bare; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 3: Dryland equivalent - Habitat 14 in land system Dp5; claypans in interdunes.

Small, extremely ephemeral, shallow claypans in interdunes.

Sparse emergent and fringing shrubs (see Habitat 14, p. 54); fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 4: Dryland equivalent - Habitat 15 in land system Dp5; [1]salt lakes in dunefields.

Small - large, extremely - very ephemeral, moderately deep salt lakes in dunefields.

Not surveyed for vegetation, although samphire Halosarcia indica ssp. leiostachya and Frankenia spp. are likely to be prominent; fauna includes species of bird that favour open saline lakes e.g. Red-capped Plover Charadrius ruficapillus, and aquatic invertebrates.

Wetland Habitat 5: Dryland equivalent - Habitat 22 in land system Dp8; clay flats in interdunes.

Small, extremely ephemeral, very shallow clay flats in interdunes.

Bare or emergent old man saltbush Atriplex nummularia shrubs; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 6: Dryland equivalent - Habitat 25 in land system Dp9; interdune claypans - hard red clay surfaces.

Small, extremely ephemeral, very shallow claypans in interdunes with hard red clay surfaces.

Bare or ephemeral herbs (see Habitat 25, p. 58); fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 7-11: Dryland equivalents - Habitats 34-38 in land system Dunc;

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[1]Salt lakes by the nature of their formation (Section 2.4.1) are likely to be deeper in general than claypans.

[1]ovoid interdune claypans.

Wetland Habitats 7-10 are very small, concentric, extremely ephemeral, very shallow claypans in ovoid interdunes; Wetland habitat 11 may also be inundated by minor drainage lines (see Habitat 38, p. 62) and is therefore comprised of very small, concentric, extremely - very ephemeral, shallow claypans in ovoid interdunes.

Wetland Habitats 7,8 and 10 are likely to be bare, 9 is likely to be bare or to contain ephemeral forbs, and 11 is likely to be bare or to contain emergent tall grasses (swamp cane grass Eragrostis australasica or umbrella cane grass Leptochloa digitata - see footnote, p. 62), pale spike-rush Elocharis pallens, Queensland bluebush Chenopodium auricomum, ephemeral forbs and herbs; fauna is likely to include birds, ± frogs and aquatic invertebrates.

Wetland Habitat 12: Dryland equivalent - Habitat 44 in land system Fc1; major channels(with pale grey silty clay or cracking clay soils).

Medium, linear, ephemeral - near-permanent, moderately deep - very deep major channels.

Aphytal or with mats of Pacific azolla Azolla filiculoides (free-floating hydrophyte) and/or emergent and overhanging fringing vegetation (see Habitat 44, p. 64); fauna includes mammals, birds, reptiles, frogs, fish and aquatic invertebrates.

Wetland Habitat 13: Dryland equivalent - Habitat 45 in land system Fc2; [2]minor channels (with grey silty clay soils).

Small, linear, ephemeral - near-permanent, shallow minor channels.

Overhanging fringing vegetation with emergent herbs e.g. nardoo Marsilea drummondii; fauna may infrequently include mammals, birds, reptiles, frogs, fish and aquatic invertebrates.

Wetland Habitat 14: Dryland equivalent - Habitat 46 in land system Fc3; major, drier channels (with silty clay soils).

Medium, linear, ephemeral - semi-permanent, moderately deep - deep major, drier channels.

Aphytal or with overhanging fringing vegetation of a much reduced areal extent and species composition than vegetation fringing Wetland Habitat 12 (see Habitat 46, p. 67); fauna may at times include mammals, birds, reptiles, frogs, fish and aquatic invertebrates.

Wetland Habitat 15: Dryland equivalent - Habitat 47 in land system Fc3; floodout (with silty clay soils).

Large, ephemeral - semi-permanent, very shallow - shallow floodout.

Emergent dense lignum Muehlenbeckia cunninghamii with an open coolibah Eucalyptus microtheca overstorey; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 16; Dryland equivalent - Habitat 48 in land system Fc4; minor, drier channels (with silty clay soils).

Small, linear, ephemeral, shallow minor channels.

Aphytal with open fringing woodland; fauna may at times include mammals, birds reptiles, frogs, fish and aquatic invertebrates.

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[1]Insufficient data to subdivide further (see Footnote, p. 59).

[2]Minor channels (and drainage lines) are those which attain a maximum depth of less than 2 m within their normal confining limits i.e. they don't contain deepwater habitat.

Wetland Habitat 17: Dryland equivalent - Habitat 49 in land system Fc4; floodout (with silty clay soils).

Large, ephemeral, very shallow floodout.

Emergent coolibah E. microtheca and coobah Acacia stenophylla trees; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 18: Dryland equivalent - Habitat 50 in land system Fc5; relict channels (with pale sandy clay soils).

Very small, linear, ephemeral, shallow relict channels.

Fringing woodland and shrubland with shrubs likely to be encroaching into the channels (see Habitat 50, p. 68); fauna is likely to include birds, ± frogs and aquatic invertebrates.

Wetland Habitat 19: Dryland equivalent - Habitat 51 in land system Fc6; floodout (with hard grey non-cracking clays of saline depressions).

Small, concentric, ephemeral, shallow floodout in the vicinity of saline depressions.

Emergent samphire and chenopod shrubland with a very open coolibah overstorey (see Habitat 51, p. 68 for species of chenopods); fauna includes birds and aquatic invertebrates.

Wetland Habitat 20: Dryland equivalent - Habitat 52 in land system Fc7; swamps that are partly channelled with fine drainage lines (with grey cracking clay soils).

Small - large, semi-permanent - near-permanent, very shallow - moderately deep swamps.

Emergent Muehlenbeckia cunninghamii shrubs, with Eleocharis pallens, Marsilea drummondii and Azolla filiculoides growing in or on the water; this wetland is most conspicuously used by numerous species of bird as nesting and feeding habitat, while mammals, frogs, fish and aquatic invertebrates are likely also - fish and mammals were not recorded this survey.

Wetland Habitat 21: Dryland equivalent - Habitat 53 in land system Fc7; fine drainage lines or channels in swamps (with grey cracking clay soils).

Small, linear, semi-permanent - near-permanent, shallow fine drainage lines or channels in swamps.

Emergent M. cunninghamii shrubs and occasional E. microtheca and A. stenophylla trees on channel fringes and mats of Azolla filiculoides floating in water; fauna is likely to include mammals, birds, reptiles, frogs, fish and aquatic invertebrates at times.

Wetland Habitat 22: Dryland equivalent - Habitat 54 in land system Fc8; swamp - flat plain with braided channels (with grey cracking clay soils with silty sections).

Medium, semi-permanent - near-permanent, shallow swamps with braided channels.

Emergent M. cunninghamii and Chenopodium auricomum shrubs and scattered trees of A. stenophylla; mammals, birds, reptiles, frogs, fish and aquatic invertebrates are likely components of the fauna with birds probably most abundant.

Wetland Habitat 23: Dryland equivalent - Habitat 55 in land system Fc8; braided channels (with grey cracking clay soils with silty sections).

Small, linear, semi-permanent - near-permanent, shallow braided channels in swamps.

Emergent fringing M. cunninghamii at channel edges, where Eucalyptus microtheca is thought to be the dominant overstorey tree in fringing woodland - channels are probably mostly aphytal within their normal confining limits, but further data is required to confirm this; mammals, birds, reptiles, frogs, fish and aquatic invertebrates are likely components of the fauna.

Wetland Habitat 24: Dryland equivalent - Habitat 56 in land system Fc9; parts of floodplains resembling swamps (with grey clay soils).

Medium, ephemeral - semi-permanent, shallow parts of floodplains resembling swamps.

Emergent M. cunninghamii shrubs with occasional patches of E. microtheca; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 25: Dryland equivalent - Habitat 57 in land system Fc10; floodout (with grey clay soils).

Medium, ephemeral, very shallow - shallow floodout.

Emergent M. cunninghamii shrubs; birds, ± frogs and aquatic invertebrates are probable components of the fauna.

Wetland Habitat 26: Dryland equivalent - Habitat 58 in land system Fc11; floodout beyond fringing woodland of Wetland Habitats 12 and 13 (with grey cracking clay soils).

Small - medium, ephemeral - near-permanent, shallow floodout.

Emergent M. cunninghamii with scattered E. microtheca and Chenopodium spp.; fauna includes birds, ± frogs, ± fish and aquatic invertebrates.

Wetland Habitat 27: Dryland equivalent - Habitat 59 in land system Fc12; floodout at the extremities of the Cooper Creek floodplain (with clay soils).

Medium, ephemeral - semi-permanent (- near-permanent), shallow floodouts at the extremities of the Cooper Creek floodplain.

Emergent M. cunninghamii shrubs and scattered E. microtheca; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 28: Dryland equivalent - Habitat 60 in land system Fc13; floodout (with clay soils).

Small, semi-permanent - near-permanent, shallow floodout.

Emergent M.cunninghamii shrubs with scattered E. microtheca, A. stenophylla, Atalaya hemiglauca and Lysiphyllum gilvum; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 29: Dryland equivalent - Habitat 61 in land system Fc14; slightly saline floodout (with sandy clay soils).

Small, semi-permanent - near-permanent, moderately deep slightly saline floodout.

Emergent Halosarcia indica ssp. leiostachya with A. victoriae, M. cunninghamii, Cassia nemophila var. zygophylla and Atriplex nummularia also sometimes present; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 30: Dryland equivalent - Habitat 62 in land system Fc15; floodout (with grey cracking clay soils).

Medium, ephemeral - semi-permanent, shallow floodout.

Emergent Atriplex nummularia shrubs with scattered M. cunninghamii, C. auricomum and E. microtheca also present; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 31: Dryland equivalent - Habitat 63 in land system Fc16; floodout at the extremities of the Cooper Creek floodplain (with clay soils).

Small, ephemeral - semi-permanent, shallow floodout at the extremities of the Cooper Creek floodplain.

Emergent A. nummularia shrubs with M. cunninghamii and C. auricomum also present; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 32: Dryland equivalent - Habitat 64 in land system Fc16; floodout (with clay soils).

Very large, ephemeral - semi-permanent, shallow floodout.

Emergent A. nummularia shrubs; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 33: Dryland equivalent - Habitat 65 in land system Fc17; floodout (with grey cracking clay soils).

Small, ephemeral, shallow floodout.

Emergent Eragrostis australasica grass tussocks with infrequent occurrences of A. nummularia and E. microtheca associates; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 34: Dryland equivalent - Habitat 66 in land system Fc18; floodout (with grey cracking clay soils).

Small, ephemeral, shallow floodout.

Emergent Chenopodium nitrariaceum shrubs; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 35: Dryland equivalent - Habitat 67 in land system Fc19; (more permanently inundated) terminal lake margin (with sandy clay soils - probably slightly saline).

Large, concentric, ephemeral, shallow near-permanent terminal lake margins.

Emergent Halosarcia indica ssp. leiostachya with occasional M. cunninghamii; fauna probably includes birds, ± frogs, ± fish and aquatic invertebrates.

Wetland Habitat 36: Dryland equivalent - Habitat 68 in land system Fc20; floodout = clay flats within floodplains bordering slat lakes (with saline clay soils).

Small - medium, ephemeral, very shallow clay flats within floodplains bordering salt lakes.

Emergent Halosarcia indica ssp. leiostachya, with Cyperus gymnocaulos, chenopods, ±coolibah and other shrubs; fauna includes birds such as the Night Parrot Geopsittacus occidentalis (the last locality record of the species in 8.4.4 in 1979 was in this habitat - see Section 5.3.2.4), ± frogs and aquatic invertebrates.

Wetland Habitat 37: Dryland equivalent - Habitat 69 in land system Fc21; floodout - very open clay flats at the extremities of floodplains.

Small, ephemeral, very shallow, very open clay flats at the extremities of floodplains.

Emergent chenopods with fringing Gunniopsis quadrifida, H. indica ssp. leiostachya and C. auricomum shrubs; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 38: Dryland equivalent - Habitat 70 in land system Fc21; terminal lake = ephemeral lakes (with clay soils).

Medium, ephemeral, shallow terminal lakes.

Vegetation essentially the same as Wetland Habitat 37 (see Habitats 69 and 70, p. 73); fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 39: Dryland equivalent - Habitat 71 in land system Fc22; floodout at the extremities of the Cooper Creek floodplain (with grey cracking clay soils).

Large - very large, very ephemeral, shallow floodout at the extremities of the Cooper Creek floodplain.

Scattered emergent E. microtheca, with very occasional Maireana aphylla, M. pyramidata and Enchylaena tomentosa shrubs; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 40: Dryland equivalent - Habitat 72 in land system Fc22; terminal lakes at the extremities of the Cooper Creek floodplain (with grey cracking clay soils).

Large - very large, very ephemeral, shallow (- ? moderately deep) ephemeral lakes at the extremities of the Cooper Creek floodplain.

Vegetation essentially as for Wetland Habitat 39 - ephemeral lakes are however, often bordered with E. microtheca, M. cunninghamii and Chenopodium spp.; fauna includes birds (see Appendix S for birds recorded on Lake Oolgoopiarie - frequently in large numbers), ± frogs and aquatic invertebrates.

Wetland Habitat 41: Dryland equivalent - Habitat 73 in land system Fc23; floodout - hard grey clay flats.

Small, very ephemeral, very shallow hard grey clay flats of floodout.

Occasional scattered emergent M. cunninghamii, C. nitrariaceum and low E. microtheca; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 42: Dryland equivalent - Habitat 74 in land system Fc24; terminal lake - extensive ephemeral lakes of the central Cooper Creek floodplain (with grey cracking clay soils).

Very large, very ephemeral, shallow lakes of the central Cooper Creek floodplain.

Aphytal or with occasional A. nummularia on edges; fauna birds, ± frogs and aquatic invertebrates.

Wetland Habitat 43: Dryland equivalent - Habitat 75 in land system Fc25; minor channels leading into ephemeral lakes (with clay soils).

Very small, linear, very ephemeral - ephemeral, shallow minor channels leading into ephemeral lakes.

Aphytal apart from fringing vegetation which may partly encroach on channel margins; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 44: Dryland equivalent - Habitat 76 in land system Fc25; terminal lake (with clay soils).

Medium, very ephemeral - ephemeral, shallow ephemeral lakes.

Aphytal; fauna birds, ± frogs and aquatic invertebrates.

Wetland Habitat 45: Dryland equivalent - Habitat 77 in land system Fc26; terminal lake - smaller, drier ephemeral lakes than Wetland Habitat 44 (with hard, grey, usually non-cracking clay soils).

Small - medium, very ephemeral, very shallow ephemeral lakes.

Aphytal or with occasional emergent forbs; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 46: Dryland equivalent - Habitat 78 in land system Fsl; channels of the Strzelecki Creek floodplain (with pale silty clay soils).

Medium, linear, very ephemeral, shallow - moderately deep channels of the Strzelecki Creek floodplain.

Aphytal or with emergent and overhanging fringing vegetation (see Habitat 78, p. 77); fauna includes birds, frogs, ± fish and aquatic invertebrates.

Wetland Habitat 47: Dryland equivalent - Habitat 79 in land system Fs2; floodout (with generally clay soils).

Very small, very ephemeral, shallow floodout.

Emergent M. cunninghamii and C. auricomum shrubs, with occasional Eremophila bignoniiflora and E. microtheca; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 48: Dryland equivalent - Habitat 80 in land system Fs3; floodout (with grey silty clay soils).

Very large, very ephemeral, shallow floodout.

Emergent A. nummularia shrubs, with associated Chenopodium spp., M. cunninghamii and E. australasica, and E. microtheca, Eremophila bignoniiflora and A. victoriae trees also occasionally present; fauna includes birds, frogs, ± fish and aquatic invertebrates.

Wetland Habitat 49: Dryland equivalent - Habitat 81 in land system Fs4; floodout (with generally clay soils).

Very large, but patchy, very ephemeral, shallow floodout.

Emergent E. australasica grass tussocks, with associated chenopods, and occasional M. cunninghamii, stunted A. nummularia, Chenopodium nitrariaceum and Enchylaena tomentosa; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 50: Dryland equivalent - Habitat 82 in land system Fs5; floodout sections at the extremities of the Strzelecki Creek floodplain (with yellow-grey silty clay soils).

Medium - large, very ephemeral, shallow floodout sections at the extremities of the Strzelecki Creek floodplain.

Aphytal or with possible emergent Frankenia spp.; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 51: Dryland equivalent - Habitat 83 in land system Fs5; terminal lake - ephemeral lakes of the Strzelecki Creek floodplain (with yellow-grey, hard silty clay soils).

Medium - large, very ephemeral, shallow ephemeral lakes of the Strzelecki Creek floodplain.

Emergent occasional C. nitrariaceum and E. australasica, with fringing or overhanging Gunniopsis quadrifida, H. indica ssp. leiostachya and E. microtheca also recorded; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 52: Dryland equivalent - Habitat 84 in land system Fo1; more major channels near waterholes (with silty clay soils).

Small - medium, linear, very ephemeral, moderately deep to deep channels of the more major creek systems (near waterholes).

Aphytal or with emergent and overhanging fringing vegetation (see Habitat 84, p. 80); fauna includes ± mammals, birds, ± reptiles, ± frogs, (?)± fish, and aquatic invertebrates.

Wetland Habitat 53: Dryland equivalent - Habitat 85 in land system Fo1; more major channels away from waterholes (soils are silty clays).

Small - medium, linear, very ephemeral, shallow - moderately deep channels of the more major creek systems (away from waterholes).

Aphytal or with emergent and overhanging fringing vegetation (see Habitat 85, p. 80); fauna includes ± mammals, birds, ± reptiles, ± frogs, (?)± fish, and aquatic invertebrates.

Wetland Habitat 54: Dryland equivalent - Habitat 86 in land system Fo2; channels in more extensive sand plains (with sandy clay soils).

Small - medium, linear, very ephemeral, shallow - moderately deep channels in more extensive sand plains.

Aphytal or with emergent of overhanging finging vegetation with *Acacia cyperophylla*, *E. microtheca* and *Hakea eyreana* prominent; fauna includes ± mammals, birds, ± reptiles, ± frogs, (?)± fish, and aquatic invertebrates.

Wetland Habitat 55: Dryland equivalent - Habitat 87 in land system Fo3; channels of the minor creek systems (type 1) - soils are generally clays.

Small, linear, very ephemeral, shallow channels of minor creek systems (type 1).

Aphytal or with emergent or overhanging tall *Acacia victoriae*, *A. farnesiana* and occasional *Santalum lanceolatum* shrubs; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 56: Dryland equivalent - Habitat 88 in land system Fo4; channels of the minor creek systems (type 2) - soils are generally clays.

Small, linear, very ephemeral, shallow channels of minor creek systems (type 2).

Aphytal or with emergent or overhanging fringing vegetation with low shrubs of *Cassia phyllodinea* and *C. oligophylla* prominent; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 57: Dryland equivalent - Habitat 89 in land system Fo5; terminal lake floors (with grey cracking clay soils).

Medium - large, very ephemeral, shallow ephemeral lakes.

Aphytal (with fringing emergent or overhanging vegetation of *E. microtheca* trees and occasional *A. nummularia* shrubs over ephemerals - see Habitat 90 in land system Fo5, p. 81); fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 58: Dryland equivalent - Habitat 92 in land system GPls; gibber plain clay lenses (with red duplex soils).

Very small, concentric, extremely ephemeral, very shallow gibber plain clay lenses.

Aphytal or with emergent perennial and ephemeral grasses, chenopods and other herbs and forbs (see Habitat 92, p. 82); fauna includes birds, frogs and aquatic invertebrates.

Wetland Habitat 59: Dryland equivalent - Habitat 94 in land system GPls; small gutters in gibber plains (with red duplex soils).

Small, linear, extremely ephemeral, very shallow gutters in gibber plains.

Aphytal or with emergent and overhanging fringing low *Maireana aphylla*, *C. auricomum*, *A. nummularia*, *Cassia helmsii* and *C. phyllodinea* shrubs; fauna includes birds, ± frogs and aquatic invertebrates.

Wetland Habitat 60: Temporary pools of the Cooper Creek Environmental Association 8.4.4.

Very small, extremely ephemeral, very shallow temporary pools.

Aphytal or with a variety of emergent or fringing vegetation possible; fauna includes birds, frogs and aquatic invertebrates.

5.5 CONCLUSIONS ON HABITATS FLORA AND FAUNA

The preceding detailed treatise is one possible interpretation of the complexity of habitat and associated fauna in the Cooper Creek Environment Association 8.4.4. Given the low level of sampling of the fauna compared with the recognition of a large variety of habitats based on the vegetation, it has proved difficult to integrate the faunal information into this habitat framework. There is a clear need for additional vertebrate sampling in the area and the habitat types now recognised will provide an extremely valuable guide to selection of future sampling sites.

6 VEGETATION CHANGE: THE ECOLOGICAL IMPACT OF CATTLE AND RABBITS

6.1 INTRODUCTION

Although feral horses, camels and donkeys have had an impact, domestic stock and feral rabbits are considered by most to have caused large scale and possibly irreversible changes to the vegetation of some pastoral areas of arid Australia due to overgrazing (e.g. Reeves, 1982). Whether this overgrazing has been deliberate as in the case of cattle grazed by the pastoral industry, for which an 'acceptable' level of disturbance is still being sought (Ratcliffe, 1936; Jessop, 1951; Dawson and Boyland, 1974; Gasteen, 1983), or accidental in the case of the introduced rabbit, the effect is still the same. The vegetation has suffered and continues to suffer under stocking regimes which ignore, in their determination, the associated influences of rabbits, and the fact that the same land also provides habitats for native plant species, mammals, birds, reptiles, frogs, fish and invertebrates (Section 5.2.7.2 - Habitats vs Land Units).

That these grazing regimes have mostly been maintained even through very poor seasons, till "... the country becomes eaten out ...", and that this practise continues to the present day (Vickery in Litchfield, 1983; Section 2.8), attests to the level of consideration afforded to the land since European settlement. Gasteen (1983) says that: "... many complex problems relate to the maintenance of an economically viable and continuing pastoral industry in the arid zones of Australia, while at the same time maintaining an environmentally acceptable balance between soils, plants and animals ...". However, the issues involved seem to go much deeper than economics (refer to Section 2.8 for a discussion of opposing views on the causes of deterioration of arid lands).

Rabbits are a major problem in the Australian arid zone, where warren complexes are easily established in the light soils (Roxby Management Services Pty. Ltd., 1982). Although their numbers are partially controlled by indigenous and introduced predators, by Myxomatosis, and by the harsh climatic conditions, rabbits breed to plague proportions in times of abundant feed (e.g. Ratcliffe, 1936). The main controlling factor then becomes lack of feed during times of drought, which results in major damage to established trees, shrubs and freshly germinated plants, before the rabbits themselves become weak and fall prey to cats, foxes and dingoes or perish for want of feed and to a lesser extent water (some rabbits may never form the habit of drinking and survive droughts in deep burrows among the roots of perennial vegetation e.g. Hakea leucoptera - Ratcliffe, 1936). Usually a small nucleus population remains from which numbers can again increase when conditions become favourable.

The extent of vegetation change caused by grazing, whether it is attributed to the effects of cattle and/or rabbits, has been marked and characteristically severe. This is not to say that the land is now thoroughly barren and beyond repair. Certainly, the study area, as an example, was seen to be widely denuded during the present survey (Section 4.5.2 and 5.2.1.7), as a consequence of pastoral activities, rabbits, an extended drought and other disturbances. But, despite evident grazing pressure some areas of representative vegetation remain in good condition e.g. the channel edge woodland of Site 14, and so, are, potentially at least, the source of propagules for the re-establishment of vegetation of the more disturbed areas.

One of the problems faced in attempting to objectively assess vegetation change is the dearth of knowlede on the nature of the vegetation prior to the implementation of such change. Vegetation reconsruction, as-it-were, has proven difficult in near settled areas e.g. the attempt at reconstruction of the pre-European vegetation of the area of Roseworthy Agricultural College is known to have been fraught with difficulty due to the fragmentary nature of early records, and is even more-so in remote arid lands, where relvant available records are very few in number. In relation to Association 8.4.4, records, partially early published records, are scarce and generally take the form of dated species lists (e.g. Tate, 1889) or are of an anecdotal nature.

Another important feature of such a reconstruction is the need for additional corollary information about other historical and pre-historical influences, which have accounted for change prior to the implementation of the European influence under consideration here. With this supporting information the pitfall of attributing all change to the European influence is avoided.

6.2 PRE-HISTORIC INFLUENCES

6.2.1 Pre-Aboriginal Time

In the wide context of Australia, the complexity of current plant communities and species are probably a response to the deteriorating climatic conditions during a least the last 1.8 million years of earth history (Crocker, 1959) and part of this time span, severe and sudden aridity or aridities, possibly associated with the periodcity of glacial and interglacial phases, profoundly affected the vegetation resulting in the extinction of some elements and retraction of others to more favourable situations (Crocker, 1959). The Cooper Creek and its distributary channels likely formed one such 'more favourable situation'.

For a considerable time prior to the arrival of the Aborigines the periodic aridities caused extinction or contractions of the vegetation to these more favourable situations. In the intervening periods between these aridities more favourable conditions allowed for the expansion of the floristic 'survivors' from their refugia in areas such as the Cooper Creek system to the adjacent country. Therefore, for the time between the onset of deteriorating climatic conditions and the arrival of Aboriginal man, the vegetation was evolving under a regime of periodic alteration from more arid to more mesic conditions.

Apart from these physical effects, biological factors likely also influenced the vegetation. Herbivores, such as the larger herbivore Diprotodon, fossils of which have been found at Lake Callabonna (to the south of the study area), probably caused changes in strategies for population persistence, including the development of spines to deter foraging. The spines, developed for and now characteristic, of the larger acanthaceous shrub species such as dead-finish Acacia tetragonaphylla and elegant wattle Acacia victoriae may well be adaptations to deter foraging by larger herbivores such as Diprotodon. Trampling of vegetation may also have been a problem faced by vegetation in areas traversed by Diprotodon, which is thought to have persisted to the late Pleistocene, before it to succumbed to the effects of deteriorating climatic conditions. Hope (1982) details the faunas which may have affected vegetation change in pre-historic times, but what changes occurred due to character release when the supressive influences of these larger herbivores ceased upon their extinction? Symon (1982) states that: "the legacy of the more recently extinct large herbivorous marsupials .... in terms of vegetational response remains largely unexplored".

It is obvious from the precending account that in a report such as this it is only possible to begin to discuss possible vegetation changes and influencing factors existing during pre-historic times. The same is true for the effects wrought on the vegetation upon the arrival and subsequent dispersal of Aboriginal man in Australia. Some influences on the vegetation during the period of Aboriginal occupation are discussed in the following subsection.

6.2.2 Aboriginal Time

The arrival of Aboriginal man in Australia, which is thought by Tindale (1981) to have taken place about 60 000 years ago, was accompanied by further profound effects upon the already changing vegetation. One of the major influences was probably changed fire regimes.

Fire in pre-Aboriginal time was a purely natural phenomenon, occuring as a result of lightning for the most part and so, was comprised of low frequency and high intensity events. Aboriginal man, however, is reported to have been careless in his use of fire, employing it indiscriminately in relation to food gathering, ritual and communication (e.g. Martin, 1973). Hence, from a pre-Aboriginal regime of low frequency and high intensity fires, the vegetation was gradually influenced, as the Aborigines became more adept in their use of fire under Australian conditions, by a regime of high frequency and low intensity fires imposed by the Aborigines.

The altered fire regimes were likely imposed in the study area for a considerable part of the time between their arrival in Australia (about 60 000 years ago) and the later 19th century, the major Period of Aboriginal occupation (see Section 2.7 for the numbers that existed along the Cooper on the coming of European man), although the exact time of their arrival in the study area is uncertain. This is apart from the periods of more intense aridity, such as occured about 18 000 years ago (e.g. Martin, 1973; Buckley, 1982b), when the tribes would have probably moved to more favourable areas on occasions when their needs for sustenance were not supplied by their regular food sources along and away from the Cooper. In the more severe arid phases, they may also have suffered population declines as occurs in populations of native fauna with the onset of drought.

Apart from the physical effects of aridity and the fire regimes imposed by the Aborigines, herbivores again may have caused change during Aboriginal time. Symon (1982) alludes to the relationship between prickliness in Solanum spp. and marsupial herbivory, in particular by browsing herbivores i.e. smaller macropods such as wallabies. The prickliness of Solanum oligacanthum, for example, may well have been maintained by the browsing activities of species such as the Desert Rat Kangaroo Caloprymnus campestris, which was previously common in the vicinity of Association 8.4.4 (Finlayson, 1932a), but may now be extinct (e.g. Environmental Research and Planning Group, 1980). Many other organisms may have effected vegetation change in ways different and more significant than the development of spinifery so, it can be seen that vegetation change is not only a result of European settlement, but is a naturally occurring phenomenon which appears to have been accelerated with the arrival in Australia and its subsequent colonisation by European man.

Before looking in detail at the nature of the pre-European vegetation it would be useful to look at the response of vegetation to the factors accounting for its change. It is feasible to assume that if the fire regimes imposed by the Aborigines have been relatively constant since their arrival in Australia, after an initial period of dispersal, then the vegetation would have attained biotic equilibrium, where extinction and immigration rates of floristic elements would be equal. Looking solely at fire as the causal factor in vegetation change, however, totally ignores the other influences on the vegetation, such as the effect of herbivores. These new fire regimes though were peculiar to the Aborigines and hence, were a significant contributary factor in the change affected by them. The other influences upon the vegetation may well have operated even if the Aborigines had chosen not to settle in Australia. What is evident from the recent literature is that the element of fire has had an obvious and profound effect on the vegetation, so much so that the present Australian vegetation requires a continuation of the pre-European fire regimes for its maintenance (e.g. Hodgkinson and Griffin, 1982).

6.3 NATURE OF THE PRE-EUROPEAN VEGETATION

"In the virgin condition almost the whole of the arid zone was covered by vegetation, there being no extensive areas of soils exposed to the elements. Some bare areas did exist, including some rock exposures on hills, the salt-covered surfaces of dry lakes (playas and some sand dunes in the driest regions ..." (Beadle, 1981). Beadle's preceding comments summarily allude to the nature of pre-European vegetation. Perennial trees and shrubs were prominent and, although" A very large number of annual plants occur in the drier region ... . before white settlement they were mostly subsidiary, but nevertheless conspicuous because of their bulk and spectacular colouration" (Beadle, 1981).

The above summary relates to the arid zone generally, but what of the pre-European vegetation of Association 8.4.4 Available information on the plant species of the study area (summarised in Appendix R) indicates that a range of plant types within the following life-form classes were present i.e. phanerophytes, chamaeophytes, hemicryptophytes, cryptophytes and therophytes - all the main life-form classes (see Specht, 1972). The two former life-form classes encompass the woody plants, while the other three encompass herbaceous species. Within the cryptophyte class examples of three life-form groupings within this class (Specht, 1972) also occur in the study area i.e. geophytes - such as Murray lily Crinum flaccidum, helophytes - such as Eleocharis spp. and hydrophytes - such as the free floating hydrophyte Pacific Azolla Azolla filiculoides.

With the range of habitats available in the study area (refer to Chapt. 5) a variety of communities of plants were possible, some of which may not be evident today. Mulga Acacia aneura seems to be one of the major absentees from the region today, which would have been conspicuous as a community dominant.

In relation to the vegetation of the dunefields it appears that they were little different from the present day and have, it appears, been fairly stable for at least some 18 000 years. The attempted reconstruction of Buckley (1982b) of sand ridge vegetation in the vicinity of the study area indicates that sandhill canegrass Zygochloa paradoxa, lobed spinifex Triodia basedowii, kahlo Crotalaria eremaea ssp. eremaea, desert chinese lantern Abutilon otocarpum and dead-finish Acacia tetragonaphylla occupied the dunes, while elegant wattle Acacia victoriae, fox brush Ptilotus polystachus, silver tails P. obovatus, Australian carrot Daucus glochidiatus and wild carrot Trachymene glaucifolia occupied the wider dunefields. Buckley's (1982b) reconstruction is for the period of an intense arid phase which occured about 18000 years ago, at which time the vegetation was subject to rainfall levels which were half that received at present. The pre-European dunefield vegetation would therefore have been far more diverse in Association 8.4.4 than is indicated by Buckley (1982b). Moreover, the proximity of many dunefields of the study area to regularly inundated floodplains (particularly of the Cooper) would have further increased this diversity by the added input of annual species.

The floodplain vegetation would have been characteristically diverse and any losses due to extinction would probably only have been temporary in most cases. Replacement would have been likely due to the exotic nature of the Cooper Creek; propagules would have been brought in the floodwaters from higher up in Queensland. This exotic input of species into a characteristically arid area has produced some unusual plant occurrences, one of the most notable of which is the previous occurrence in the study area of an orchid i.e. bluebeard caladenia Caladenia deformis, and the possible occurrence of another (Appendix R). It should be apparent from Appendix R that the diversity of species encompassed by the pre-European vegetation within all habitats in Association 8.4.4 was high indeed, albeit now much reduced.

One of the more important things to note about the pre-European vegetation of Association 8.4.4 and the arid zone generally is that it was old. It was (and is) comprised of hydrophytes, mesophytes, xerophytes and halophytes and all species have either managed in a variety of ways to survive severe periods of aridity or have such an efficient means of dispersal that they are rapidly replaced in the event of loss. "Some elements of this flora ..." of the arid "... seem to derive from pre-existing scleophylls e.g. ... Hakea and Grevillea, and may have evolved in situ, thus being amonst the oldest components" (Martin, 1982). And, "Even though the ..." mistletoes" ... are mesomorphic ..., association of mistletoes with efficient xerophyte hosts has probably allowed them to persist continuously in the arid zone, even through periods of maximum aridity" (Barlow, 1981). "The present distribution of Australian grass genera is a reflection of ..." the "... availability of suitable habitats, efficiency of dispersal mechanisms, relative competitive ability and the previous history of the area" (Clifford and Simon, 1981)." ... radiation and rise to dominance..." of Eucalyptus "... seems to have been due to parallel evolution ... of features that enabled them to survive and to become established on newly available sites, under circumstances of some water-stress" (Pryor and Johnson, 1981). "the development of an arid-adapted vegetation in inland Australia was associated with the restriction of the more mesic elements of the original floras to wetter coastal environments" (Truswell and Hariis, 1982).

These few literary examples allude to the nature of the pre-European vegetation of Association 8.4.4 as a highly specialised biota which has resulted from considerable admixing of Australasian floristic elements (Section 5.2.1.1) under sometimes extreme environmental influences. This specialised and for the most part arid-adapted vegetation has been described as resilient (Social and Ecological Assessment Pty. Ltd., 1982), but the extent of change since European settlement indicates the contrary.

6.4 VEGETATION CHANGE: THE ECOLOGICAL IMPACT OF CATTLE AND RABBITS

The approximate area of the Cooper Creek Environmental Association considered to be significantly affected by introduced grazing animals is shown in Figure 13. The extent of the change, undoubtedly due to the combined effects of rabbits and cattle is enormous both in geographic extent and biological impact.

As far as can be determined the present de-stocking of north-eastern South Australia due to the BTB Programme which began on most properties in 1979, is the first period since the country was taken up as pastoral runs that cattle have not occupied the area. Hence there has been a sustained stocking pressure in all properties in the study region for possibly a hundred years, apart from breaks during the more severe droughts (Section 2.7, 2.8). Significant and permanent de-stocking is unlikely to occur in the short term. and subdivision of properties as part of the BTB programme will provide more significant controls over stock numbers

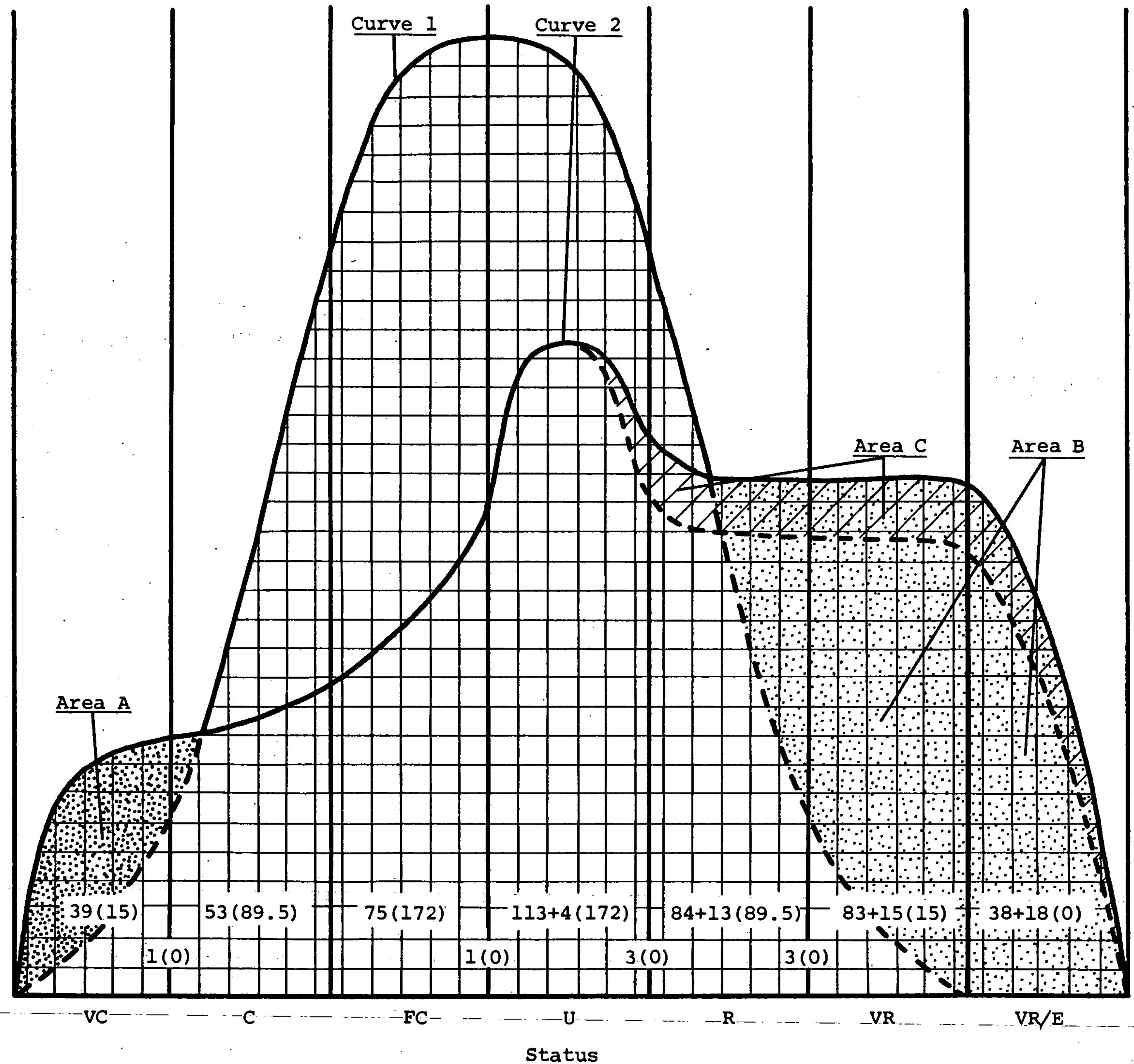

Figure 17 - Representation of possible change in status of plant species, subspecies and varieties in the Cooper Creek Environmental Association 8.4.4 since European occupation.

Curve 1 - Hypothetical curve of the distribution of plant species, subspecies and varieties according to status under conditions prevailing prior to European occupation. Each square under the curve represents a species, subspecies or variety and the number in each class is recorded in brackets under the curve.

Curve 2 - Curve representing the distribution of species, subspecies and varieties according to status as determined from presently available data (Appendix R). The number in each class of status is recorded under the curve. In classes U, R, VR and VR/E the first number represents the number definitely in that class, while the second (proceeding the bracketed number) indicates the additional number which are possibly misidentified.

Area A - Represents the proportion of species, subspecies and varieties which have increased in abundance since European occupation.

Area B - Represents the proportion of species, subspecies and varieties which have decreased in abundance since European occupation.

Area C - Represents the prportion in classes U, R, VR and VR/E considered to be possibly misidentified (see Appendix R).

N.B. - The total number under each of the curves is 553.

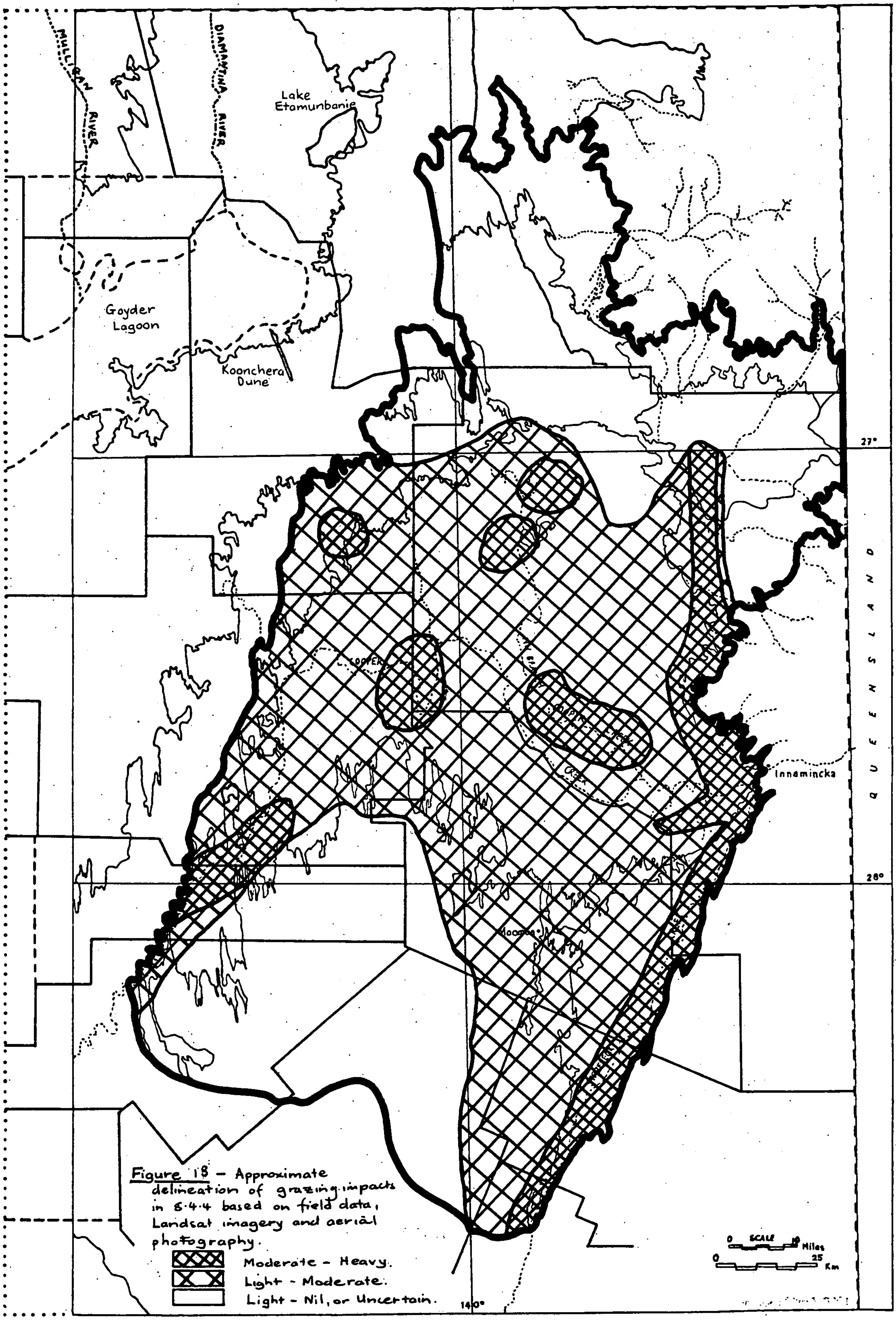

Figure 18 - Approximate delineation of grazing impacts in 8.4.4 based on field data, Landsat imagery and aerial photography.

Moderate - Heavy.
Light - Moderate.
Light - Nil, or Uncertain.

(Section 2.). The location of fencing and size of paddocks however has been left up to lessees, so that on some properties controls will be more effective than others. It is considered by the authors that the effects of this sustained stocking pressure on vegetation has been extreme. In times of drought rabbit numers tend to fall off as feed is reduced whereas under existing pastoral practise cattle are left to fend for themselves till the next muster. In better watered regions such as the Cooper Creek Flood Plain such practises can no longer be considered as viable if the habitats of breeding birds and other components of fauna are to be maintained. It is considered that most components of the natural fauna and flora have adjusted to the regime of land use associated with cattle grazing and the reduced numbers of ground dwelling species of mammals and to a lesser extent birds and reptiles tend to indicate this. Vegetation has changed significantly since the land was first settled.

Furthermore it is expected that in the future as the properties are restocked the reviewed fencing associated with the BTB programme will force stock to use areas which in the past have been largely un-utilized grazing areas. Further change in habitat and adjustment of populations of organisms is likely to result from such effects.

It is not possible to attribute the changes in vegetation and loss or decline of species purely to the effects of overgrazing as bad seasons or changed water regimes would have affected the ability of the vegetation to resist disturbance. The problem remaining is that these disturbances have been sustained through bad seasons and without influence of changed water regimes. The problem is well understood so there is no biological reason that it should be allowed to containue.

A graphical representation of possible changes in the status of floristic elements of 8.4.4. since European occupation is shown in Figure 17. It has several shortcomings, one of which is the lack of distinction between annuals and perrenials in the assessment of the status of floristic elements. Collector bias has not been taken into account and this may also be a problem as most collections have been made in the Spring months. In spite of these possible problems the curve clearly demonstates the major changes in floristics that have occured since European settlement.

Curve 1
This is the hypothetical curve of plant species occuring in the area prior to European settlement. The six classes of status represented under the curve indicate that the majority of species were uncommon (U) or fairly common (FC), a smaller but significant proportion were common (C) or rare (R) while a few species were very common (VC), or very rare (VR). The dividing lines between each class of status are arbitrarily placed as one possible representation of the pre-European situation.

Cuve 2
This represents the distribution of plant species now as determined from the presently available data (see Appendix R).

Area A
Area A reprsents the proportion of species, sub-species and varieties which have increased in abundance since European occupation. Examples of these "increaser" species include species which are unpalatable such as *Sclerolaena* or slightly palatable such as Cottonbush (*Maireana aphylla*) which is also reported to replace Bladder Saltbush (*Atriplex vesicaria* where the latter is destroyed by overgrazing (Ratcliffe, 1936). Other species in area A include those which can compete successfully in sites opened up by grazing such as Native Pear (*Cynanchum floribundum*) Sandhill Wattle (*Acacia ligulata*) Green Birdflower (*Crotalaria cunninghamii*), *Crotellaria ermeaea* and *Solanum oligacanthum*. In addition *Acacia*

ligulata is considered by both Jessup (1951) and Dawson and Boyland (1974) to be unpalatable or at most slightly palatable and so is a prime candidate for development as an "increaser species".

Area B

Area B represents the proportion of species, subspecies and varieties whih have decreased in abundance since European occupation. These "decreaser species" have been markedly affected to the point where some may be on the verge of extinction. It should be noted that a considerable proportion of the flora was rare or very rare to begin with and the European occupation has provided the impetus to push these species towards extinction much more rapidly than would have been the case prior to European settlement.

There does not seem to be a direct correlation between palatability and the observed decline of species but these palatability assessments were based on well-managed grazing systems and it is clear that at various times in the past in the Cooper Creek Environmental Association stock and rabbit numbers have been such that they were forced to eat any available vegetation.

6.5 CONCLUSIONS

The lands comprising the Cooper Creek Environmental Association 8.4.4 are significant for a number of different reasons. They overlie the majority of South Australia's productive oil and gas fields and also comprise some of the best pastoral land in the State - two significant economic factors that make them a focus of attention by the majority of South Australians. Some people visit this area as tourists.

Another reason that Association 8.4.4 is significant is the diversity of habitats encompassed within its bounds, and the diversity of its flora and fauna. This area contains good representative examples of all major habitat types present in the north-east of South Australia, apart from a few which are unique or nearly so. These habitats provide niches for up to 500 or more species of plant, 185 species of bird, 25 mammals, 47 reptiles, 5 frogs, 16 fish and countless aquatic invertebrates species. There is a potential for the resident biota, which is currently under some degree of threat, to increase in abundance. However, this will require the acceptance by all land-users of a the need to accommodate all land-uses within this area.

The key to the co-existence of all land-users is proper management that also accounts for the presence and need for the diversity of land-uses that are present. All land-users have a legitimate right to the land they occupy, however, in some instances the needs of particular land-users have application to the same area of land surface. This causes perplexing problems related to attempts at weighing economic gains against ecological losses and, these problems have no easy answers. It will be impossible to set aside all of the land for the purposes of conservation and, in the same way it will be impossible to have all available land set aside for use by the pastoral industry. Because the petroleum exploration/extraction industries interests are largely underground they are not specifically interested in permanent rights to an area of land surface. Rather, they wish to ensure that their economic interests are maintained, at least for the duration of a particular field. The difficulty then is to accommodate these different interests.

Conservation authorites should therefore assess very carefully the available information before selecting an area of land that may comprise suitably unique features that warrant its designation as a reserve. And, both the pastoral and petroleum exploration/extraction industries should strive to go beyond the surficial acceptance of conservation as it is in their long-term interest to work together with conservation authorities for lasting and mutual benefit.

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7. REFERENCES

A reference sheet used in the compilation of the annotated bibliography (Section (5) of the Brief) is included as Appendix U.

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DEPARTMENT OF ENVIRONMENT AND PLANNING

APPENDICES

to

Biological Survey of the Cooper
Creek Environmental Association
(8.4.4) North-Eastern South
Australia

by

Frans. H. Mollenmans, Julian R.W. Reid,
Michael B. Thompson, Lynne Alexander
and Lynn P. Pedler

7 APPENDICES

A	The Brief
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Appendix A

APPENDIX A

THE BRIEF

(1) Collection of data in a form suitable for integration into computer data bases currently being generated by the Survey and Research Section of the National Parks and Wildlife Division of the Department of Environment and Planning.

(2) Classification of wetlands within the Cooper Creek Environmental Association having regard for areal extent, permanence, depth and associated flora and fauna.

(3) Establishment of representative, permanently marked sites which will provide baseline data against which ecological implications of flood events within the region can be assessed.

(4) Consideration of ecological impacts of grazing by both feral animals and stock.

(5) Production of an annotated bibliography of all available information relating to ecology of the study area.

(6) Detailing of current and projected land uses within the environmental region.

(7) In addition to the full report which will concern matters related to the above requirements the consultants are to produce a confidential report within which recommendations pertaining to conservation priorities for the area should be given. This confidential report shall include a map delimiting areas of conservation value and discuss as far as practicable the resolution of land use conflicts within the area.

Appendix B

APPENDIX B

GLOSSARY

Deepwater Habitat - An area of land surface with consistent soils, vegetation and topographic elements, which is being utilised and which is temporarily or permanently inundated by greater than 2 m of water..(defined on P. 139).

Environmental Association - A particular combination of a limited number of Environmental units, which are unique mapping areas..(defined by Laut et al., 1977 - P. 1).

Environmental Subassociations - Agglomerations of Environmental units within Environmental Associations, which are more homogeneous mapping areas within more complex Environmental Associations like 8.4.4..(see Section 2.3.1, P.11).

Environmental subunits - Components of Environmental units that encompass a number of habitats or land units..(see Section 2.3.6, P. 16).

Environmental units - Basic landform features..(Laut et al., 1977, P.1).

Habitat - An area of land surface with consistent soils, vegetation and topographic elements, which is being utilised..(defined on P. 110).

Land System - An area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation..(see Section 2.3.4, P. 14).

Land unit - An area of land surface with consistent soils, vegetation and topographic elements and some potential for utilisation..(defined on P. 19).

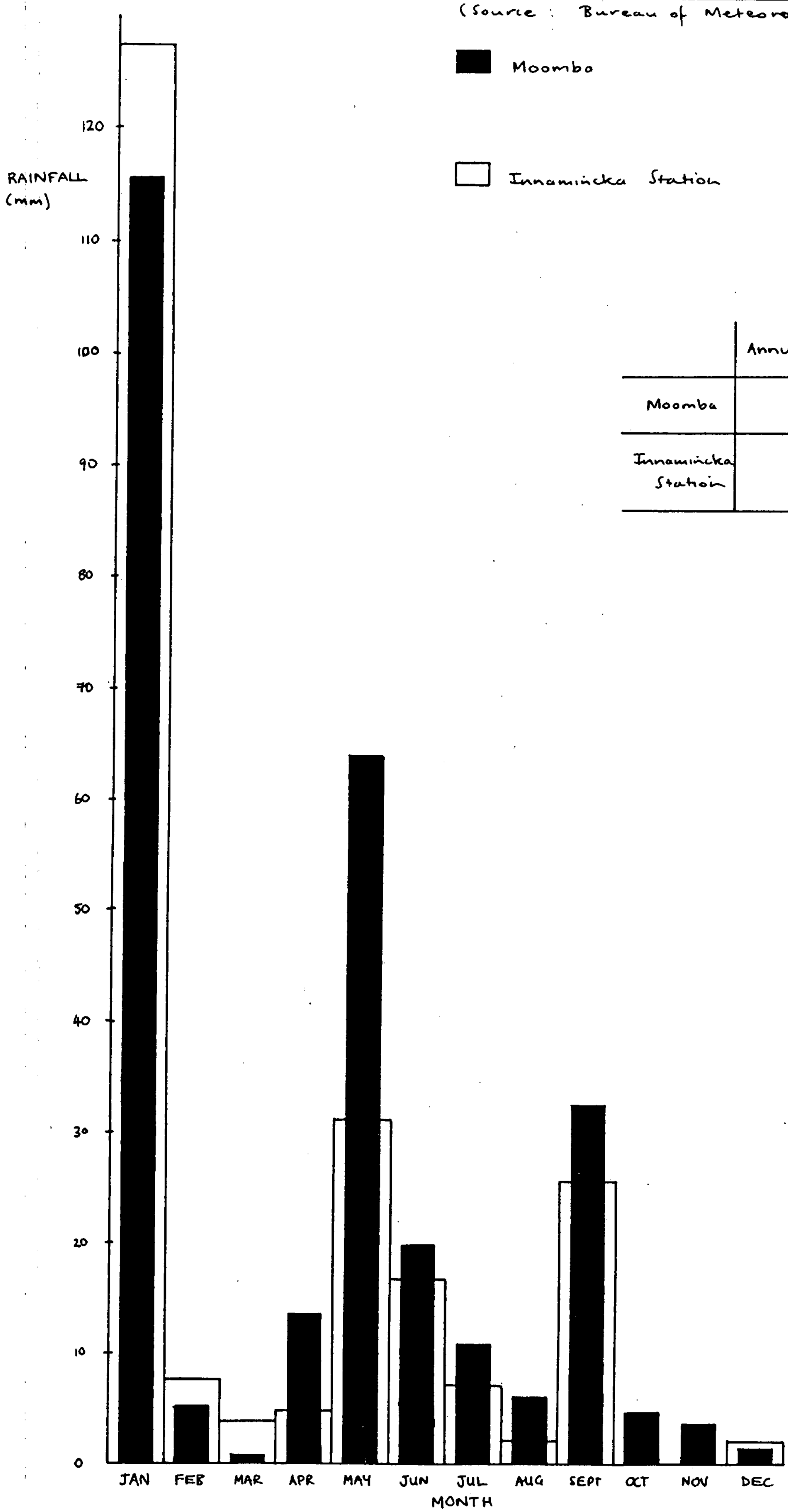
Land Zone - Broad groups of land systems, namely: the dunefields, the floodplains and the gibber plains..(see Section 2.3.3, P. 12).

Physiography - Description of nature, of natural phenomena.

Wetland Habitat - An area of land surface with consitent soils, vegetation and topographic elements, which is being utilised and which is temporarily or permanently inundated by up to 2 m of water..(defined on P. 139).

Appendix C

Appendix C1 - MONTHLY RAINFALL TOTALS FOR MOOMBA AND INNAMINCKA STATION.
(Source : Bureau of Meteorology).

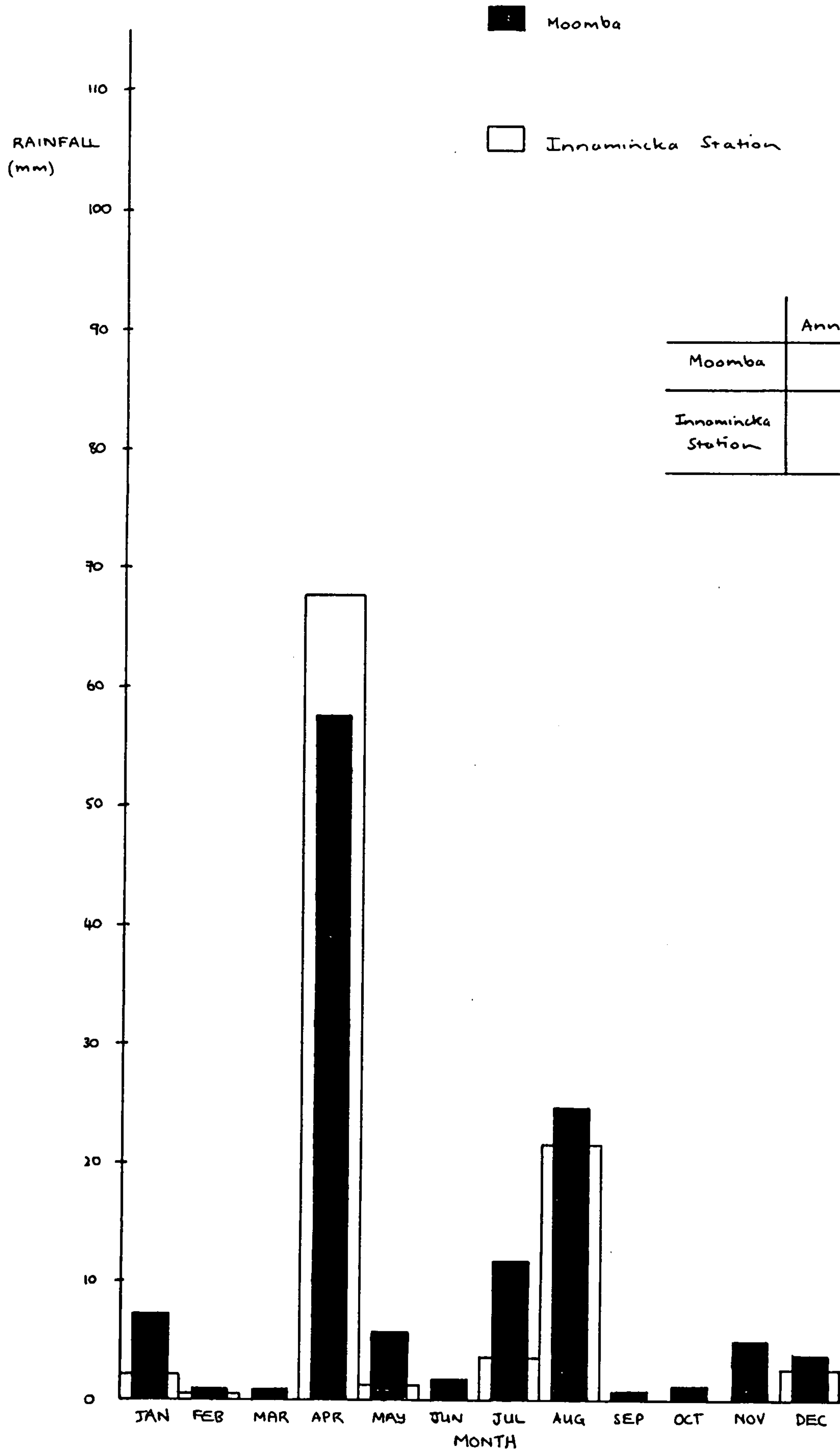


	Annual Total (mm)
Moomba	277.4
Innamincka Station	228.4

F.M.'84

C2 - 1980

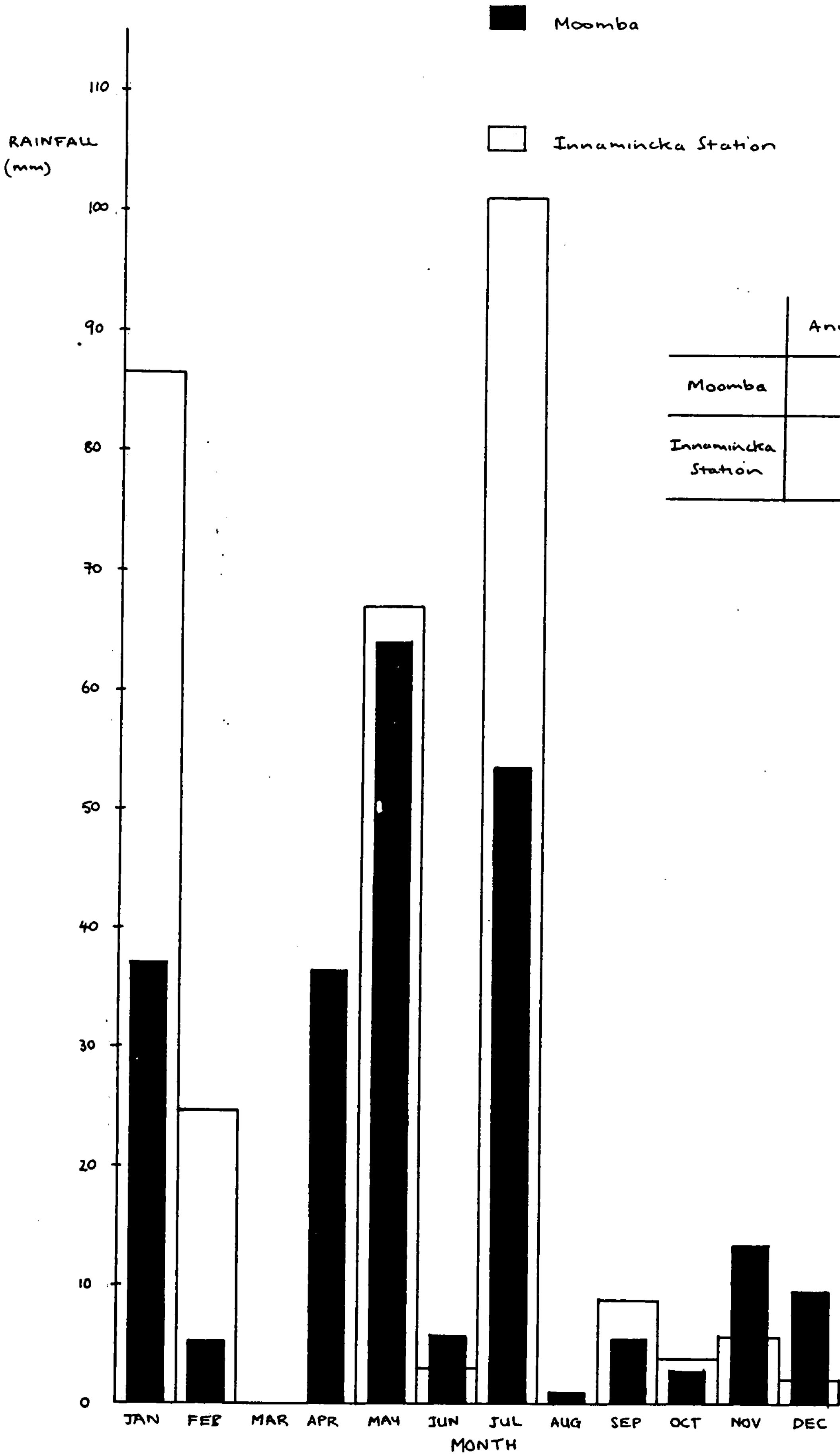
Appendix C2 – MONTHLY RAINFALL TOTALS FOR MOOMBA AND INNAMINCKA STATION.
(Source: Bureau of Meteorology).



	Annual Total (mm)
Moomba	120·6
Innamincka Station	99·4

F.M.'84

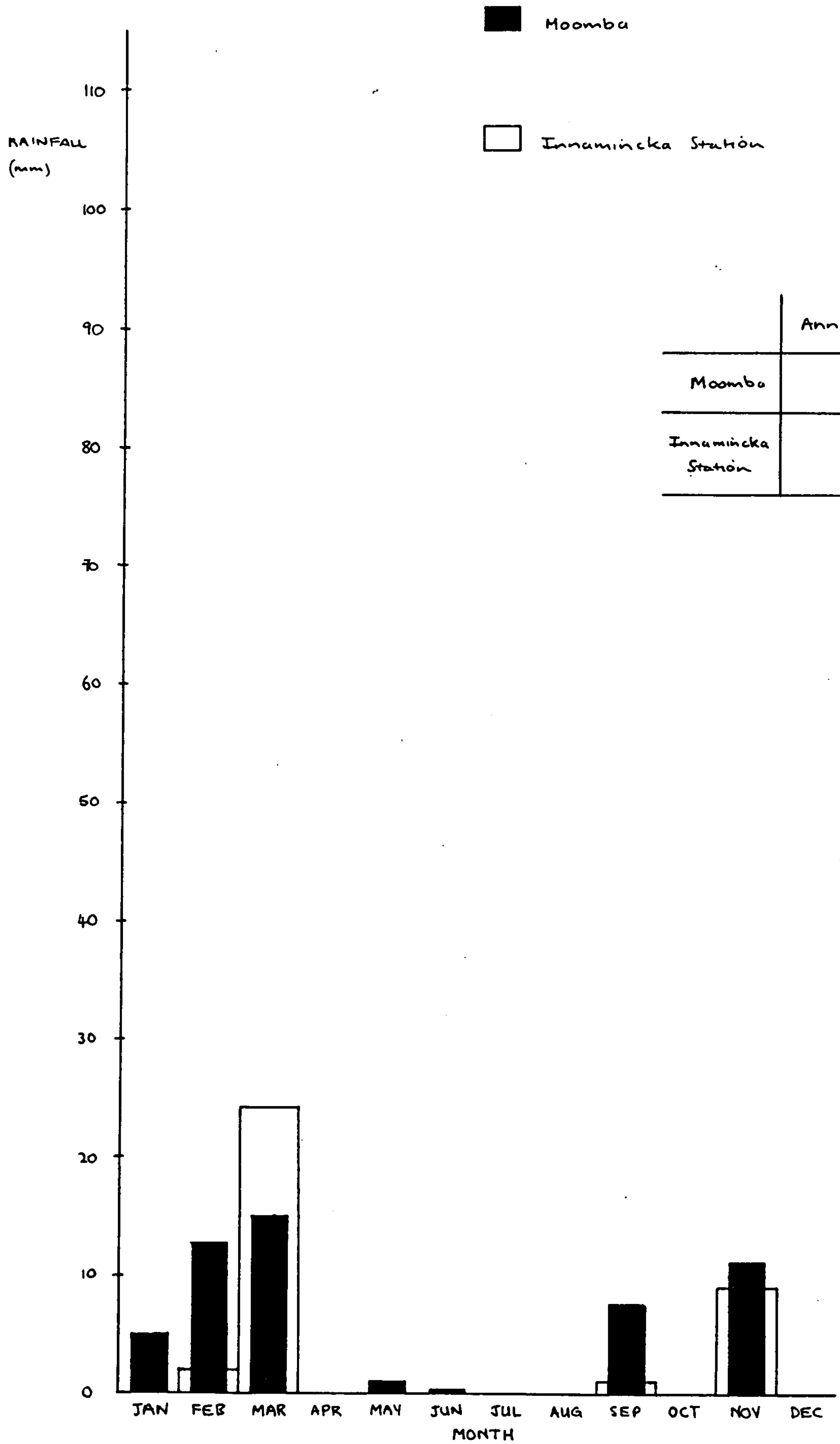
Appendix C3 - MONTHLY RAINFALL TOTALS FOR MOOMBA AND INNAMINCKA STATION.
(Source : Bureau of Meteorology).



	Annual Total (mm)
Moomba	233.6
Innamincka Station	302.4

F.M.'84

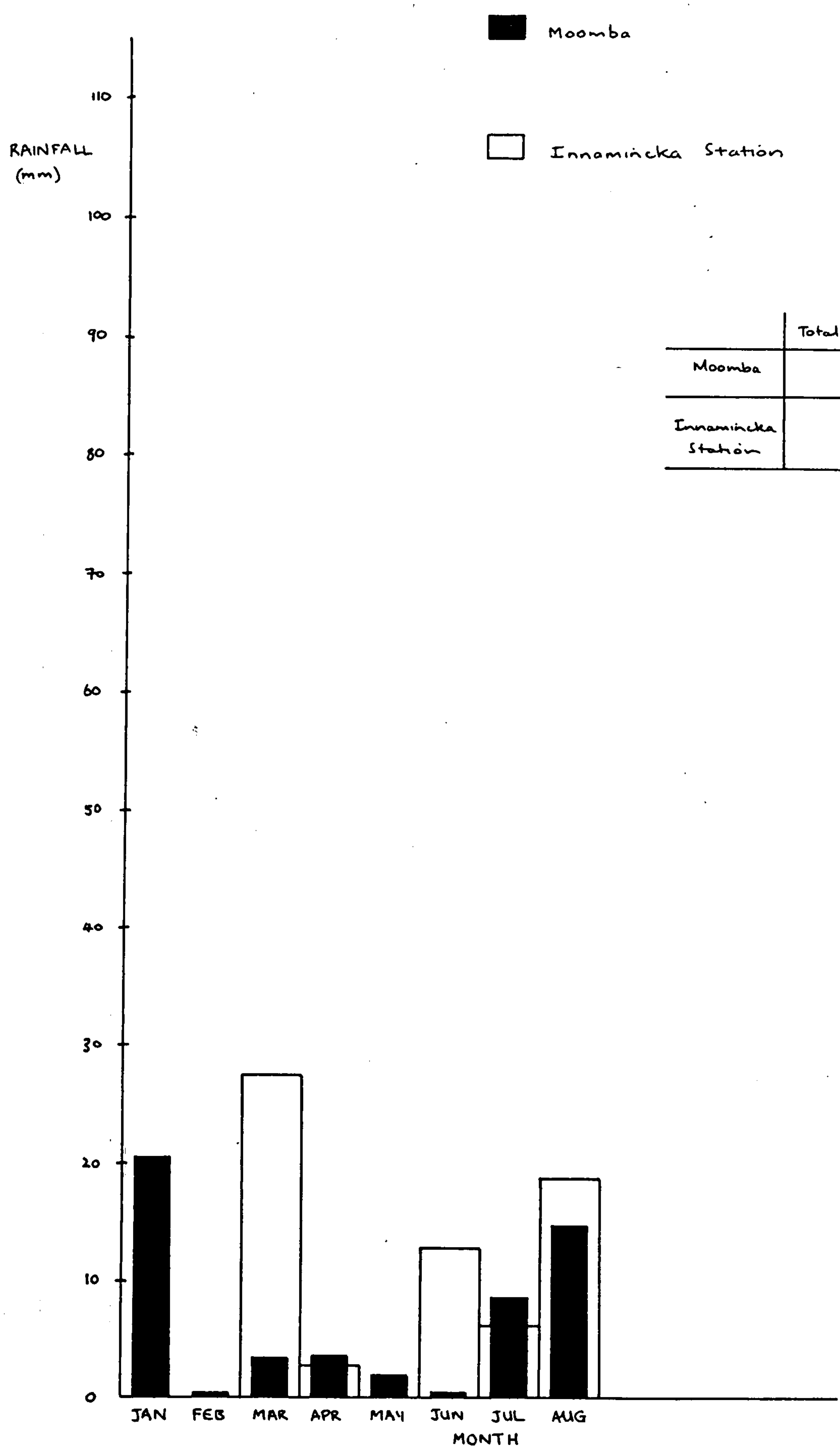
Appendix C4 - MONTHLY RAINFALL TOTALS FOR MOOMBA AND INNAMINCKA STATION.
(Source : Bureau of Meteorology).



	Annual Total (mm)
Moomba	52.5
Innamincka Station	36.6

F.M. '84

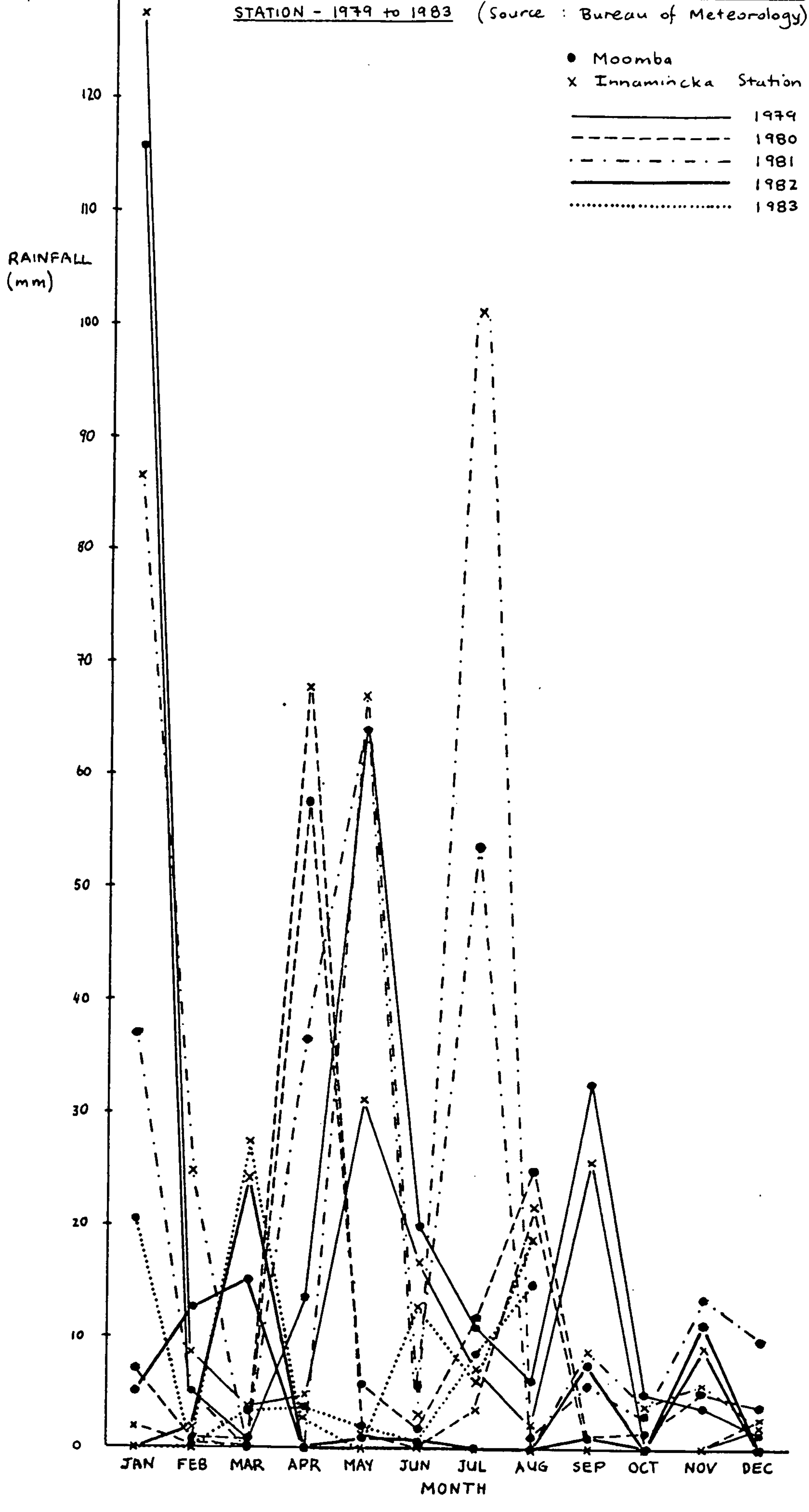
Appendix C5 – MONTHLY RAINFALL TOTALS FOR MOOMBA AND INNAMINCKA STATION (Source : Bureau of Meteorology).



	Total to August (mm)
Moomba	53·4
Innamincka Station	68·2

C6 - 1979 to 1983

Appendix C6 — YEARLY FALLS OF RAINFALL FOR MOOMBA AND INNAMINCKA STATION - 1979 to 1983 (Source : Bureau of Meteorology).



L.A.'84

Appendix D

Appendix D – ANNUAL RAINFALL TOTALS, MEAN ANNUAL TOTALS AND MEAN MONTHLY TOTALS OF RAINFALL FOR POPULATION CENTRES RELEVANT TO THE STUDY AREA OR FOR COMPARISON, (all in mm).

All records available (Source: Bureau of Meteorology).

CORDILLO DOWNS HOMESTEAD 26°42'S 140°37'

Annual Totals

DECADE

YEAR	0	1	2	3	4	5	6	7	8	9
188_	–	–	–	168	137	349	199	244	102	382
189_	406	221	159	348	157	232	130	179	178	86
190_	31	112	68	171	95	61	213	291	225	49
191_	315	167	167	210	134	45	296	169	160	75
192_	377	173	119	83	62	96	191	33	58	19
193_	148	192	104	67	118	49	143	64	84	276
194_	59	158	135	?	?	70	123	231	263	423
195_	319	45	129	119	91	231	181	62	86	60
196_	358	59	144	120	163	53	203	116	131	47
197_	?(low)	225	93	306	580	246	(hi)	130	197	293
198_	77	290								

Mean Annual Total (168)

Mean Monthly Totals

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
24	26	22	9	11	11	8	7	6	12	12	15

INNAMINCKA HOMESTEAD 27°44'S 140°46'E

Annual Totals

DECADE

YEAR	0	1	2	3	4	5	6	7	8	9
188_	–	–	dry	102	72	503	147	189	43	272
189_	353	214	77	262	226	136	128	93	148	84
190_	47	103	142	243	70	56	263	389	?(hi)	74
191_	224	256	161	131	98	88	205	190	140	129
192_	254	171	166	?(av)	?	?(lo)	173	47	64	–
193_	127	173	53	48	68	97	227	36	75	342
194_	14	146	215	63	182	86	104	?(av)	95	477
195_	337	96	114	37	183	345	270	130	123	101
196_	266	52	252	72	115	60	183	242	187	46
197_	33	301	63	292	1026	252	426	84	273	229
198_	100	303	?(low)							

Mean Annual Total (174)

Mean Monthly Totals

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
30	22	23	12	13	13	9	7	7	11	11	16

BIRDSVILLE 25°54'S 139°21'

Annual Totals

DECADE

YEAR	0	1	2	3	4	5	6	7	8	9
189_	–	–	103	176	158	–	–	–	123	50
190_	61	102	77	293	314	53	165	415	204	80
191_	204	135	117	34	183	52	543	–	–	–
192_	442	222	88	96	75	45	190	35	37	51
193_	101	162	113	134	58	63	164	55	109	269
194_	65	105	100	114	127	57	77	240	271	337
195_	390	57	193	166	174	385	309	131	163	76
196_	151	33	168	89	188	68	313	66	198	59
197_	123	136	80	254	495	328	208	242	155	271
198_	151	257								

Mean Annual Total (168)

Mean Monthly Totals

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
27	29	18	9	12	11	10	7	6	11	12	16

D2

ANNUAL RAINFALL TOTALS, MEAN ANNUAL TOTALS AND MEAN MONTHLY TOTALS OF RAINFALL FOR POPULATION CENTRES RELEVANT TO THE STUDY AREA OR FOR COMPARISON (all in mm).

All records available (Source: Bureau of Meteorology)

MARREE

29°39'S 138°04'E

Annual Totals

YEAR	0	1	2	3	4	5	6	7	8	9
188_	–	–	–	–	–	–	206	167	61	228
189_	137	146	116	134	197	157	126	93	140	190
190_	90	69	56	183	257	130	237	156	165	127
191_	232	179	126	156	214	91	148	167	129	123
192_	257	185	93	122	133	113	145	137	114	93
193_	222	107	194	97	83	109	116	171	119	290
194_	56	356	155	76	88	136	191	116	205	161
195_	409	88	136	182	156	352	241	142	266	80
196_	72	112	98	148	122	87	122	41	177	138
197_	121	131	149	325	387	342	379	79	202	361
198_	182	190								

DECADE

Mean Annual Total (160)

Mean Monthly Totals

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
16	21	14	12	14	14	9	9	11	13	11	16

TAMBO

24°53'S 146°15'E

YEAR	0	1	2	3	4	5	6	7	8	9
189_	1359	650	546	554	865	553	489	441	379	280
190_	371	339	230	598	611	417	930	658	533	548
191_	845	449	365	526	347	206	720	670	561	428
192_	775	740	557	337	749	423	255	557	629	317
193_	432	532	436	653	214	358	575	326	388	434
194_	549	668	525	443	454	455	300	521	391	697
195_	1056	286	385	388	739	840	1034	364	349	557
196_	655	532	587	937	484	299	349	325	–	235
197_	519	361	419	534	642	505	435	633	714	343
198_	–	603								

DECADE

Mean Annual Total (528)

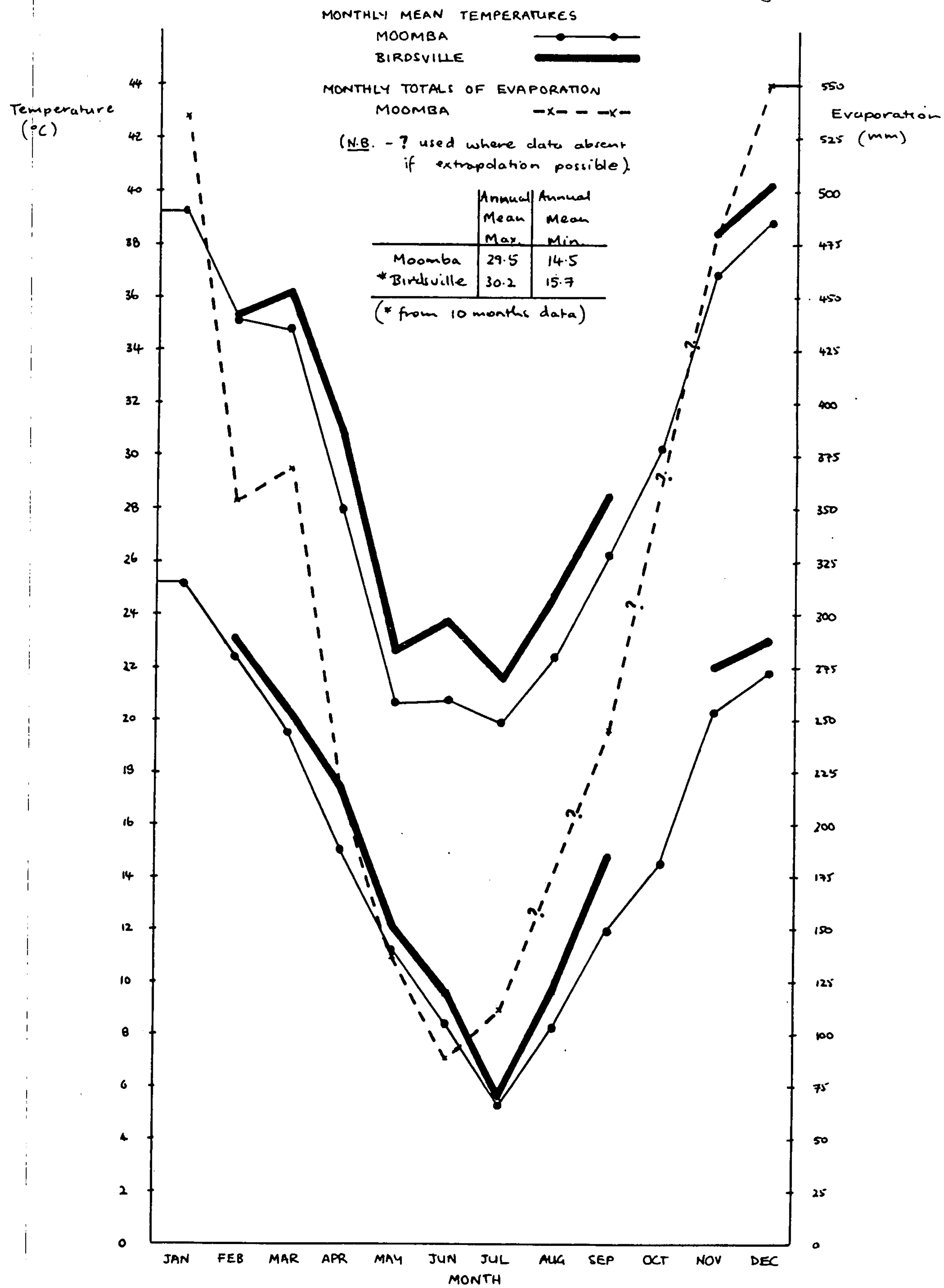
Mean Monthly Totals

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
78	77	63	36	34	28	28	19	20	34	44	67

Appendix E

Appendix E1 – MEAN MONTHLY MAXIMUM AND MINIMUM TEMPERATURES FOR MOOMBA AND BIRDSVILLE, AND MONTHLY TOTALS OF EVAPORATION FOR MOOMBA.

(Source : Bureau of Meteorology).



	Annual Mean Max.	Annual Mean Min.
Moomba	29·5	14·5
*Birdsville	30·2	15·7

(* from 10 months data)

F.M.'84

Appendix E2 – MEAN MONTHLY MAXIMUM AND MINIMUM TEMPERATURES FOR MOOMBA AND BIRSVILLE, AND MONTHLY TOTALS OF EVAPORATION FOR MOOMBA.

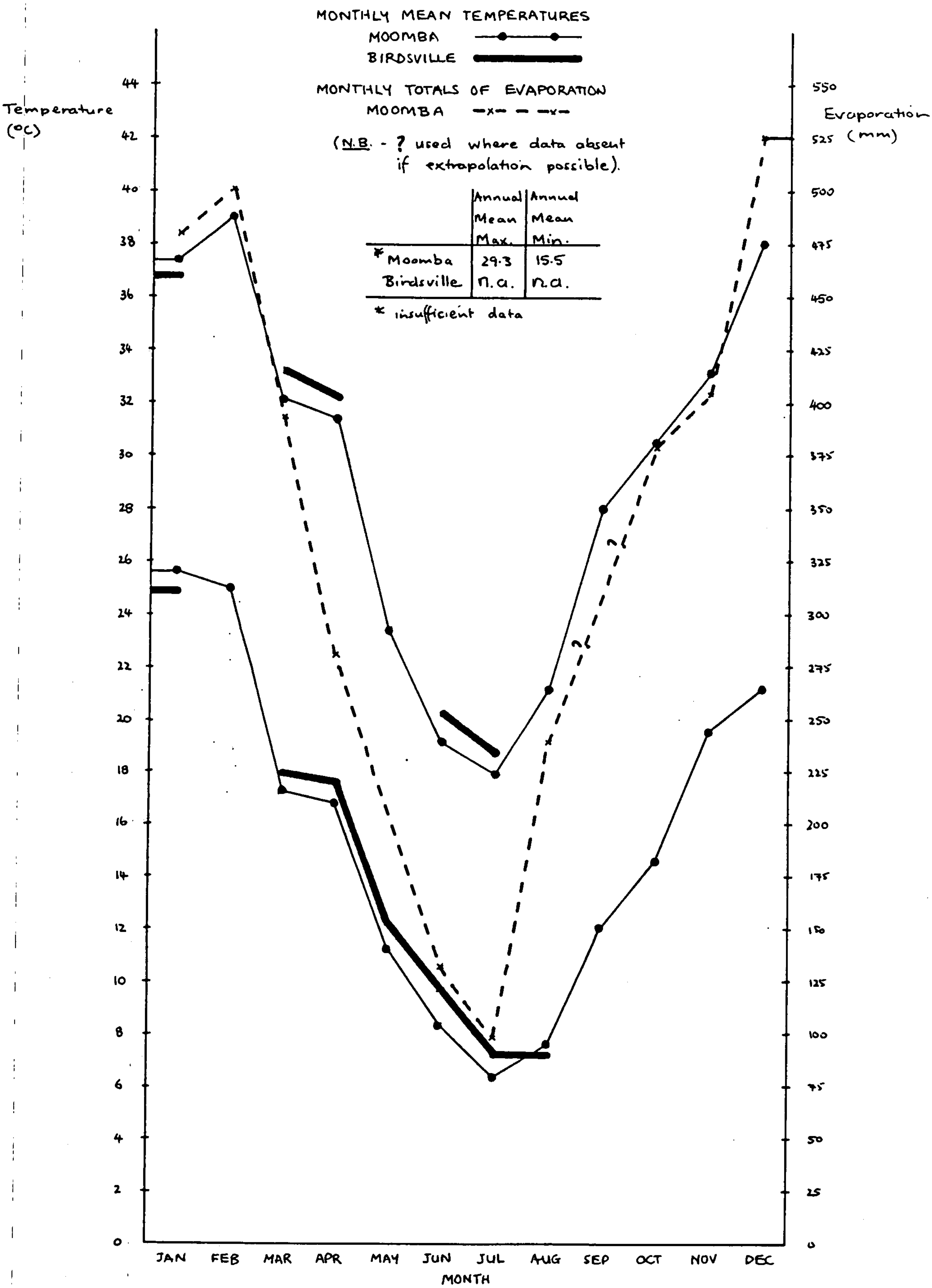
(Source : Bureau of Meteorology).

	Annual Mean Max.	Annual Mean Min.
Moomba	30·3	15·3
Birdsville	31·8	16·5

F.M.'84

Appendix E3 – MEAN MONTHLY MAXIMUM AND MINIMUM TEMPERATURES FOR MOOMBA AND BIRDSVILLE, AND MONTHLY TOTALS OF EVAPORATION FOR MOOMBA.

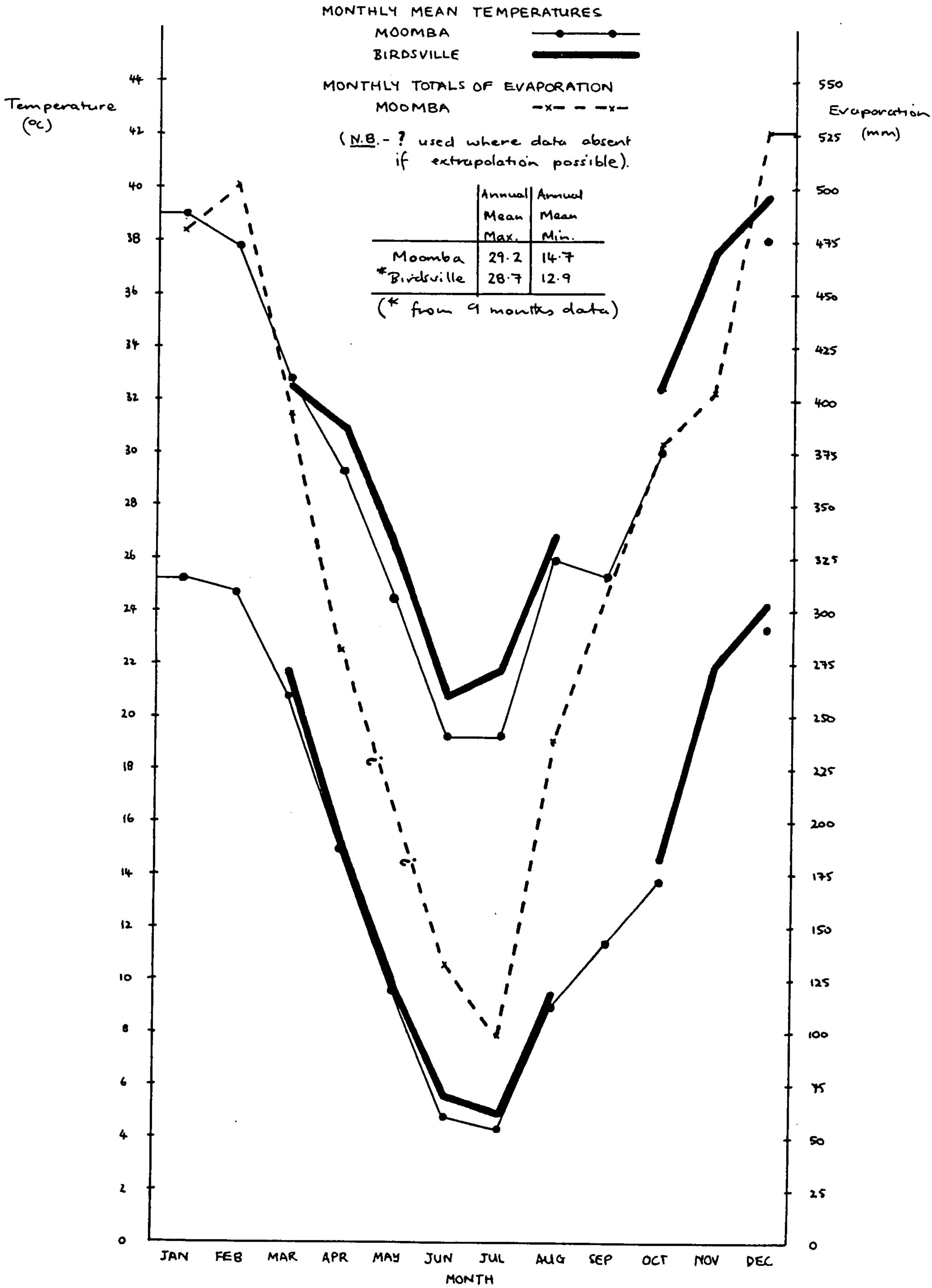
(Source : Bureau of Meteorology).



E4 - 1982

Appendix E4 - MEAN MONTHLY MAXIMUM AND MINIMUM TEMPERATURES FOR MOOMBA AND BIRDSVILLE, AND MONTHLY TOTALS OF EVAPORATION FOR MOOMBA.

(Source : Bureau of Meteorology).



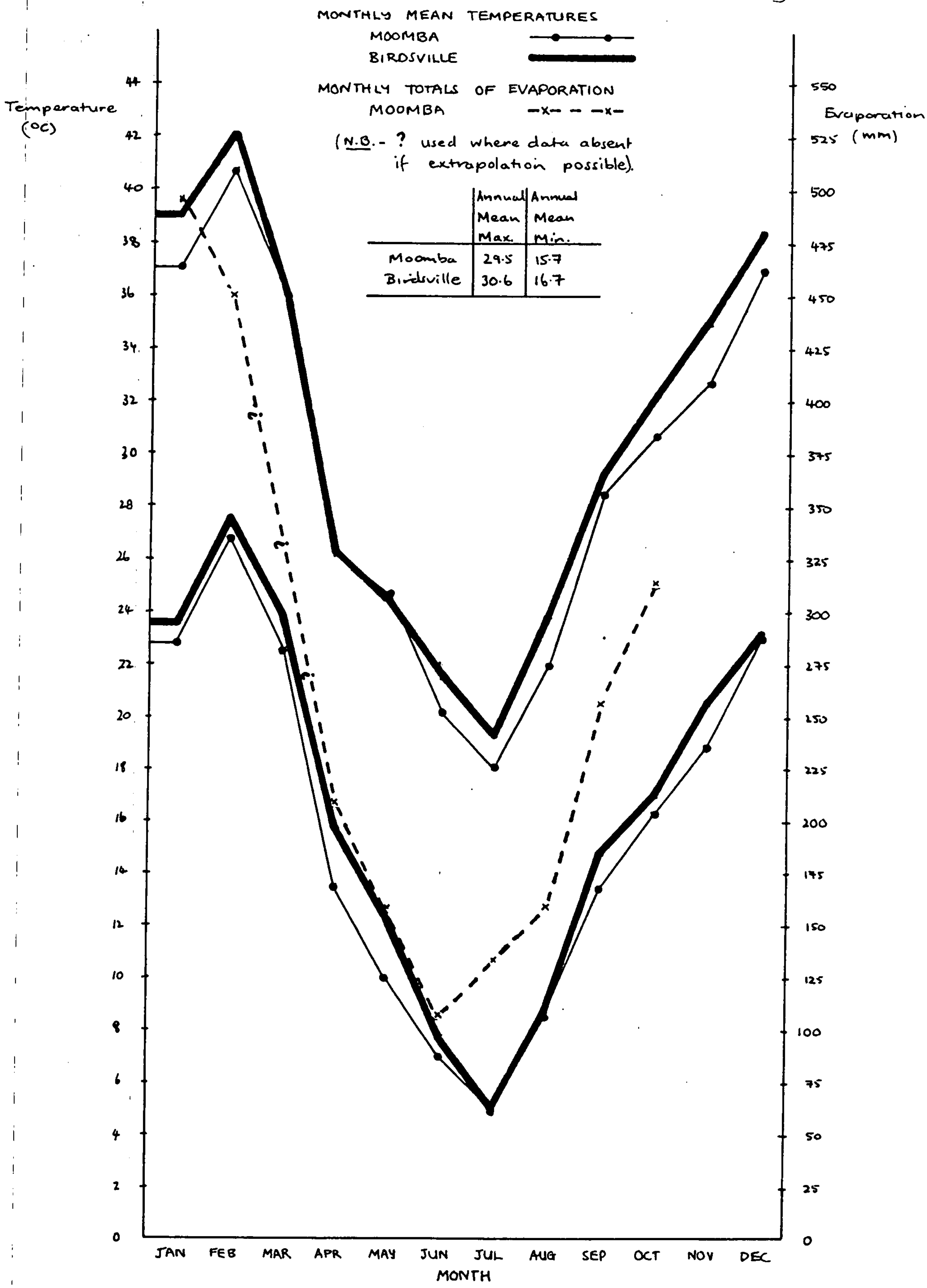
	Annual Mean Max.	Annual Mean Min.
Moomba	29·2	14·7
*Birdsville	28·7	12·9

(* from 9 months data)

F.M. '84

Appendix E5 – MEAN MONTHLY MAXIMUM AND MINIMUM TEMPERATURES FOR MOOMBA AND BIRDSVILLE, AND MONTHLY TOTALS OF EVAPORATION FOR MOOMBA.

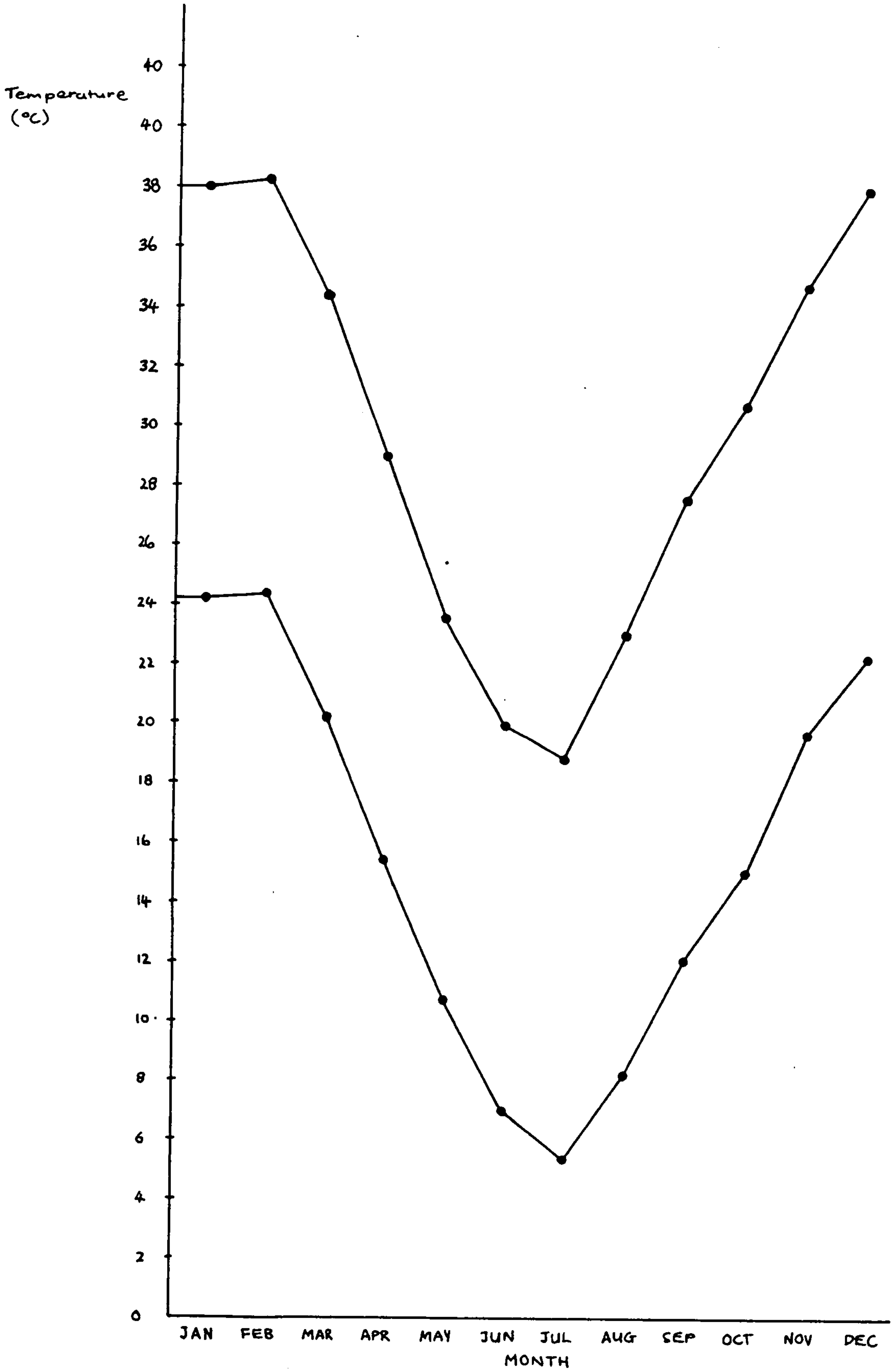
(Source : Bureau of Meteorology).



	Annual Mean Max.	Annual Mean Min.
Moomba	29.5	15.7
Birdsville	30.6	16.7

F.M. '84

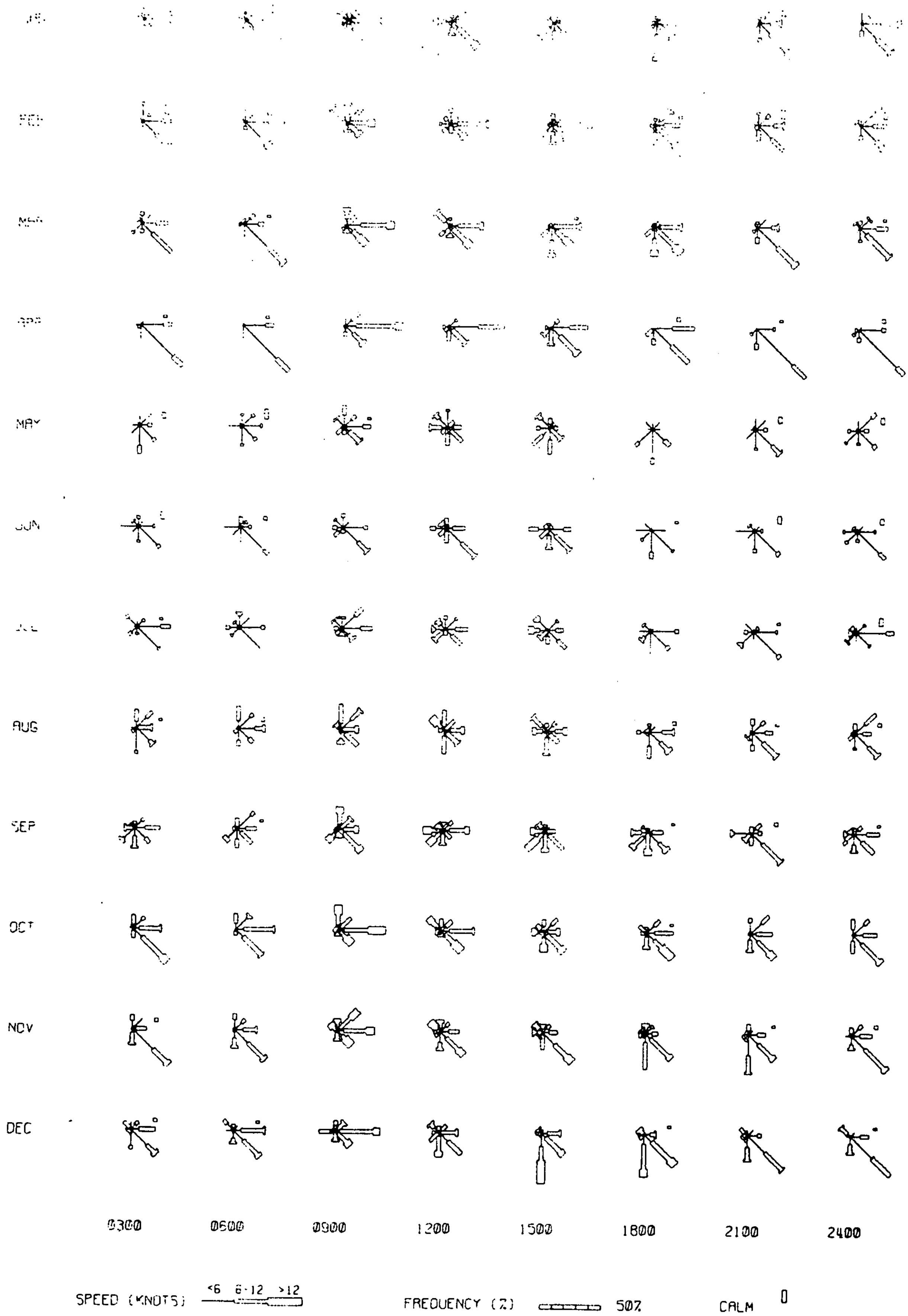
Appendix E6 - MEAN MONTHLY MAXIMA AND MINIMA FOR MOOMBA FOR THE PERIOD 1979 - 1983. (Source: Bureau of Meteorology).



J.R.W.R. '84

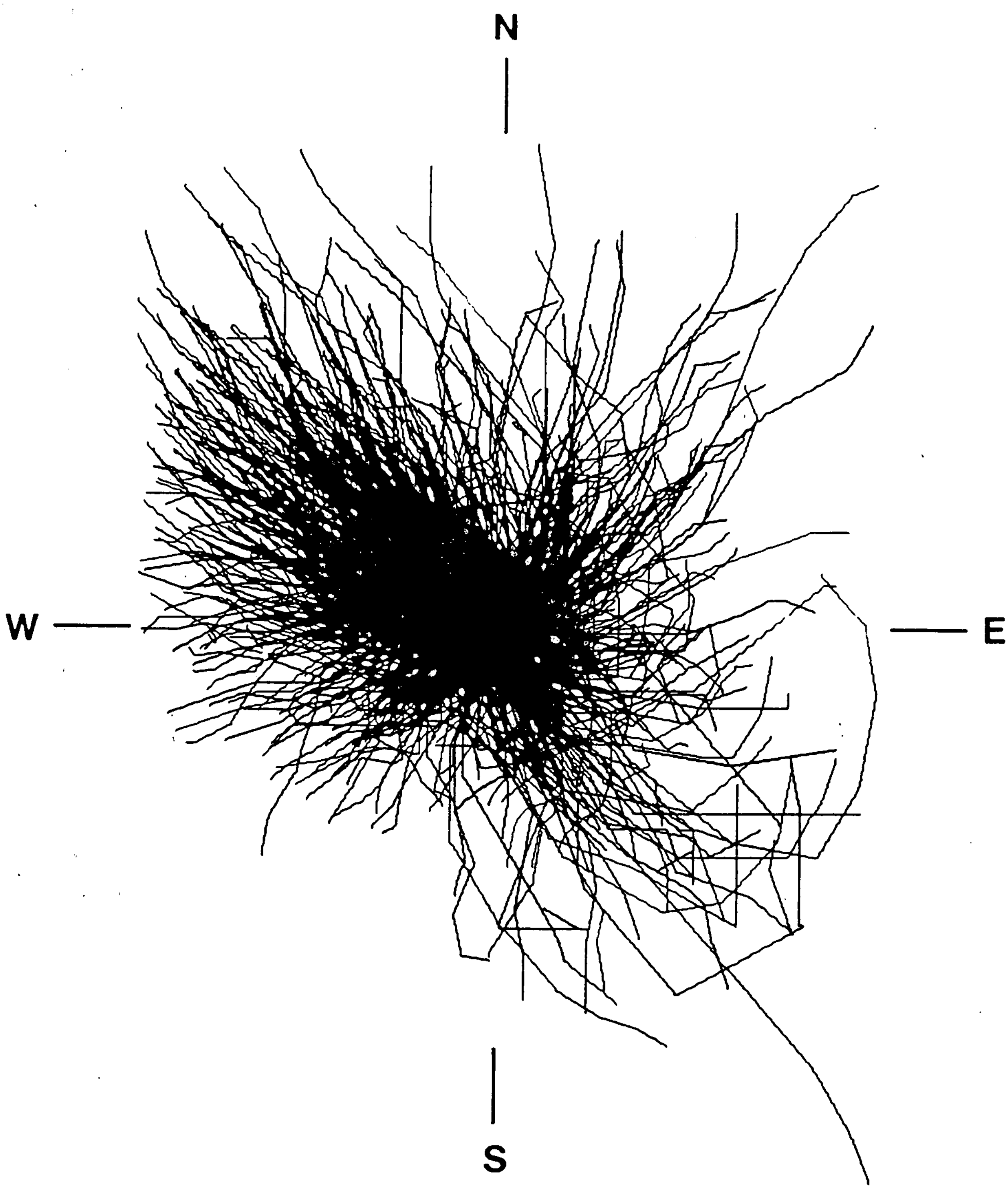
Appendix F

APPENDIX F WINDS



THREE-HOURLY WIND ROSES FOR MOOMBA (Source: SANTOS, 1981)
1979

F2



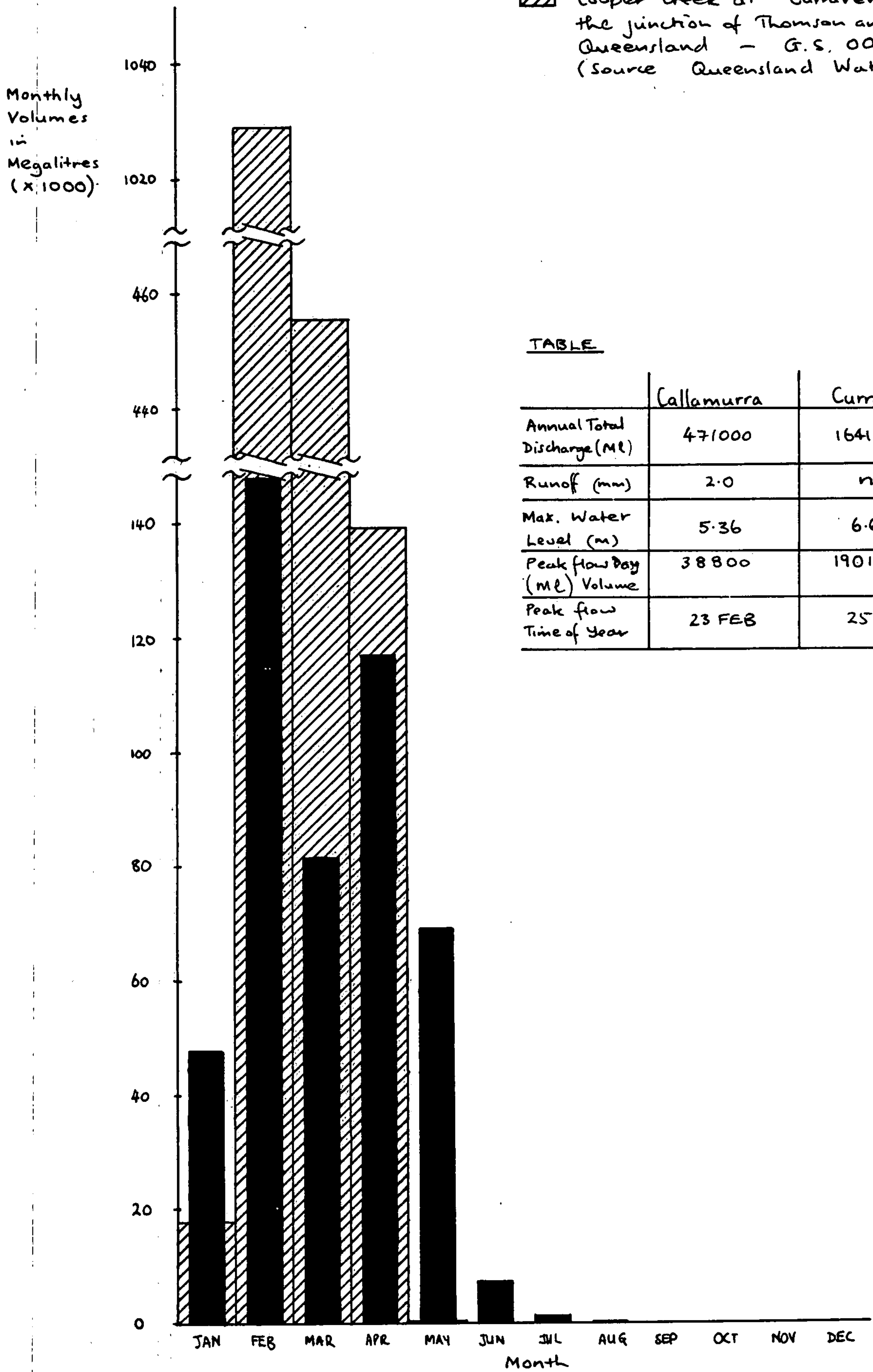
PROGRESSIVE WIND VECTORS 24-HOUR DAYS (Source: SANTOS, 1981)
MOOMBA 1977 AND 1978

Appendix G

Appendix G1 - MONTHLY TOTAL FLOW VOLUMES ON THE COOPER CREEK AT CALLAMURRA W.H., S.A. AND CURRAREVA, QLD, FOR 1979 (IN MEGALITRES).

■ Cooper Creek at Callamurra W.H.-G.S. 003501 (Source E. & W.S. Dept., S.A.).

▨ Cooper Creek at Currareva, 25 km SW of the junction of Thomson and Barcoo Rivers, Queensland - G.S. 003101A (Source Queensland Water Resources Commission).



TABLE

	Callamurra	Currareva
Annual Total Discharge (Ml)	471000	1641943
Runoff (mm)	2.0	n.a.
Max. Water Level (m)	5.36	6.65
Peak flow Day (Ml) Volume	38800	190106.2
Peak flow Time of Year	23 FEB	25 FEB.

N.B. - catchment area for Callamurra W.H. - 240 000 km² (E.&W.S.)

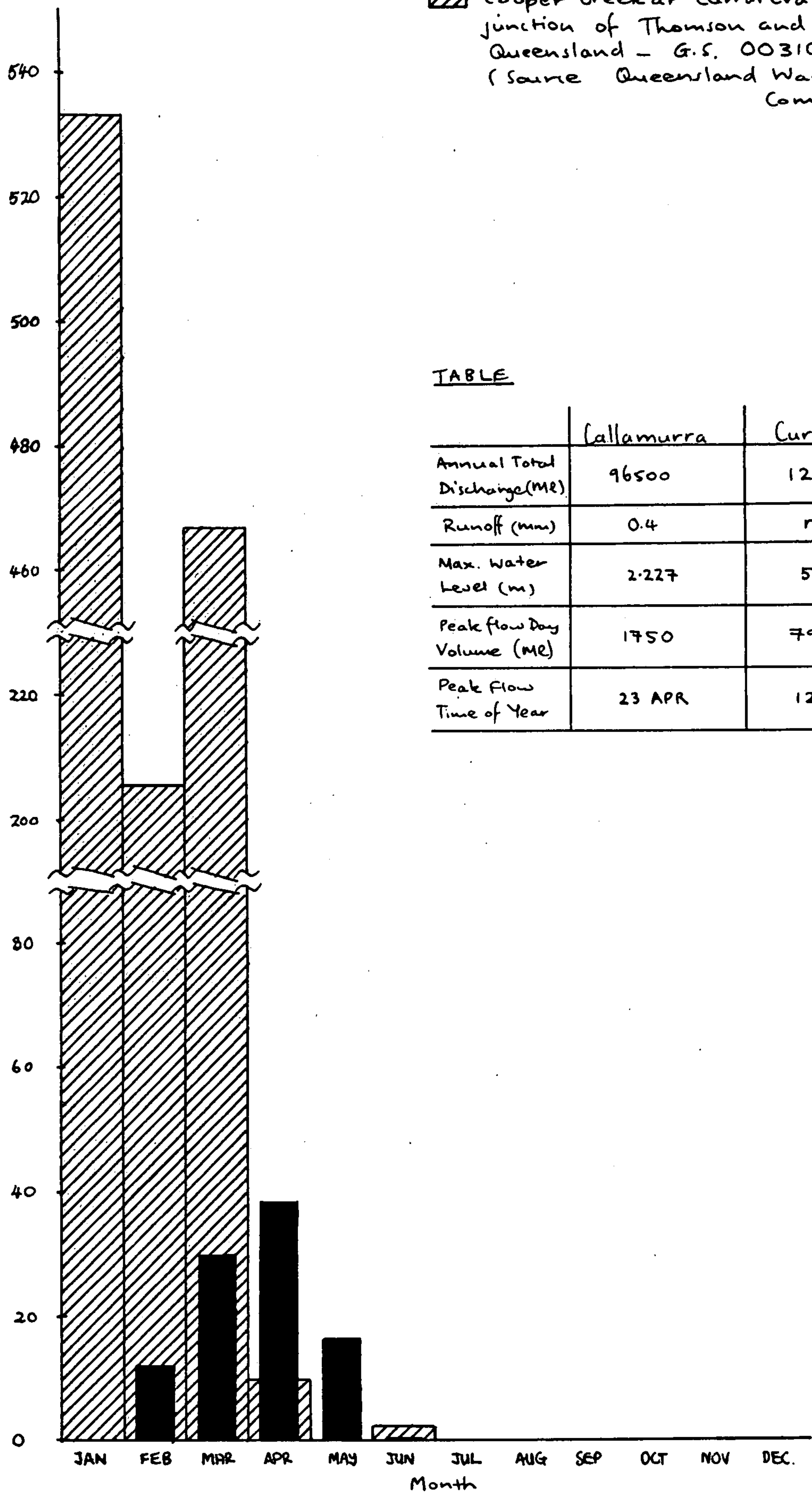
F.M.'84

G2-1980

Appendix G2 – MONTHLY TOTAL FLOW VOLUMES ON THE COOPER CREEK AT CALLAMURRA W.H., S.A. AND CURRAREVA, QLD, FOR 1980 (IN MEGALITRES).

■ Cooper Creek at Callamurra W.H. – G.S. 003501 (Source E. & W.S. Dept., S.A.).

▨ Cooper Creek at Currareva, 25km SW of the junction of Thomson and Barcoo Rivers, Queensland – G.S. 003101A (Source Queensland Water Resources Commission).



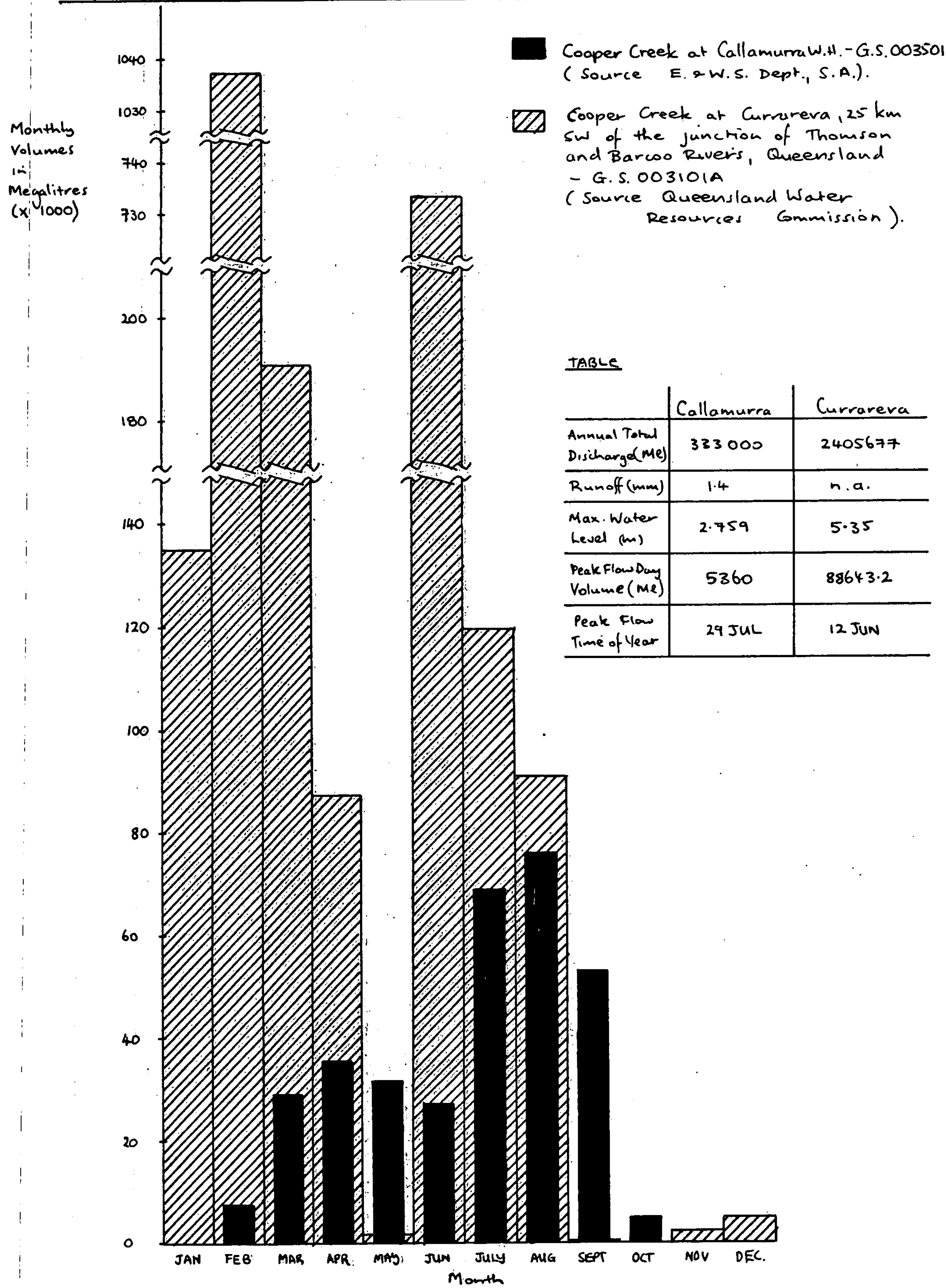
TABLE

	Callamurra	Currareva
Annual Total Discharge (Ml)	96500	1217239
Runoff (mm)	0.4	n.a.
Max. Water Level (m)	2.227	5.17
Peak flow Day Volume (Ml)	1750	79396.7
Peak Flow Time of Year	23 APR	12 JAN

N.B. – catchment area for Callamurra W.H. – 240000 km^2 (E.&W.S.).

F.M. '84

App. G3 – MONTHLY TOTAL FLOW VOLUMES ON THE COOPER CREEK AT CALLAMURRA W.H., S.A., AND CURRAREVA, QLD, FOR 1981 (IN MEGALITRES).



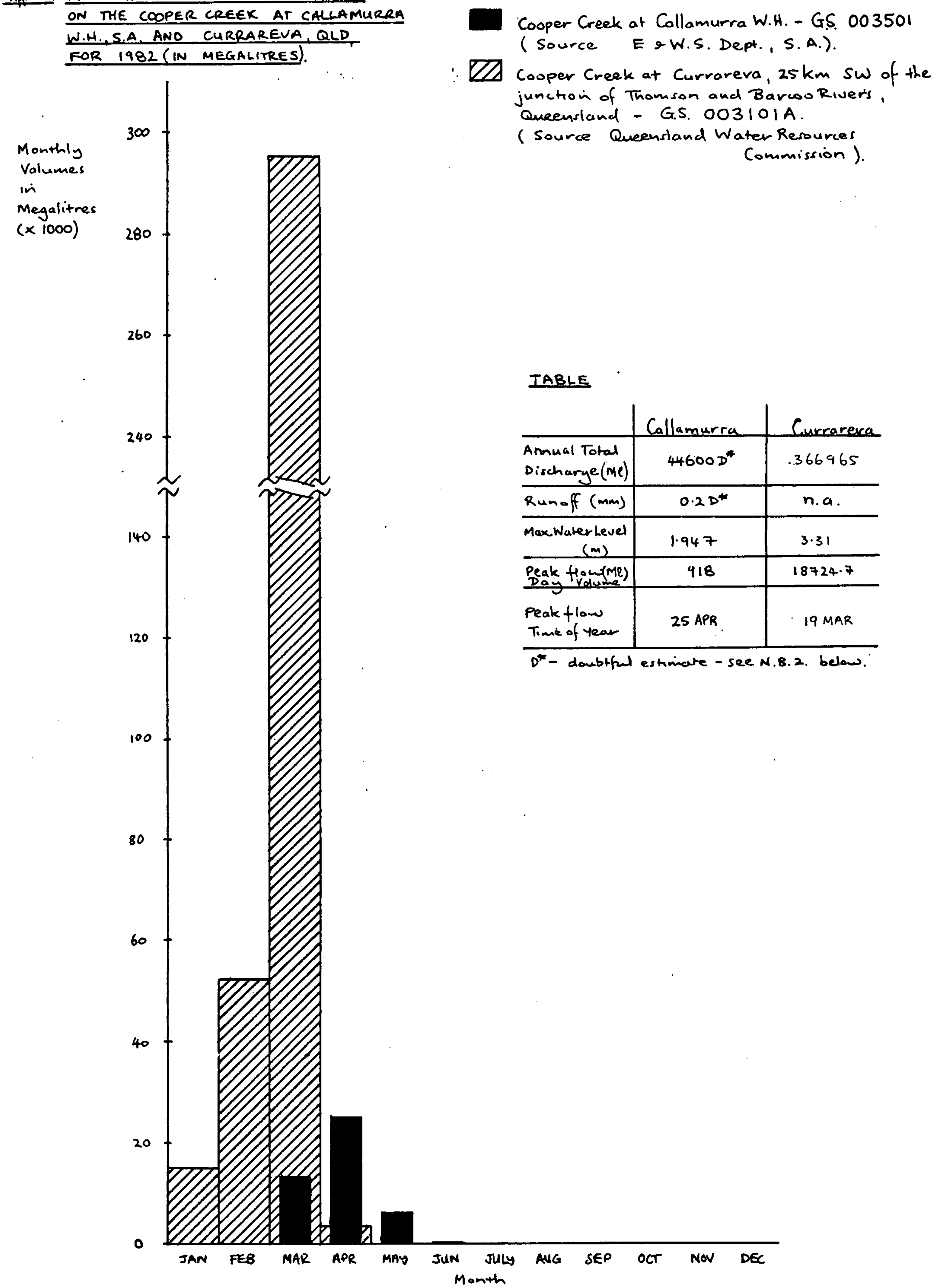
TABLE

	Callamurra	Currareva
Annual Total Discharge (Ml)	333 000	2405677
Runoff (mm)	1·4	n.a.
Max. Water Level (m)	2·759	5·35
Peak Flow Day Volume (Ml)	5360	88643·2
Peak Flow Time of Year	29 JUL	12 JUN

N.B. – catchment area for Callamurra W.H. – 240 000 km² (E.&W.S.).

F.M. '84

App. G4 - MONTHLY TOTAL FLOW VOLUMES ON THE COOPER CREEK AT CALLAMURRA W.H., S.A. AND CURRAREVA, QLD, FOR 1982 (IN MEGALITRES).



TABLE

	Callamurra	Currareva
Annual Total Discharge (Ml)	44600 D*	366965
Runoff (mm)	0.2 D*	n.a.
Max. Water Level (m)	1.947	3.31
Peak flow (Ml) Day Volume	918	18724.7
Peak flow Time of Year	25 APR	19 MAR

D* - doubtful estimate - see N.B.2. below.

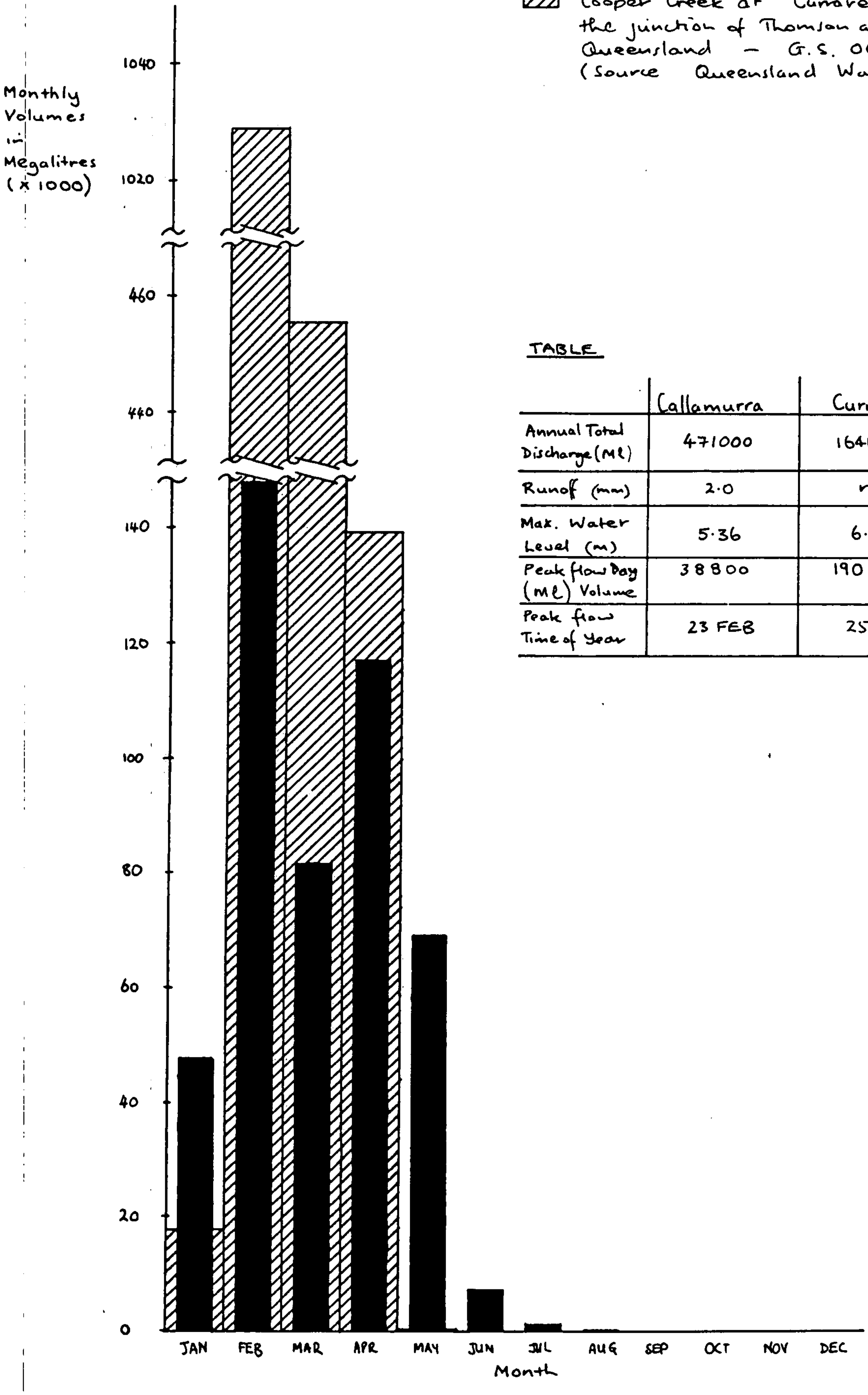
N.B.1 - catchment area for Callamurra W.H. - 240 000 km² (E&W.S.)
N.B.2 - records from 10 ii 82 to 19 iii 82 doubtful estimates as float tape removed and instrument not recording.

F.M. '84

Appendix G1 - MONTHLY TOTAL FLOW VOLUMES ON THE COOPER CREEK AT CALLAMURRA W.H., S.A. AND CURRAREVA, QLD, FOR 1979 (IN MEGALITRES).

■ Cooper Creek at Callamurra W.H. - G.S. 003501 (Source E. & W.S. Dept., S.A.).

▨ Cooper Creek at Currareva, 25 km SW of the junction of Thomson and Barcoo Rivers, Queensland - G.S. 003101A (Source Queensland Water Resources Commission).



TABLE

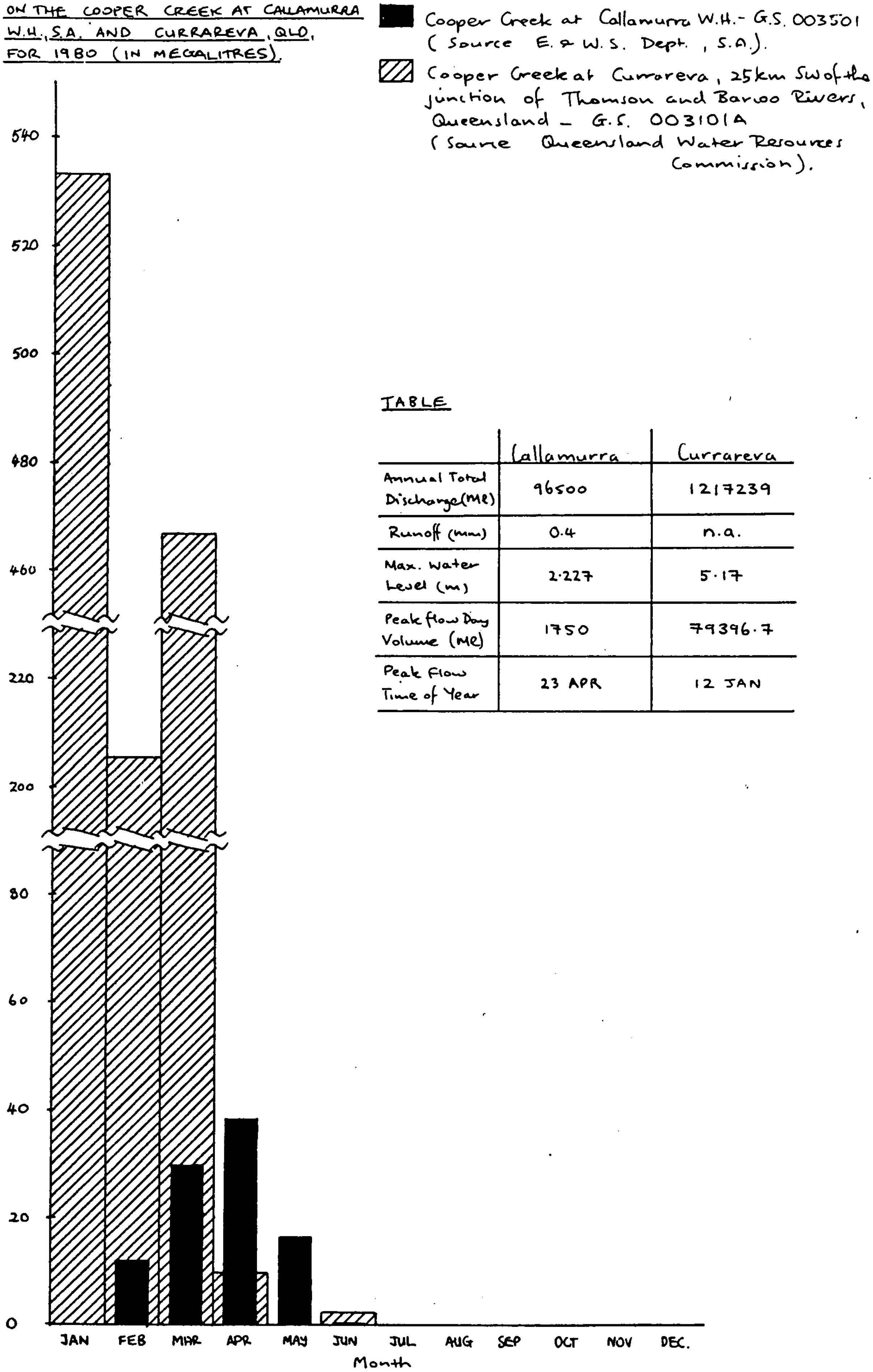
	Callamurra	Currareva
Annual Total Discharge (Ml)	471000	1641943
Runoff (mm)	2.0	n.a.
Max. Water Level (m)	5.36	6.65
Peak flow Day (Ml) Volume	38800	190106.2
Peak flow Time of Year	23 FEB	25 FEB.

N.B. - catchment area for Callamurra W.H. - 240 000 km² (E.&W.S.)

F.M.'84

G2-1980

Appendix G2 – MONTHLY TOTAL FLOW VOLUMES ON THE COOPER CREEK AT CALLAMURRA W.H., S.A. AND CURRAREVA, QLD, FOR 1980 (IN MEGALITRES).



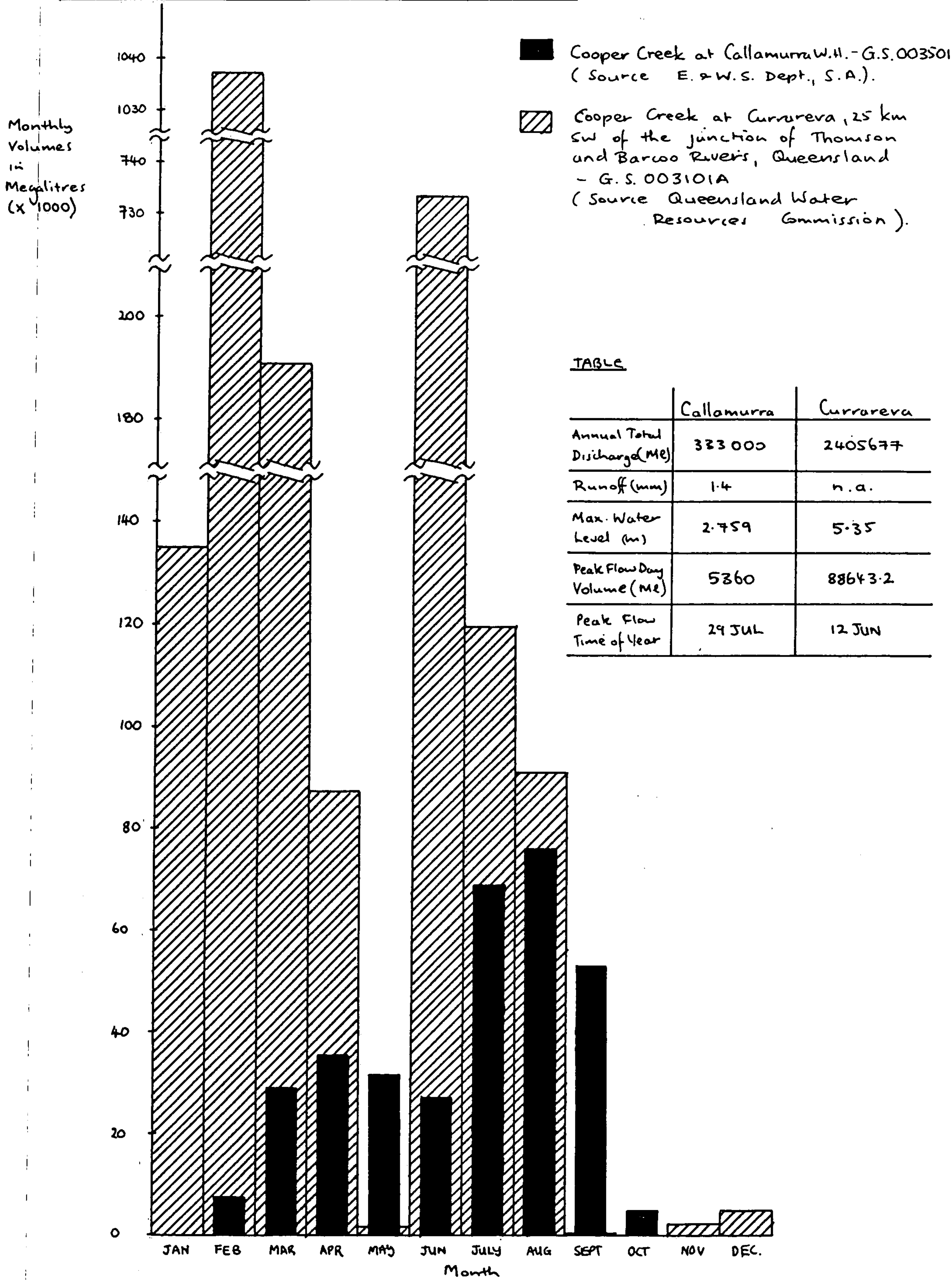
TABLE

	Callamurra	Currareva
Annual Total Discharge (Ml)	96500	1217239
Runoff (mm)	0.4	n.a.
Max. Water Level (m)	2.227	5.17
Peak flow Day Volume (Ml)	1750	79396.7
Peak Flow Time of Year	23 APR	12 JAN

N.B. – catchment area for Callamurra W.H. – 240000 km² (E.&W.S.).

F.M. '84

App. G3 – MONTHLY TOTAL FLOW VOLUMES ON THE COOPER CREEK AT CALLAMURRA W.H., S.A., AND CURRAREVA, QLD, FOR 1981 (IN MEGALITRES). G3-1981



TABLE

	Callamurra	Currareva
Annual Total Discharge (Ml)	333 000	2405677
Runoff (mm)	1.4	n.a.
Max. Water Level (m)	2.759	5.35
Peak Flow Day Volume (Ml)	5360	88643.2
Peak Flow Time of Year	29 JUL	12 JUN

N.B. – catchment area for Callamurra W.H. – 240 000 km² (E.&W.S.).

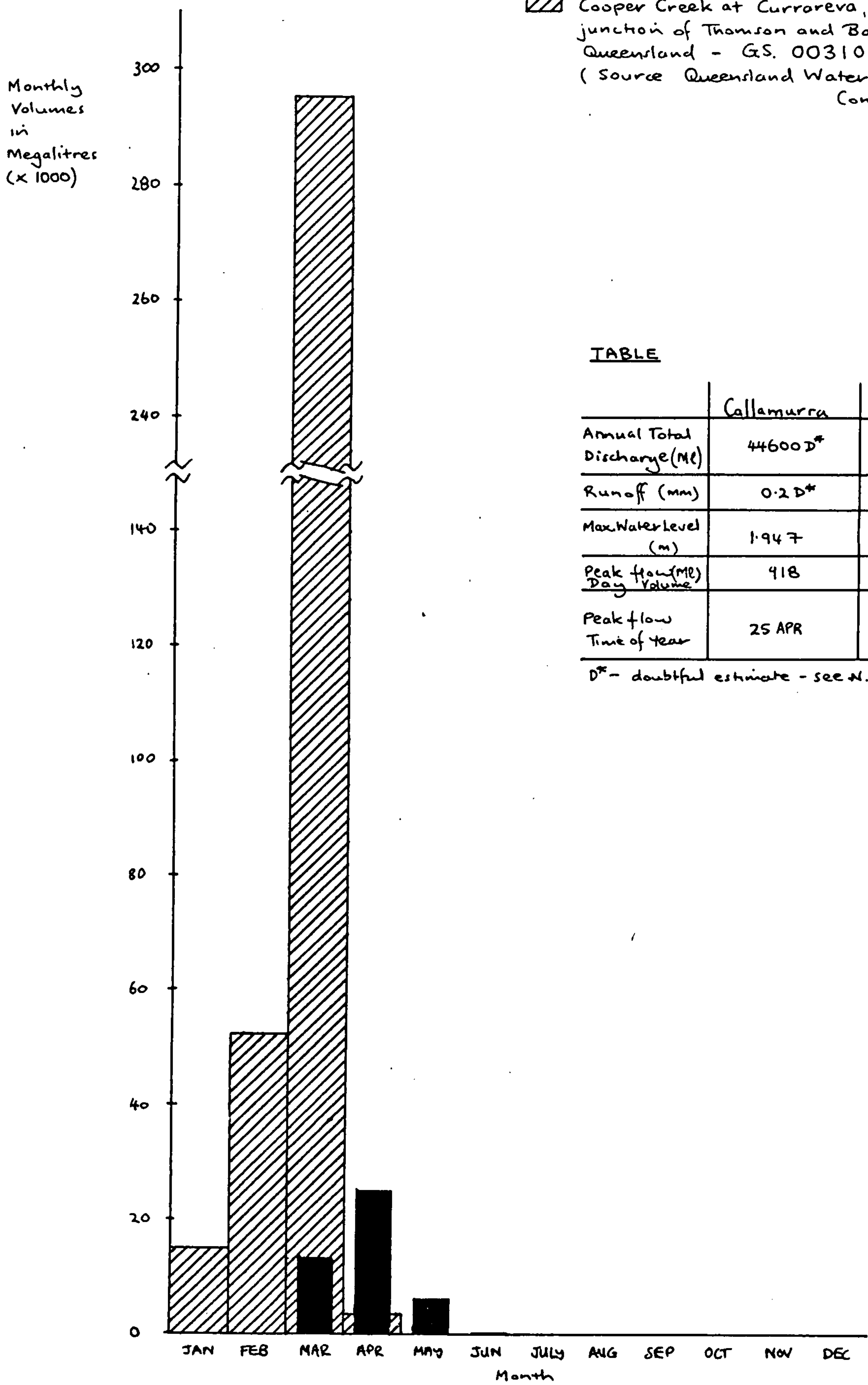
F.M. '84

App. G4 - MONTHLY TOTAL FLOW VOLUMES ON THE COOPER CREEK AT CALLAMURRA W.H., S.A. AND CURRAREVA, QLD. FOR 1982 (IN MEGALITRES).

G4-1982

■ Cooper Creek at Callamurra W.H. - G.S. 003501 (Source E & W.S. Dept., S.A.).

▨ Cooper Creek at Curroreva, 25 km SW of the junction of Thomson and Barcoo Rivers, Queensland - G.S. 003101A. (Source Queensland Water Resources Commission).



TABLE

	Callamurra	Currareva
Annual Total Discharge (Ml)	44600 D*	.366965
Runoff (mm)	0.2 D*	n.a.
Max. Water Level (m)	1.947	3.31
Peak flow (Ml) Day Volume	418	18724.7
Peak flow Time of Year	25 APR	19 MAR

D* - doubtful estimate - see N.B.2. below.

N.B.1 - catchment area for Callamurra W.H. - 240 000 km² (E&W.S.)
N.B.2 - records from 10 ii 82 to 19 iii 82 doubtful estimates as float tape removed and instrument not recording.

F.M. '84

APPENDIX G5 - CHRONOLOGY OF KNOWN EVENTS FROM ALONG THE COOPER AND STREZLECKI CREEKS AND OTHER AREAS THAT MAY INDICATE FLOODS OR FLOWS

Abbreviations of Source:

E.& W.S. - Personal communication by Mr. B. Nicholson, E. & W.S. Water Resources Branch

Lewis - Government Survey Expedition commanded by J.W. Lewis in 1874 to the area around Lake Eyre to the Macumba River, Warburton River, Lake Everard and the Cooper to 6 miles east of the South Australia/Queensland Border. (Nappamerrie).

Sturt - Sturt (and Stuart) went up the Cooper in 1845 to as far as Innamincka.

Classes of flow: A - average 1 - level 1 flood 2 - level 2 flood
3 - level 3 flood L - local rainfall

DATE	OBSERVATION	FLOW	SOURCE
1845	Water in waterholes of the Strzelecki Creek	A & L(?)	Sturt in Pearce (1973)
1860-61	Burke and Wills Expedition - water in Waterholes along Cooper Creek - Strzelecki Creek dry 1861.	A	e.g. White (1917b)
1874-75	Lake Eyre dry from 27th Oct. 1874 to 12th July, 1875	A	Lewis in Mason (1955) and Lewis (1875)
1877 1877-78	Heavy rain flooded the Cooper Creek Exceptionally good season in the "Dead Heart"	1 or 2	Pearce (1978) Madigan (1946)
1879	One of the best seasons (average rainfall 254 mm)	1 & L 2 or & L	Madigan (1946)
Early 1880's	Dry conditions prevailed	A	Litchfield (1993)
1882	Strzelecki Creek flowed near Merty Merty	A & L	E. & W.S.
1885	One of the best seasons (av. rainfall 254 mm)	A	Madigan (1946)
1885	412 mm at Innamincka - one of the best years	L	Madigan (1946)
1885	Cooper May have reach Lake Eyre	1 or 2	Mason (1955)
1886-87	Cooper probably flowed into Lake Eyre	2 or 3	Mason (1955)
1887	Flow into Lake Eyre which may be comparable with that of 1949.	2	Mason (1955)

1889-90	Exceptionally good season	1 or 2	Madigan (1946)
1889-90	Cooper may have reached lake Eyre	2	Mason (1955)
1890	One of the best seasons - 406 mm at Cordillo Downs	2	Madigan (1946)
1890	Lake Killalpininna on the Cooper Creek near Kopperamanna filled	2	Litchfield (1983)
1890-91	Rain records show it as a period when a great flooding (of the 1949/50 and 1973/74 type) was likely.	3	Mason (1955)
1891	Cooper Creek flowed to lake Eyre or in its lower course - according to "old timers".	2 or 3	Madigan (1946)
1891	Lake Killalpaninna on the Cooper Creek near Kopperamanna again filled.	?2	Litchfield (1983)
1894	Cooper Creek probably flowed into Lake Eyre in an equivalent flow to 1949	2 or 3	Mason (1955)
1898	Cooper Creek flowed to lake Eyre or in its lower coarse - according to "old times".	1 or 2	Madigan (1946)
1898	Lake Killalpaninna on the Cooper Creek near Kopperamanna filled.	2	Litchfield (1983)
1898 to 1902	A very bad period in terms of drought	A	Madigan (1946)
1900	General bad year (ave rainfall 63 mm)	A	Madigan (1946)
1903	Cooper probably flowed to Lake Eyre or lower in its course	2 or 3	Mason (1955)
1906	Cooper probably flowed to Lake Eyre or lower in its course - 1949 flow	2 or 3	Madigan (1946) and Mason (1955)
1906	Strzelecki Creek flowed near Merty Merty	L	E. & W.S.
1906-7	Heavy rains in Queensland resulted in a Cooper Creek flood at Innamincka	1 or 2	Mason (1955)
1907	413 mm at Innamincka - one of the best years	L	Madigan (1946)
1907	Heavy floods of 1906 filled Lake Killalpaninna on the Cooper Creek near Kopperamanna	2	Litchfield (1983)
1909-10	Exceptionally good season (study area averaged 248 mm in 1910)	L	Madigan (1946)

1910-11	Exceptionally good season (study area averaged 219m in 1911)	L	Madigan (1946)
1916	Strzelecki Waterholes carried water in September - fine season	1	White (1917b)
	Water flowed in the Cooper for 5 weeks to the 29 September 1916 only possible for camels to cross at the time		White (1917b)
1916-17	Cooper probably flowed to Lake Eyre in a flow comparable to 1949	1 or 2	Mason (1955)
1917	Single good season particularly in the Clifton Hilss and Kariowana areas - western part of the study area (average rainfall 318 mm).	L	Madigan (1946)
1918	Big flood of Cooper Creek reached Lake Eyre from 1917 rains	L	Madigan (1946)
1920	Cooper probably flowed to Lake Eyre		Mason (1955)
1920	A single good season - the best general season (average rainfall 305 mm)		Madigan (1946)
1920-21	Cooper probably flowed to Lake Eyre in a flow equivalent to that of 1949.		Mason (1955)
1927-28	Very bad period of drought		Madigan (1946); Pearce, (1978)
1929	Worst general season or drought known (average rainfall 46 mm) - Lake Eyre dry.		Madigan (1946)
1932	Water reached Lake Hope eighteen times times in the preceeding 45 years (1887) - claim of an "old timer" - requires exceptionally heavy rains		Madigan (1946)
1934	Strzelecki Track abandoned as too dry for stock or even camels		Mr. J. Vickery (pers. comm.) Pearce (1978).
1936	Strzelecki Creek flowed near Merty Merty	L	E. & W.S.
1939	One of the best seasons (average rainfall 254 mm)	L	Madigan (1946)
1939	Cooper Creek may have flowed to Lake Eyre	2	Mason (1955)
1939	One of the worst years on record (average rainfall 51mm)	A	Madigan (1946)

1941	Cooper Creek probably flowed (in a flow comparable to that of 1949) to Lake Eyre.	2	Mason (1955)
1944	Cooper Creek may have flowed to Lake Eyre	1 or 2	Mason (1955)
1944	A bad local drought in west		Litchfield (1983)
1949	Strzelecki Creek flowed near Merty Merty	L	E. & W.S.
1949	Flood waters reached Lake Eyre	2	Mason (1955)
1950	Strzelecki Creek flowed near Merty Merty	3	E. & W.S.
1951	Strzelecki Creek flowed near Merty Merty	L	E. & W.S.
1953	Water in Lake Eyre - minor flood	Bonython (1955) - 1922	Mason (1955)
1955	Strzelecki Creek flowed near Merty Merty		E. & W.S.
1955	Water in Lake Eyre - Qld tributaries of Cooper Creek running at flood level		Mason (1955)
1956	Strzelecki Creek flowed near Merty Merty		Litchfield (1983)
1956-63	Drought		
1963	Strzelecki Creek flowed near Merty Merty		E. & W.S.
1969	Etadunna flooded - local flood		Litchfield (1983)
1971	Strzelecki Creek flowed near Merty Merty		E. & W.S.
1973	Strzelecki Creek flowed near Merty Merty		E. & W.S.
1974-75 -76	Exceptional Seasons		Litchfield (1983)
1974	Strzelecki Creek flowed near Merty Merty	3	E. & W.S.
1976	Strzelecki Creek flowed near Merty Merty	L	E. & W.S.

1977	Strzelecki Creek flowed near Merty Merty	L	E. & W.S.
1979	Strzelecki Creek flowed near Merty Merty	L	E. & W.S.
1984	Strzelecki Creek flowed near Merty Merty	L	Inferred

Appendix H

APPENDIX H

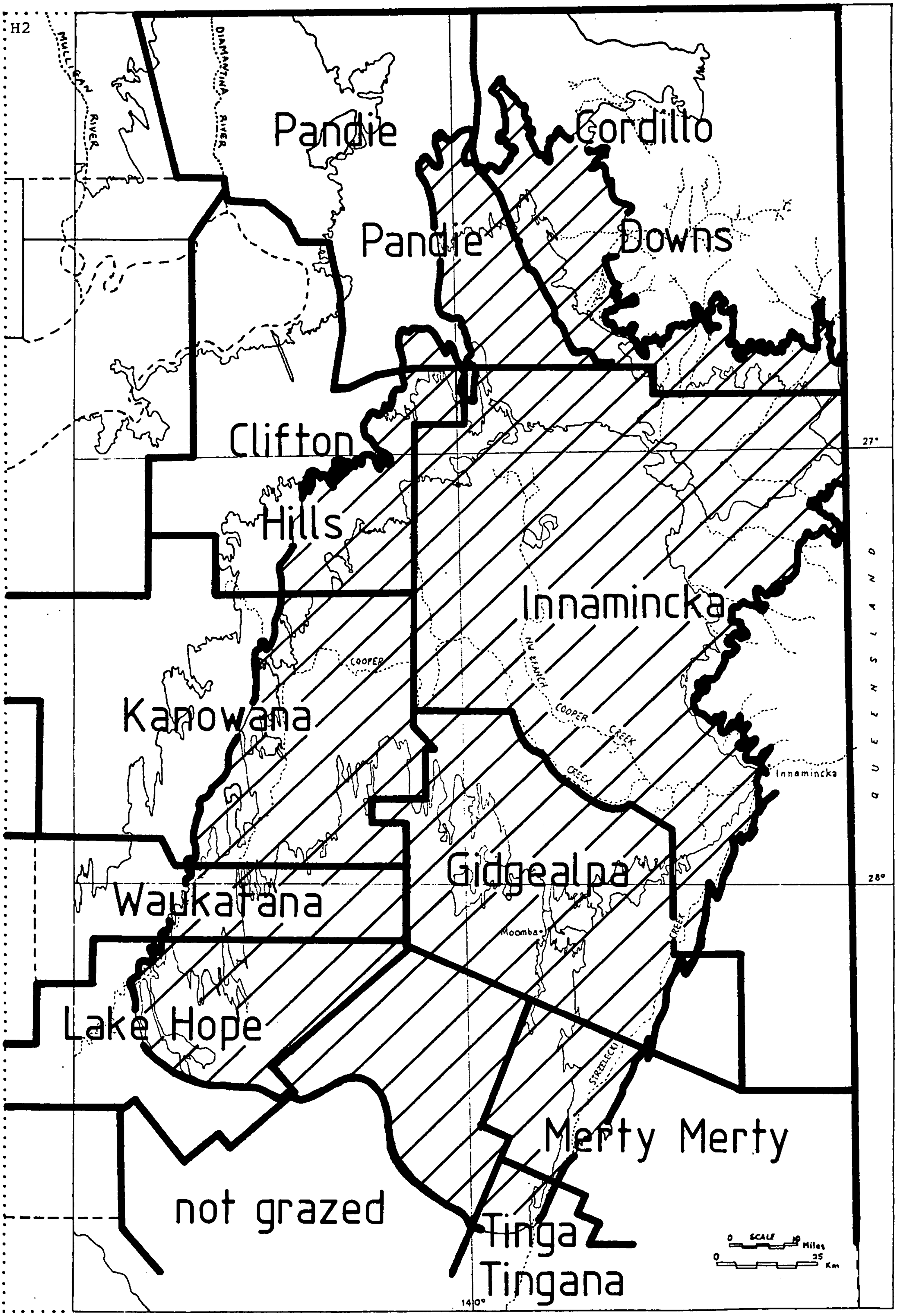
CURRENT PASTORAL LEASES[1]

Information from South Australian Department of Lands Pastoral Plans

Property	Pastoral Lease No.	Block No.	Area (km^2)	Approx. Area in 8.4.4 (km^2)
Cordillo Downs	2066	851	7874	1829
Pandie Pandie	2406	1193 1238 1239	6625 1160 420 ≰ 8205	1098
Clifton Hills	2387 2421	1178 1179	3401 1122 ≰ 4523	1050
Waukatana	2449	1168	2368	1100
Kanowana	2386	1177	6799	2526
Lake Hope	2447	1175	3791	1760
Innamincka	2405	757	13818	9630
Gidgealpa	2425	1180	4909	4044
Merty Merty	2422	1181	4136	1536
Tinga Tingana	2452	1205	3626	167
not grazed	-	-	-	2310
				≰ 27050

SEE MAP OVER ON PAGE...H2

[1]Prior to fencing associated with the Brucellosis/Tuberculosis (BTB) Programme, many lease boundaries existed only on paper. Hence, the new fences may be located somewhat differently to what is shown on pastoral plans - this is in response to field conditions during fencing (Mr. G. Drewin, pers. comm.).



H2
MULLIGAN RIVER
DIAMANTINA RIVER
Pandie
Pandie
Cordillo
Downs
Clifton
Hills
Innamincka
Kanowana
COOPER
NW BRANCH
COOPER CREEK
CREEK
Innamincka
QUEENSLAND
27°
28°
Gidgealpa
Waukatana
Moomba
CREEK
Lake Hope
STRZELECKI
Merty Merty
not grazed
Tinga Tingana
SCALE
Miles
Km
140°

Appendix I

APPENDIX I DATA SHEETS

SITE SHEET

PROPERTY/PADDOCK______________________/______________ SITE:______

COOPER CREEK ENVIRONMENTAL ASSOCIATION

(8.4.4)

OBSERVERS:____ DATE:______________
AUSTRALIAN MAP GRID ______________EASTINGS:_ _ _ _ _ _ NORTHINGS:_ _ _ _ _
RESOLUTION CODE(i.e. accuracy of location)_____
1=27m 2=270m 3=810m 4=1.6km 5=16.2km 6=48.6km 7=97.2km
DISTANCE AND DIRECTION FROM NEAREST NAMED PLACE(Straight Line):

____

DESCRIPTION OF SITE:(Landform, aspect, vegetation structure,etc.)

____

____

____

____

PHOTOGRAPHS(ROLL/FRAME):______________/_________________
LANDFORM: [] PLAIN [] DUNE [] INTERDUNE LOW [] CLAYPAN(FRESHWATER)
[]SALT LAKE [] FLOODOUT [] TERMINAL LAKE [] SWAMP [] CHANNEL
[] OTHER______________
SUBSTRATE:(Insert numbers in order of prevalence)
TYPE:[] CLAY [] SILT [] LOAM [] SAND [] GRANULE(2-4mm) [] PEBBLE(4-64mm)
[] COBBLE(64-256mm) [] BOULDER(>256mm)
A(Dominant):________________ B(Subdominant(s)):_________________
COLOUR:[] BLACK [] BROWN [] RED [] ORANGE [] YELLOW [] WHITE [] OTHER
WATER CHARACTERISTICS: [] PRESENT [] ABSENT
[] FLOWING [] STATIC [] ENCLOSED [] CHANNELED [] PERRENNIAL[] EPHEMERAL
MAX. DEPTH:[] 0-0.5m [] 0.5-1m [] 1-1.5m [] >1.5m
SECCHI DISC READING:__________________________centimeters
VEGETATION:PERCENTAGE BARE GROUND: [] <10 [] 10-30 [] 30-70 [] >70

	DOMINANT SPECIES	VOUCHER NO.	*HABIT	HEIGHT (m)	ESTIMATED PROJ. COVER(%) <10	10-30	30-70	>70
1								
2								
3								
4								
5								

*HABIT:(Terrestrial) T=tree; S=shrub; G=ground layer;(Aquatic) E=emergent; F=floating; U=underwater; (Marginal) R=reed/sedge.

FAUNA:	DOMINANT SPECIES	VOUCHER NO.	COMMENT
1			
2			
3			
4			
5			

Additional Species of plants or animals should be listed on the back

SITE NUMBER: ______________________________

SPECIES	VOUCHER NUMBER	HABIT	HEIGHT (m)	COMMENT

VEGETATION RECORDING SHEETS

OBSERVERS: ______________________________ DATE: ______________________
AMG GRID REFERENCE ______________________ SITE NO. ________
DESCRIPTION: (size, location, direction, etc)

PHOTOGRAPHS (ROLL/FRAME) ____________________

SPECIES	VOUCHER NO.	HABIT	Estimated Projected Cover (%			
			<10	10-30	30-70	>7

SITE NUMBER: ____________________

SPECIES	VOUCHER NUMBER	HABIT	HEIGHT (m)	COMMENT

SITE NUMBER: ______________________

SPECIES	VOUCHER NUMBER	HABIT	HEIGHT (m)	COMMENT

SITE NUMBER: ______________________________

SPECIES	VOUCHER NUMBER	HABIT	HEIGHT (m)	COMMENT

VERTEBRATE FIELD SHEET

PROPERTY/PADDOCK NAME: ______________________________ SITE: ____________
OBSERVERS: ______________________________ DATE: ____________________
TEMPERATURE: ________CLOUD COVER(%) _______WIND(KPH): ___________TIME: ____
AUSTRALIAN MAP GRID: ____54__________ EASTINGS: ____________________
NORTHINGS: ____________________
RESOLUTION CODE(i.e. accuraccy of location)______________________________
1=27m 2=270m 3=810m 4=1.6km 5=16.2km 6=48.6km 7=97.2km
DIRECTION AND DISTANCE TO NEAREST NAMED PLACE(Straight Line):
____
____
PHOTOGRAPHS(ROLL/FRAME): __________________/__________________
LANDFORM: [] PLAIN [] DUNE [] INTERDUNE LOW [] CLAYPAN(FRESHWATER)
[] SALT LAKE [] FLOODOUT [] TERMINAL LAKE [] SWAMP [] CHANNEL
[]OTHER______________________________________
SUBSTRATE:(Insert numbers in order of prevalence)
TYPE:[] CLAY []SILT [] LOAM [] SAND [] GRANULE(2-4mm) [] PEBBLE(4-64mm)
[] COBBLE(64-256mm) [] BOULDER(>256mm)
A (Dominant)___________________ B (Subdominant(s):__________________
COLOUR:[] BLACK [] BROWN [] RED [] ORANGE [] YELLOW [] WHITE []OTHER
WATER CHARACTERISTICS: [] PRESENT [] ABSENT
[] FLOWING [] STATIC [] ENCLOSED [] CHANNELED [] PERRENNIAL [] EPHEMERAL
MAX. DEPTH: [] 0-0.5m [] 0.5-1m [] 1-1.5m [] > 1.5m
SECCHI DISC READING: ___________________________ centimeters
PERCENTAGE BARE GROUND: []<10 []10-30 []30-70 []>70

DOMINANT PLANT SPECIES	HABIT (T/S/GC)	HEIGHT (m)	COVER <10	10-30	30-70	>70
1)						
2)						
3)						
4)						
5)						

SPECIES	VOUCHER NUMBER /SAM NUMBER	COMMENT (MICROHABITAT,ETC)
	/	
	/	
	/	
	/	
	/	
	/	
	/	
	/	

Additional Species should be listed on another page referenced to this site

SITE NUMBER: ______________________________

SPECIES	VOUCHER NUMBER	HABIT	HEIGHT (m)	COMMENT

SITE NUMBER: ______________________

SPECIES	VOUCHER NUMBER	HABIT	HEIGHT (m)	COMMENT

SITE NUMBER: ____________________

SPECIES	VOUCHER NUMBER	HABIT	HEIGHT (m)	COMMENT

Appendix J

APPENDIX J

METHODOLOGY TO BE EMPLOYED IN THE SAMPLING OF FLORA AND FAUNA IN THE COOPER CREEK ENVIRONMENTAL ASSOCIATION (8.4.4).

N.B. - The sampling methodology below is designed assuming three major habitat types in each area sampled, e.g. dunefields consisting of dunes, swales and claypans. This methodology may need revision after the first field trip.

FLORA

Prior to field work aerial photographs will be examined to select representative sample sites. These will be rechecked in the field to assess representativeness. Different vegetation patterns will be tentatively identified and mapped from aerial photograph interpretation.

Field methods will comprise vegetation description and sampling.

Sampling

At each site selected to represent a major vegetation type, a permanent quadrat will be established by location of permanent markers at each of the four corners. A photographic record of the quadrat will be taken.

Several quadrats will be used at each permanent site. The quadrat on the major feature of a landform complex, e.g. dune in a dunefield, will be pegged as the permanent site and the location of other quadrats will be related to this by description on a data sheet. Due to time constraints, a maximum of 6 (i.e. 2 on dunes, 2 on swales and 2 on claypans in a dunefield) quadrats will be sampled. Depending on vehicle space and peg availability, one corner peg may be placed on a selected corner of each of these other quadrats.

Sizes of quadrats will be varied according to the species richness of the vegetation type, determined by construction of a species/area curve. Sizes are likely to be in the order of 25m^2 the size often used in arid zone vegetation sampling.

The incidence of all species present in each quadrat will be recorded. In addition the projected foliage cover of each stratum will be estimated by eye, as well as the cover of litter and the amount of bare ground. It may be that photography from the roof of a vehicle will be used to determine ground cover, but the use of booms or similar equipment has been found to be too time consuming.

Additional to the above, at each permanent sample point, a transect will be taken through each vegetation type and species present in each stratum will be recorded in 5-10m radius quadrats at intervals along the transect. Intervals will depend on the species richness of the vegetation.

This procedure will be repeated for each sub-unit of a vegetation type, e.g. dune, swale and claypan.

At each site descriptions of observable features: soil, topography, grazing pressure will be recorded.

Specimens of the range of plant species present at the time of the field trip near survey sites will be collected and later deposited in the State Herbarium.

Description

Within the identified landform complexes qualitative observations will be made from vehicular and pedestrian traverses to check areas identified from aerial photograph-interpretation. This will assist in producing a vegetation map and to establish the relationship between adjacent land systems.

Vegetation types will be described in terms of strata present, height, projected foliage cover of each stratum, and constantly recurring species in each stratum. Associations will be assessed on the stratum which contributes most to the biomass. Within a given stratum species will be listed in order of decreasing prominence. Notes will be taken on observable features: soil, landforms and grazing pressure, for example.

FAUNA

Mammals

A trapline will consist of 25 aluminium box traps. An attempt will be made to place at least two traplines in each habitat type. The traps will be laid on transects with approximately 15m between each trap. Assuming three habitat types this requires 150 traps. A further 50 traps will be placed in significant areas, e.g. concentrated around burrows, spoil heaps and tracks, for example. In this way quantitative sampling of species will be made (i.e. by use of selective concentrated trapping).

At this stage we do not know how many cage traps we will be able to accomodate. The number is likely to be limited (may be about 10, but probably less). They will be distributed amongst the habitat types along the aluminium box trap transects.

Three sets of ten pitfall trap/drift fence systems will be used. One will be placed completely within each of three major habitat types. It may that within each habitat type the pitfall trap/drift fence systems will be divided into two, so that there are actually two pitfall lines in each habitat type consisting of 5 pitfalls and 50m of drift fence.

The availability of harp (bat) traps is still uncertain. Bats will be collected with mist nets. A minimum of four hours will be spent mist-netting (on one night) at each site. The mistnetting will be conducted on the last or second last night at a site. By this time our observations will have established the best sites for mistnetting. A shotgun may be used to collect bats where the opportunity arises.

A minimum of one night (4 hours) per site will be spent spot-lighting from the vehicle. The relative amounts of time spent in each habitat type will depend on the relative abundance of that habitat in the area and its accessability (e.g. flooded river flats will not be sampled in this way).

Reptiles

Sampling for reptiles will be done largely in conjunction with the mammal trapping. It is to be expected that more reptiles will be caught in the pitfall traps than mammals and that more reptiles will be spot-lighted than mammals. In addition to these sampling techniques active searching for reptiles in different habitats will be conducted during the day time. This will include moving rock, logs and rubbish and excavating burrows. Specimens seen active on the surface will be caught. Records of tortoises observed in the water will be made at each site visited to add to information collected by Thompson (in prep.).

Birds

A travel log will be kept at all times when travelling in a vehicle recording all fauna seen (time, mileage, habitat) and a general log will account for habitats encountered and definitive features observed (fences, intersections, bores, waterholes, homesteads - logged by time and mileage).

The permanent site will be censused using a standardised "point census - line transect" method in early mornings and late afternoons to indicate numerical densities. Censusing will be carried out to cover the range of habitats around each site, with at least one census in each habitat in the morning and afternoon. Avian communities will be delineated according to vegetation type and physical features. Habitat preferences /requirements and association of species will be noted and if the base camp is near a wetland a separate census of waterbirds will be conducted.

About ten wetlands will be intensively sampled, described and censused and thus all wetlands will be classified by extrapolation of these data. Three bird communities will be"censused" at such sites, viz. 1. birds of open water, 2. birds of margins (in 1. and 2. birds will be counted), 3. dryland birds associated with wetlands, e.g. in gums, lignum flats (not censused but searched). The wetland sampling is a middle of day/travelling activity. Representative specimens will be collected.

Also during the middle part of days, besides wetland sampling, time will be spent on specific searching for cryptic, rare species in suitable habitats. In addition a search will be made for birds in all unusual/ distinctive habitats encountered while driving/logging birdlife up to 50km from base camp and sampled wetlands. A second ornithologist will travel with the botanist up to 100km from the permanent site.

At night, activities will include: spotlighting/listening for nocturnal fauna: skinning, cataloguing, scanning and reviewing the day's collected data.

Frogs

It is hoped that some frogs will be caught in pitfalls, but the likelihood of this depends as much on the weather as the siting of the traps. Active collecting, by rolling logs and removing bark from trees will also be done. However, the main sampling of frogs will be done by listening,and recording, calling frogs at night. By recording frogs, identifications can be verified in Adelaide.

An attempt will be made to find and collect tadpoles.

Fish

Fish will be collected with seine and gill nets. Seine nets of 10mm and 1mm mesh size will be used and a gill net with a mesh size of not less than 25mm will be set for varying periods. Three main types of water body will be sampled: 1. riverine, 2. billabong/oxbow lake - type backwaters, 3. shallow flood plains. Traps with funnel entrances may also be used.

Aquatic Invertebrates

A dip net of mesh size 300μm will be used to sample aquatic invertebrates in the three water bodies mentioned above. This method often results in the capture of some fish that will augment the fish collected using seine and gill nets.

Other Invertebrates

Other invertebrates caught in the pitfall traps will be collected. A special effort will be made to collect some groups where a request has been made, e.g. Ants : G. Browning, Dept. of Zoology; Scorpions : C. Shanahan, Dept. of Genetics and by light trap - Caddis flies : A. Wells, Dept. of Zoology; Dipterans : M. Kokkin, Dept. of Zoology.

HANDLING OF SPECIMENS COLLECTED IN THE FIELD

FLORA

All plant specimens collected during the field surveys will initially be held for identification and reference. They will afterwards be deposited in the State Herbarium.

FAUNA

Mammals and Reptiles

One specimen of each species (each sex if possible) of small reptile and mammal will be taken at each site except where special requests have been made. Such requests include: bats - livers for P. Baverstock and testes for W. Breed (Scientific Permit 856), certain live rodents for W. Breed (Scientific Permit 906), certain reptiles for T. Schwaner. Specimens of reptiles will be kept alive if possible for T. Schwaner, however some field preparation will be necessary. Tissue and blood samples of reptiles and livers and testes of bats will be placed in liquid N_2 and the animal preserved in formalin. Large animals, e.g. dingoes, rabbits, kangaroos and goannas will not be collected.

Birds

Representative specimens of wetland and dryland birds will be collected and gut contents stored for eventual examination.

Fish and Frogs

Series of specimens will be taken and preserved in formalin in the field.

Invertebrates

The different groups will be preserved by appropriate methods in the field or maintained live.

ANTICIPATED TIMETABLE AT EACH SITE (4 sites per trip)

Arrive late afternoon

- set up camp
- familiarisation with the lie of the land

Evening

- spotlighting
- set up harp (bat) traps
- set up light trap

DAY 1

A.M.

- site main permanent site peg (relate all other activities to this)
- set up traplines
- site and monitor quadrats (vegetation sampling and photographs)

P.M.

- set up pitfall lines
- vegetation transects

Evening

- spotlighting (vehicle)
- harp trap/light trap , etc.

DAY 2

A.M.

- check traps and pitfalls/bird censusing around site till around 11.00 a.m.
- botanist and second ornithologist set off to observe and collect to within 100km of site

A.M. & P.M.

- away from water - search for reptiles, scorpions, ants, etc.
- near water - seine/gill net for fish
  - sweep net for invertebrates and search for same
  - collecting/recording frogs
- censuses of birds at wetlands and searches for birds in other habitats up to 50km away

P.M.

- check pitfalls/bird censusing around site
- botanist and second ornithologist return or camp out

Evening

- mistnetting
- harp trap/light trap, etc.

<u>DAY 3</u> - same as DAY 2

<u>DAY 4</u>

A.M.

- pick up traps and pitfalls

Lunchtime

- break camp

Afternoon

- move to next site perhaps sampling a wetland en route

Appendix K

APPENDIX K

PROGRESS REPORT ON THE ENVIRONMENTAL CONSULTANCY RELATING TO THE COOPER CREEK ENVIRONMENTAL ASSOCIATION (8.4.4)

This progress report outlines initial findings of the field survey in the Cooper creek Environmental Association (8.4.4). It is ordered according to the Schedule and indicates the progress of each stage of the Schedule to-date.

(1) Collection of data in a form suitable for integration into computer data bases currently being generated by the Survey and Research Section of the National Parks and Wildlife Division of the Department of Environment and Planning.

Based on liaison between Consultants and staff of the Survey and Research Section, a series of data sheets (site, vegetation and vertebrate) have been developed to encourage a consistency in data format by the various parties involved in data collection. As these sheets were in a first trial stage during the Cooper Creek survey it was expected that problems would be encountered by the various parties (with widely diverse backgrounds) using them. Detailing of these problems should enable a more efficient set of data sheets to be compiled for use in future surveys of this type. During the survey of the Cooper Creek area, notebooks were used to indicate anything of note and not catered for by data sheets. These data are thus in a form suitable for integration into the computer data bases being generated by the Survey and Research Section.

(2) Classification of wetlands within the Cooper Creek Environmental Association having regard for areal extent, permanence, depth and associated flora and fauna.

A number of wetlands were visited to gather the data indicated above, prior to development of a wetland classification scheme. These data have yet to be analysed.

(3) Establishment of representative, permanently marked sites which will provide baseline data against which ecological implications of flood events within the region can be assessed.

At this stage, six permanent sites have been established in localities that are representative of environmental units within the study region. Another four are planned.

(3) Cont'd

The majority of these sites are in the Cooper Creek Floodplain at various locations along the Cooper Creek. Monitoring of these sites should enable assessment of ecological implications of flood events using the baseline data gathered in this survey and data gathered in future surveys. An outline of these data and alterations to the previously prepared methodology are indicated below.

FLORA

So far over 100 species of plant have been identified from the collection of over 800 plant specimens by Consultants, Rangers and other staff of the Department of Environment and Planning.

At sample sites, quadrat sizes were based on species/area determinations and were generally in the order of 15m X 15m. In addition, in the vicinity of the permanent quadrat a further quadrat was sampled along with a 1km transect. At intervals along the transect, all plants within a 5m radius were recorded or collected for later identification. Vegetation was described for later mapping and species collected at varying distances from the permanent site peg as time allowed.

On the basis of this vegetation survey a number of vegetation associations were determined. It is likely that these will be revised and extended after the second field trip. These vegetation associations may be divided in terms of broad environmental units as follows:- those of the dunefields and those of the river channels and floodplains.

Dunefields

- Zygochloa paradoxa hummock grassland/ Acacia species low shrublands of the SW dunefields.
- Cynanchum floribundum/Acacia species low shrubland of the SW dunes.
- Bare crests and Acacia species low shrubland in areas adjacent to sand sources (principally to the SE adjacent to the Strzelecki Ck.).
- Acacia species/Cassia species mixed low open shrublands on western clay/sand slopes and dissected dune areas abutting lakes and floodplains.
- Ephemeral herbfields occupying claypans, predominantly composed of Atriplex spongiosa and Sclerolaena species.

River Channels and Floodplains

- Eucalyptus microtheca woodlands bordering river channels commonly in associationwith Lysiphyllum gilvum, Acacia stenophylla and A. salicina.
- Muehlenbeckia cunninghamii shrublands on cracking clay semi-permanent

swamps.

- *Chenopodium* species/ *Muehlenbeckia* species low open shrubland on less frequently inundated areas.
- *Atriplex nummularia* open shrublands with sparse lignum, *Chenopodium* species and low herbs.
- *Eragrostis australasica* clay flats bordered with occasional lignum or *Chenopodium* species.
- Ephemeral herbfields of the ephemeral lakes and claypans composed of *Atriplex* species, *Sclerolaena* species and some Asteraceae and Poaceae.
- Limited samphire communities bordering saline ephemeral lakes, e.g. Lake Perigundi.

FAUNA

Fifteen species of mammals, 28 species of reptiles, 108 species of birds, 3 species of frogs, 1 species of fish and numerous invertebrates were observed and/or collected during field surveys. These numbers are tentative only and at this stage are still subject to confirmation . Further species are likely to be added during the second field trip.

In the mammal and reptile studies the following methodology was used:- At each site trapping was conducted in each of four habitat types. The trapping effort consisted of ten pitfalls, one hundred metres of drift fence and fifty aluminium box traps. Box traps used were either Sherman or Elliot traps. Eighteen traps were set along the drift fence, one on each side between every two pitfalls, and thirty-two traps were set in a line out from the fence at approximately 15m intervals. Traps were checked daily and pitfalls twice daily. The trapping protocol was varied from that described on occasions (e.g. due to trap malfunction or lack of time to complete a line of pitfalls in one day) . Mistnetting for bats was not successful while spotlighting yielded some results in other animal groups. The trap effort was:-

Pitfall Nights	Sherman Nights	Elliot Nights
409	829	999

Noteable records include *Planigale gilesi* and *Pseudomys hermannsburgensis*.

During studies of the avifauna of the region a "point-census" method was used and not the "point-census line-transect" method as indicated in the previously prepared methodology. Noteable records include Plumed Tree-duck (very rare in S.A.), Black-breasted Buzzard, Red-rumped Parrot and

Crested Bellbird.

Frogs were collected by active collection, while fishes and aquatic invertebrates (still to be identified)were collected by Seine netting. Invertebrates other than aquatics were collected in pitfalls, with light traps or by other means.

GENERAL

There is a marked change in character of the land between the Cooper Creek Environmental Association and those Environmental Associations adjoining it. An example, is the difference between the Cooper Creek within the study region and the Cooper Creek to the SW of the study region. Within the Cooper Creek Environmental Association the Cooper Creek forms a well defined channel occupied by a good growth of vegetation. To the SW of the study region, however, the channel of the Cooper Creek is ill defined and sparsely covered with vegetation. Such an example adds subjective weight to the environmental divisions developed by Laut et al. (1977).

Some interesting observations on water flows to-date are as follows. Since peak flows were experienced at Innamincka on July 15th, 1983, two months had elapsed prior to the water front reaching the SW end of the Cooper Creek Floodplain, SSE of Lake Perigundi, on September 17th, 1983. Although these floodwaters were several metres above the causeway at Innamincka on July 15th, 1983 the water level was still less than the 7m rise required for entry into the Strzelecki Creek. Consequently the Strzelecki Creek section of the study region was found to be markedly drier than the Cooper Creek section.

(4) Consideration of ecological impacts of grazing by both feral animals and stock.

Although stock have been removed from the properties within the study region due to the brucellosis programme, the combined affects of the recent drought and grazing pressure by feral horses, camels and rabbits still results in the country of the study region having a denuded appearance. Occasional horses and camels and their tracks and traces were seen, but the most marked influence appears to be due to rabbits. Burrows and dung heaps were widespread,although numbers appeared to be low possibly due to the drought. Some areas in particular were severely thrashed,with signs that the rabbits had in fact stripped bark of shrubs and ascended these where possible to get at the foliage. Stock are now gradually being moved back into the area.

(5) Production of an annotated bibliography of all information relating to the ecology of the study area.

Over 50 references have to-date been collected which contain information relating to the ecology of the study area. Preparation of the annotated bibliography is proceeding.

(6) Detailing of current and projected land uses within the environmental region.

The major land uses within the study region are pastoral activities related to the cattle industry, oil and gas exploration and recreational pursuits of the general public. Some 10000 people visit the study region annually to carry out these land uses. All activities are expected to increase in the future.

(7) Recommendations pertaining to conservation priorities for the area.

Areas of conservation significance and their level of priority have been noted during field surveys in the first field trip. Further obsrvations will be made during the second field trip in order to carry out the requirements of this section of the Schedule.

Appendix L

APPENDIX L

Plant specimens collected during the survey of the Cooper Creek Environmental Association, 8.4.4.- Confirmed by the State Herbarum (AD) and rechecked by F.M., except 1611 to 1630 (identities based on data sheet entries - specimens lost in transit to Adelaide) and 3511 to 3581 (collected and rechecked by Dr. S. Barker).

1001	Mimosaceae	*Acacia ligulata* A. Cunn. ex Benth.
1002	Mimoscaeae	*Acacia ligulata* A. Cunn. ex Benth.
1003	Mimosaceae	*Acacia ligulata* A. Cunn. ex Benth.
1004	Mimosaceae	*Acacia ligulata* A. Cunn. ex Benth.
1005	Papilionaceae	*Crotalaria cunninghamii* R.Br.
1006	Amaranthaceae	*Ptilotus polystachus* (Gaudich.) F.Muell. *var*. *polystachu*
1007	Solanaceae	*Nicotiana velutina* Wheeler
1008	Papilionaceae	*Crotalaria cunninghamii* R.Br.
1009	Papilionaceae	*Crotalaria cunninghamii* R.Br.
1010	Solanaceae	*Nicotiana velutina* Wheeler
1011	Poaceae	*Zygochloa paradoxa* (R.Br.) S. T. Blake
1012	Poaceae	*Zygochloa paradoxa* (R.Br.) S. T. Blake
1013	Poaceae	*Zygochloa paradoxa* (R.Br.) S. T. Blake
1014	Asteraceae	*Myriocephalus stuartii* (F. Muell. & Sond. ex Sond.)Benth
1015	Asteraceae	*Myriocephalus stuartii* (F. Muell. & Sond. ex Sond.)Benth
1016	Asteraceae	*Myriocephalus stuartii* (F. Muell. & Sond. ex Sond.)Benth
1017	Asclepiadaceae	*Cynanchum floribundum* R.Br.
1018	Asclepiadaceae	*Rhyncharrhena linearis* (Decne.) K. L. Wilson
1019	Asclepiadaceae	*Cynanchum floribundum* R.Br.
1020	Asclepiadaceae	*Cynanchum floribundum* R.Br.
1021	Asclepiadaceae	*Cynanchum floribundum* R.Br.
1022	Asclepiadaceae	*Cynanchum floribundum* R.Br.
1023	Poaceae	*Triodia basedowii* Pritzel
1024	Poaceae	*Triodia basedowii* Pritzel
1025	Cucurbitaceae	*Mukia maderaspatana* (L.) M. Roemer
1026	Poaceae	*Triodia basedowii* Pritzel
1027	Goodeniaceae	*Scaevola ovalifolia* R.Br.
1028	Portulacaceae	*Portulaca intraterranea* J. Black
1029	Portulacaceae	*Portulaca intraterranea* J. Black
1030	Portulacaceae	*Portulaca intraterranea* J. Black
1031	Boraginaceae	*Trichodesma zeylanicum* (Burman. f.) R.Br.
1032	Boraginaceae	*Trichodesma zeylanicum* (Burman. f.) R.Br.
1033	Poaceae	*Eriachne aristidea* F. Muell.
1034	Poaceae	*Eriachne aristidea* F. Muell.
1035	Poaceae	*Eriachne aristidea* F. Muell.
1036	Amaranthaceae	*Amaranthus mitchellii* Benth.
1037	Amaranthaceae	*Amaranthus mitchellii* Benth.
1038	Loranthaceae	*Lysiana exocarpi* (Behr) Tieghem *ssp*. *exocarpi*
1039	Loranthaceae	*Lysiana exocarpi* (Behr) Tieghem *ssp*. *exocarpi*
1040	Loranthaceae	*Lysiana exocarpi* (Behr) Tieghem *ssp*. *exocarpi*
1041	Chenopodiaceae	*Salsola kali* L.
1042	Chenopodiaceae	*Salsola kali* L.
1043	Chenopodiaceae	*Salsola kali* L.
1044	Asteraceae	*Myriocephalus stuartii* (F. Muell. & Sond. ex Sond.)Benth
1045	Asteraceae	*Myriocephalus stuartii* (F. Muell. & Sond. ex Sond.)Benth
1046	Mimosaceae	*Acacia ligulata* A. Cunn. ex Benth.
1047	Mimosaceae	*Acacia ligulata* A. Cunn. ex Benth.
1048	Mimosaceae	*Acacia ligulata* A. Cunn. ex Benth.
1049	Euphorbiaceae	*Euphorbia tannensis* Spreng. *ssp*. *eremophila* (A. Cunn.) Hassall *var*. *eremophila*
1050	Euphorbiaceae	*Euphorbia tannensis* Spreng. *ssp*. *eremophila* (A. Cunn.) Hassall *var*. *eremophila*

1051	Papilionaceae	Swainsona rigida (Benth.) J. Black
1052	Papilionaceae	Swainsona rigida (Benth.) J. Black
1053	Malvaceae	Abutilon otocarpum F. Muell.
1054	Chenopodiaceae	Salsola kali L.
1055	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1056	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1057	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1058	Asteraceae	Senecio gregorii F. Muell.
1059	Asteraceae	Senecio gregorii F. Muell.
1060	Asteraceae	Senecio gregorii F. Muell.
1061	Poaceae	Tragus australianus S. T. Blake
1062	Poaceae	Tragus australianus S. T. Blake
1063	Poaceae	Triraphis mollis R.Br.
1064	Poaceae	Triraphis mollis R.Br.
1065	Poaceae	Triraphis mollis R.Br.
1066	Boraginaceae	Trichodesma zeylanicum (Burman. f.) R.Br.
1067	Boraginaceae	Trichodesma zeylanicum (Burman. f.) R.Br.
1068	Papilionaceae	Psoralea pallida N. Burb.
1069	Papilionaceae	Psoralea pallida N. Burb.
1070	Papilionaceae	Psoralea pallida N. Burb.
1071	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
1072	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
1073	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
1074	Asteraceae	Sonchus oleraceus L.
1075	Portulacaceae	Portulaca intraterranea J. Black
1076	Portulacaceae	Portulaca intraterranea J. Black
1077	Portulacaceae	Portulaca intraterranea J. Black
1078	Zygophyllaceae	Tribulus occidentalis R.Br.
1079	Asteraceae	Helipterum moschatum (A. Cunn. ex DC.) Benth.
1080	Solanaceae	Nicotiana velutina Wheeler
1081	Solanaceae	Nicotiana velutina Wheeler
1082	Asteraceae	Helipterum moschatum (A. Cunn. ex DC.) Benth.
1083	Asteraceae	Helipterum moschatum (A. Cunn. ex DC.) Benth.
1084	Asteraceae	Helipterum moschatum (A. Cunn. ex DC.) Benth.
1085	Zygophyllaceae	Zygophyllum howittii F. Muell.
1086	Mimosaceae	Acacia tetragonaphylla F. Muell.
1087	Mimosaceae	Acacia tetragonaphylla F. Muell.
1088	Mimosaceae	Acacia victoriae Benth.
1089	Mimosaceae	Acacia victoriae Benth.
1090	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
1091	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
1092	Cyperaceae	Eleocharis pallens (Benth.) S. T. Blake
1093	Cyperaceae	Eleocharis pallens (Benth.) S. T. Blake
1094	Cyperaceae	Eleocharis pallens (Benth.) S. T. Blake
1095	Cyperaceae	Eleocharis pallens (Benth.) S. T. Blake
1096	Chenopodiaceae	Chenopodium nitrariaceum (F. Muell.) F. Muell. ex Benth.
1097	Chenopodiaceae	Chenopodium nitrariaceum (F. Muell.) F. Muell. ex Benth.
1098	Chenopodiaceae	Chenopodium nitrariaceum (F. Muell.) F. Muell. ex Benth.
1099	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
1100	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
1101	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
1102	Asteraceae	Senecio lautus Forst. f. ex Willd. ssp. dissectifolius Ali
1103	Asteraceae	Senecio lautus Forst. f. ex Willd. ssp. dissectifolius Ali
1104	Asteraceae	Senecio lautus Forst. f. ex Willd. ssp. dissectifolius Ali
1105	Asteraceae	Senecio lautus Forst. f. ex Willd. ssp. dissectifolius Ali
1106	Asteraceae	Calotis ancyrocarpa J. Black
1107	Asteraceae	Calotis ancyrocarpa J. Black
1108	Asteraceae	Calotis ancyrocarpa J. Black

1109	Asteraceae	*Calotis ancyrocarpa* J. Black
1110	Asteraceae	*Calotis ancyrocarpa* J. Black
1111	Marsileaceae	*Marsilea drummondii* A. Braun
1112	Marsileaceae	*Marsilea drummondii* A. Braun
1113	Asteraceae	*Senecio lautus* Forst. f. ex Willd. *ssp. maritimus* Ali
1114	Asteraceae	*Senecio lautus* Forst. f. ex Willd. *ssp. maritimus* Ali
1115	Asteraceae	*Senecio lautus* Forst. f. ex Willd. *ssp. maritimus* Ali
1116	Geraniaceae	*Erodium crinitum* Carolin
1117	Asteraceae	*Vittadinia sp.*
1118	Papilionaceae	*Trigonella suavissima* Lindley
1119	Papilionaceae	*Trigonella suavissima* Lindley
1120	Papilionaceae	*Trigonella suavissima* Lindley
1121	Chenopodiaceae	*Atriplex sp.*
1122	Chenopodiaceae	*Atriplex sp.*
1123	Chenopodiaceae	*Atriplex* sp.
1124	Chenopodiaceae	*Atriplex sp.*
1125	Asteraceae	*Calotis hispidula* (F. Muell.) F. Muell.
1126	Asteraceae	*Calotis hispidula* (F. Muell.) F. Muell.
1127	Asteraceae	*Calotis hispidula* (F. Muell.) F. Muell.
1128	Asteraceae	*Calotis hispidula* (F. Muell.) F. Muell.
1129	Asteraceae	*Calotis hispidula* (F. Muell.) F. Muell.
1130	Mimosaceae	*Acacia murrayana* F. Muell. ex Benth.
1131	Chenopodiaceae	*Atriplex nummularia* Lindley
1132	Chenopodiaceae	*Chenopodium nitrariaceum* (F. Muell.) F. Muell. ex Benth.
1133	Apiaceae	*Trachymene* ?
1134	Asclepiadaceae	*Cynanchum floribundum* R.Br.
1178	?Polygonaceae	*Muehlenbeckia cunninghamii* (Meisn.)F. Muell.
1179	?Polygonaceae	*Muehlenbeckia cunninghamii* (Meisn.)F. Muell.
1180	?Polygonaceae	*Muehlenbeckia cunninghamii* (Meisn.)F. Muell.
1181	Chenopodiaceae	*Sclerolaena bicornis* Lindley
1182	Chenopodiaceae	*Sclerolaena bicornis* Lindley
1183	Chenopodiaceae	*Sclerolaena bicornis* Lindley
1184	Chenopodiaceae	*Atriplex spongiosa* F. Muell.
1185	Chenopodiaceae	*Atriplex spongiosa* F. Muell.
1186	Chenopodiaceae	*Atriplex spongiosa* F. Muell.
1187	Poaceae	*Eragrostis australasica* (Steudel) C. E. Hubb.
1188	Poaceae	*Eragrostis australasica* (Steudel) C. E. Hubb.
1189	Poaceae	*Eragrostis australasica* (Steudel) C. E. Hubb.
1190	Marsileaceae	*Marsilea drummondii* A. Braun
1191	Marsileaceae	*Marsilea drummondii* A. Braun
1192	Marsileaceae	*Marsilea drummondii* A. Braun
1193	Myrtaceae	*Eucalyptus sp.* (no buds or fruit) Probably *E. microtheca* F. Muell.
1194	Myrtaceae	*Eucalyptus sp.* (no buds or fruit) Probably *E. microtheca* F. Muell.
1195	Myrtaceae	*Eucalyptus sp.* (no buds or fruit) Probably *E. microtheca* F. Muell.
1196	Chenopodiaceae	*Atriplex nummularia* Lindley
1197	Chenopodiaceae	*Atriplex nummularia* Lindley
1198	Chenopodiaceae	*Atriplex nummularia* Lindley
1199	Portulacaceae	*Portulaca intraterranea* J. Black
1200	Portulacaceae	*Portulaca intraterranea* J. Black
1201	Portulacaceae	*Portulaca intraterranea* J. Black
1202	Chenopodiaceae	*Sclerolaena intricata* (R. Anderson) A. J. Scott
1203	Chenopodiaceae	*Sclerolaena intricata* (R. Anderson) A. J. Scott
1204	Chenopodiaceae	*Sclerolaena intricata* (R. Anderson) A. J. Scott
1205	Chenopodiaceae	*Halosarcia indica* (Willd.) Paul G. Wilson *ssp. leiostachya* (Benth.) Paul G. Wilson

1206	Chenopodiaceae	Halosarcia indica (Willd.) Paul G. Wilson ssp. leiostachya (Benth.) Paul G. Wilson
1207	Chenopodiaceae	Halosarcia indica (Willd.) Paul G. Wilson ssp. leiostachya (benth.) Paul G. Wilson
1208	Solanaceae	Nicotiana velutina Wheeler
1209	Solanaceae	Nicotiana velutina Wheeler
1210	Solanaceae	Nicotiana velutina Wheeler
1211	Chenopodiaceae	Chenopodium auricomum Lindley
1212	Chenopodiaceae	Chenopodium auricomum Lindley
1213	Chenopodiaceae	Chenopodium auricomum Lindley
1214	Amaranthaceae	Alternanthera nodiflora R.Br.
1215	Amaranthaceae	Alternanthera nodiflora R.Br.
1216	Amaranthaceae	Alternanthera nodiflora R.Br.
1217	Chenopodiaceae	Enchylaena tomentosa R.Br.
1218	Chenopodiaceae	Enchylaena tomentosa R.Br.
1219	Chenopodiaceae	Enchylaena tomentosa R.Br.
1220	Chenopodiaceae	Salsola kali L.
1221	Chenopodiaceae	Salsola kali L.
1222	Chenopodiaceae	Salsola kali L.
1223	?Papilionaceae	Templetonia egena (F. Muell.) Benth. Insufficient material
1224	Chenopodiaceae	Salsola kali L.
1225	Solanaceae	Nicotiana velutina Wheeler
1226	Asteraceae	Myriocephalus stuartii (F. Muell.& Sond. ex Sond.) Benth.
1227	Aizoaceae	Zaleya galericulata (Melville) H. Eichler
1228	Chenopodiaceae	Atriplex angulata Benth.
1229	Chenopodiaceae	Halosarcia indica (Willd.) Paul G. Wilson ssp. leiostachya (Benth.) Paul G. Wilson
1230	Poaceae	Eragrostis setifolia Nees
1231	Poaceae	Triodia sp. Probably T. basedowii Pritzel
1232	Proteaceae	Hakea leucoptera R.Br.
1233	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
1234	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
1235	Mimosaceae	Acacia ligulata A. Cunn. ex Benth.
1236	Euphorbiaceae	Phyllanthus fuernrohrii F. Muell.
1237	Mimosaceae	Acacia victoriae Benth.
1238	Chenopodiaceae	Salsola kali L.
1239	Portulacaceae	Portulaca intraterranea J. Black
1240	Mimosaceae	Acacia oswaldii F. Muell.
1241	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. zygophylla (Benth.) Benth.
1242	Lamiaceae	Teucrium racemosum R.Br. var. racemosum
1243	Chenopodiaceae	Dissocarpus paradoxa (R.Br.) F. Muell. ex Ulbr. var. latifolius (J. Black) Ulbr.
1244	Amaranthaceae	Ptilotus polystachus (Gaudich.) F. Muell. var. polystachus
1245	Chenopodiaceae	Atriplex spongiosa F. Muell.
1246	Meliaceae	Owenia acidula F. Muell.
1247	Thymelaeaceae	Pimelea trichostachya Lindley
1248	Proteaceae	Hakea eyreana (S. Moore) D. McGillivrayi
1249	Chenopodiaceae	Einadia nutans (R.Br.) A. J. Scott
1250	Sapindaceae	Atalaya hemiglauca (F. Muell.) F. Muell. ex Benth.
1251	Poaceae	Enneapogon avenaceus (Lindley) C. E. Hubb.
1252	Papilionaceae	Swainsona phacoides Benth.
1253	Poaceae	Insufficient material for further identification.
1254	Poaceae	Eragrostis setifolia Nees
1255	Poaceae	Eragrostis eriopoda Benth.
1256	Sapindaceae	Dodonaea angustissima DC.
1257	Malvaceae	Sida ammophila F. Muell. ex J. H. Willis
1258	Lamiaceae	Teucrium racemosum R.Br. var. racemosum

1259	Loranthaceae	Lysiana exocarpi (Behr) Tieghem ssp. exocarpi
1261	Proteaceae	Hakea leucoptera R.Br.
1262	Malvaceae	Abutilon otocarpum F. Muell.
1263	Chenopodiaceae	Enchylaena tomentosa R.Br.
1264	Mimosaceae	Acacia tetragonaphylla F. Muell.
1265	Amaranthaceae	Ptilotus atriplicifolius (A. Cunn. ex Moq.) Benl var. atriplicifolius
1266	Euphorbiaceae	Euphorbia tannensis Spreng. ssp. eremophila (A. Cunn.) Hassall var. eremophila
1267	Mimosaceae	Acacia victoriae Benth.
1268	Haloragaceae	Haloragis aspera Lindley
1269	Amaranthaceae	Ptilotus polystachus (Gaudich.)F. Muell. var. polystachus
1270	Myoporaceae	Eremophila macdonnellii F. Muell.
1271	Lamiaceae	Teucrium racemosum R.Br. var. tripartitum F. Muell.ex Benth.
1272	Chenopodiaceae	Maireana aphylla (R.Br.) Paul G. Wilson
1273	Chenopodiaceae	Sclerolaena diacantha (Nees) Benth.
1274	Chenopodiaceae	Salsola kali L.
1275	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
1276	Mimosaceae	Acacia ligulata A. Cunn. ex Benth .
1277	Poaceae	Aristida browniana Henr.
1278	Poaceae	Triraphis mollis R.Br.
1279	Poaceae	Enneapogon avenaceus (Lindley) C. E. Hubb.
1280	Asteraceae	Minuria denticulata (DC.) Benth.
1281	Poaceae	Enneapogon polyphyllus (Domin) N. Burb.
1282	Asteraceae	Helipterum moschatum (A. Cunn. ex DC.) Benth.
1283	Poaceae	Aristida anthoxanoides (Domin) Henr.
1284	Myoporaceae	Eremophila maculata (Ker Gawler) F. Muell.
1322	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
1323	Apiaceae	Trachymene glaucifolia (F. Muell.) Benth.
1324	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.) Benth.
1325	Asteraceae	Senecio gregorii F. Muell.
1326	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
1327	Mimosaceae	Acacia ligulata A. Cunn. ex Benth.
1328	Goodeniaceae	Lechenaultia divaricata F. Muell.
1329	Poaceae	Aristida browniana Henr.
1330	Boraginaceae	Trichodesma zeylanicum (Burman. f.) R.Br.
1331	Papilionaceae	Crotalaria eremaea F. Muell. ssp. eremaea
1332	Amaranthaceae	Ptilotus polystachus (Gaudich.)F. Muell. var. polystachus
1333	Poaceae	Plagiosetum refractum (F. Muell.) Benth.
1334	Myrtaceae	Eucalyptus microtheca F. Muell.
1335	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
1336	Caesalpinaceae	Lysiphyllum gilvum (Bailey) Pedley
1337	Asteraceae	Senecio cunninghamii DC.
1338	Mimosaceae	Acacia salicina Lindley
1339	Myoporaceae	Eremophila bignoniiflora (Benth.) F. Muell.
1340	Chenopodiaceae	Enchylaena tomentosa R.Br.
1341	Loranthaceae	Diplatia grandibractea (F. Muell.) Tieghem
1342	Loranthaceae	Amyema preissii (Miq.) Tieghem
1343	Solanaceae	Nicotiana velutina Wheeler Immature specimen.
1344	Solanaceae	Nicotiana sp. ?
1345	Malvaceae	Lavatera plebeia Sims
1346	Mimosaceae	Acacia stenophylla A. Cunn. ex Benth.
1466	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.) Benth.
1467	Proteaceae	Grevillea stenobotrya F. Muell.
1468	Poaceae	Eragrostis dielsii Pilger
1469	Chenopodiaceae	Sclerolaena intricata (R. Anderson) A. J. Scott
1470	Chenopodiaceae	Atriplex spongiosa F. Muell.
1471	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake

1472	Papilionaceae	*Crotalaria eremaea* F. Muell. *ssp*. *eremaea*
1473	Amaranthaceae	*Ptilotus latifolius* R.Br.
1474	Meliaceae	*Owenia acidula* F. Muell.
1475	Myoporaceae	*Eremophila longifolia* (R.Br.) F. Muell.
1476	Asteraceae	*Myriocephalus stuartii* (F. Muell. & Sond. ex Sond.) Benth.
1477	Mimosaceae	*Acacia murrayana* F. Muell. ex Benth.
1478	Apiaceae	*Trachymene glaucifolia* (F. Muell.) Benth.
1479	Boraginaceae	*Trichodesma zeylanicum* (Burman. f.) R.Br.
1480	Sapindaceae	*Atalaya hemiglauca* (F. Muell.) F. Muell. ex Benth.
1481	Chenopodiaceae	*Sclerolaena diacantha* (Nees) Benth.
1482	Chloanthaceae	*Dicrastylis costelloi* Bailey
1483	Poaceae	*Aristida browniana* Henr.
1484	Poaceae	*Triodia basedowii* Pritzel
1485	Chenopodiaceae	*Enchylaena tomentosa* R.Br.
1486	Poaceae	*Aristida browniana* Henr.
1487	Frankeniaceae	*Frankenia angustipetala* Summerh.
1488	Asteraceae	*Calocephalus platycephalus* (F. Muell.) Benth.
1489	Chenopodiaceae	*Chenopodium auricomum* Lindley
1490	Proteaceae	*Hakea leucoptera* R.Br.
1491	Caesalpinaceae	*Cassia phyllodinea* R.Br.
1492	Amaranthaceae	*Ptilotus polystachus* (Gaudich.) F. Muell. *var*. *polystachus*
1493	Goodeniaceae	*Scaevola ovalifolia* R.Br.
1494	Campanulaceae	*Wahlenbergia sp*.
1495	Caesalpinaceae	*Cassia nemophila* A. Cunn. ex J. Vogel *var*. *nemophila*
1496	Myoporaceae	*Eremophila bignoniiflora* (Benth.) F. Muell.
1498	Papilionaceae	*Crotalaria smithiana* A. Lee
1499	Asteraceae	*Gnephosis eriocarpa* (F. Muell.) Benth.
1500	Papilionaceae	*Psoralea australasica* Schldl.
1501	Asteraceae	*Senecio gregorii* F. Muell.
1502	Sapindaceae	*Dodonaea angustissima* DC.
1503	Malvaceae	*Hibiscus krichauffianus* F. Muell.
1504	Malvaceae	*Sida ammophila* F. Muell. ex J. H. Willis
1505	Poaceae	*Aristida browniana* Henr.
1506	Euphorbiaceae	*Euphorbia tannensis* Spreng. *ssp*. *eremophila* (A. Cunn.) Hassall *var*. *eremophila*
1507	Poaceae	*Leptochloa digitata* (R.Br.) Domin
1508	Asteraceae	*Gnaphalium luteoalbum* L.
1509	Brassiacaceae	*Lepidium muelleriferdinandii* Thell.
1510	Polygonaceae	*Rumex crystallinus* Lange
1511	Cyperaceae	*Cyperus sp*. *aff*. *cunninghamii* (C. B. Clarke) C. Gardner
1512	Amaranthaceae	*Alternanthera nodiflora* R.Br.
1513	Asteraceae	*Sonchus oleraceus* L.
1514	Santalaceae	*Santalum lanceolatum* R.Br.
1515	Loranthaceae	*Lysiana exocarpi* (Behr) Tieghem *ssp*. *exocarpi*
1516	Chenopodiaceae	*Rhagodia gaudichaudiana* Moq.
1517	Asteraceae	*Pterocaulon sphacelatum* (Labill.) Benth.& Hook.f. ex F.Muell
1518	Asteraceae	*Calocephalus platycephalus* (F. Muell.) Benth.
1519	Asteraceae	*Helipterum moschatum* (A. Cunn. ex DC.) Benth.
1520	Goodeniaceae	*Scaevola depauperata* R.Br.
1521	Euphorbiaceae	*Adriana hookeri* (F. Muell.) Muell. - Arg.
1522	Portulacaceae	*Calandrinia remota* J. Black
1530	Poaceae	*Aristida browniana* Henr.
1530'	Asteraceae	*Myriocephalus rudallii* (F. Muell.) Benth.
1531	Asteraceae	*Helipterum floribundum* DC.
1532	Asteraceae	*Centipeda cunninghamii* (DC.) A. Br. & Aschers.
1532'	Chenopodiaceae	*Atriplex velutinella* F. Muell.
1533	Solanaceae	*Nicotiana velutina* Wheeler
1534	Papilionaceae	*Lotus cruentus* Court

1535	Gentianaceae	Centaurium spicatum (L.) Fritsch
1536	Asteraceae	Myriocephalus rudallii (F. Muell.) Benth.
1537	Asteraceae	Centipeda thespidioides F. Muell.
1538	Asteraceae	Minuria denticulata (DC.) Benth.
1539	Mimosaceae	Acacia oswaldii F. Muell.
1611	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
1612	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1613	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1614	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1619	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1620	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1623	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1628	Chenopodiaceae	Atriplex sp. ?
1629	Chenopodiaceae	Halosarcia indica (Willd.) Paul G. Wilson ssp. leiostachya (Benth.) Paul G. Wilson
1630	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
1754	Chenopodiaceae	Salsola kali L.
1755	Papilionaceae	Crotalaria cunninghamii R.Br.
1756	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1757	Mimosaceae	Acacia ligulata A. Cunn. ex Benth.
1758	Boraginaceae	Trichodesma zeylanicum (Burman.f.) R.Br.
1759	Mimosaceae	Acacia oswaldii F. Muell.
1760	Solanaceae	Nicotiana velutina Wheeler
1761	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
1762	Papilionaceae	Tephrosia sphaerospora F. Muell.
1763	Euphorbiaceae	Phyllanthus lacunarius F. Muell.
1764	Chenopodiaceae	Enchylaena tomentosa R.Br.
1765	Mimosaceae	Acacia ligulata A. Cunn. ex Benth.
1766	Portulacaceae	Portulaca intraterranea J. Black
1767	Myrtaceae	Eucalyptus microtheca F. Muell.
1768	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
1769	Chenopodiaceae	Sclerolaena intricata (R. Anderson) A. J. Scott
1770	Poaceae	Aristida browniana Henr.
1771	Poaceae	Triraphis mollis R.Br.
1772	Scrophulariaceae	Morgania floribunda Benth.
1773	Chenopodiaceae	Atriplex leptocarpa F. Muell.
1774	Chenopodiaceae	Atriplex leptocarpa F. Muell.
1775	Chenopodiaceae	Babbagia acroptera F. Muell. & Tate
1776	Asteraceae	Senecio gregorii F. Muell.
1777	Chenopodiaceae	Atriplex velutinella F. Muell.
1778	Euphorbiaceae	Phyllanthus lacunarius F. Muell.
1779	Chenopodiaceae	Atriplex spongiosa F. Muell.
1780	Myoporaceae	Eremophila bignoniiflora (Benth.) F. Muell.
1781	Mimosaceae	Acacia stenophylla A. Cunn. ex Benth.
1782	Zygophyllaceae	Tribulus occidentalis R.Br.
1783	Papilionaceae	Tephrosia sphaerospora F. Muell.
1784	Chenopodiaceae	Salsola kali L.
1785	Portulacaceae	Portulaca intraterranea J. Black
1786	Asteraceae	Myriocephalus stuartii F. Muell. & Sond. ex Sond.)Benth.
1787	Cyperaceae	Cyperus gymnocaulos Steudel
1788	Mimosaceae	Acacia stenophylla A. Cunn. ex Benth.
1789	Asteraceae	Calocephalus platycephalus (F. Muell.) Benth.
1790	Poaceae	Aristida browniana Henr.
1791	Thymelaeaceae	Pimelea trichostachya Lindley
1792	Aizoaceae	Gunniopsis quadrifida (F. Muell.) Pax
1793	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
1794	Proteaceae	Hakea leucoptera R.Br.
1795	Sapindaceae	Atalaya hemiglauca (F. Muell.) F. Muell. ex Benth.
1796	Chenopodiaceae	Enchylaena tomentosa R. Br.

1797	Myoporaceae	Eremophila longifolia (R.Br.) F. Muell.
1798	Mimosaceae	Acacia ligulata A. Cunn. ex Benth.
1799	Asteraceae	Helipterum moschatum (A. Cunn. ex DC.) Benth.
1800	Sapindaceae	Dodonaea angustissima DC.
1801	Amaranthaceae	Ptilotus obovatus (Gaudich.) F. Muell. var. obovatus
1802	Amaranthaceae	Ptilotus polystachus (Gaudich.)F. Muell. var. polystachus
1803	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
1804	Malvaceae	Sida ammophila F. Muell. ex J. H. Willis
1805	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
1806	Poaceae	Aristida browniana Henr.
1807	Poaceae	Paractaenum novae-hollandiae P. Beauv.
1808	Poaceae	Tragus australianus S. T. Blake
1809	Poaceae	Eriachne aristidea F. Muell.
1810	Poaceae	Eragrostis dielsii Pilger
1811	Solanaceae	Nicotiana velutina Wheeler
1812	Goodeniaceae	Scaevola aemula R.Br.
1813	Poaceae	Triraphis mollis R.Br.
1814	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
1815	Mimosaceae	Acacia victoriae Benth.
1816	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
1817	Boraginaceae	Trichodesma zeylanicum (Burman. f.) R.Br.
1818	Chenopodiaceae	Salsola kali L.
1819	Papilionaceae	Crotalaria cunninghamii R.Br.
1820	Apiaceae	Trachymene glaucifolia (F. Muell.) Benth.
2001	Solanaceae	Solanum oligacanthum F. Muell.
2002	Asteraceae	Senecio cunninghamii DC.
2003	Loranthaceae	Lysiana exocarpi (Behr) Tieghem ssp. exocarpi
2004	Chenopodiaceae	Atriplex leptocarpa F. Muell.
2005	Rubiaceae	Dentella pulvinata Airy Shaw var. pulvinata
2006	Chenopodiaceae	Halosarcia indica (Willd.) Paul G. Wilson ssp. leiostachya (Benth.) Paul G. Wilson
2007	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
2008	Loranthaceae	Amyema preissii (Miq.) Tieghem
2009	Myoporaceae	Eremophila bignoniiflora (Benth.) F. Muell.
2010	Asclepiadaceae	Cynanchum floribundum R.Br.
2011	Scrophulariaceae	Morgania floribunda Benth.
2012	Cucurbitaceae	Mukia maderaspatana (L.) M. Roemer
2013	Mimosaceae	Acacia oswaldii F. Muell.
2014	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
2015	Proteaceae	Hakea leucoptera R.Br.
2016	Mimosaceae	Acacia ligulata A. cunn. ex Benth.
2017	Chenopodiaceae	Enchylaena tomentosa R.Br.
2018	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
2019	Chenopodiaceae	Chenopodium nitrariaceum (F. Muell.) F. Muell. ex Benth.
2020	Chenopodiaceae	Atriplex nummularia Lindley
2021	Euphorbiaceae	Phyllanthus fuernrohrii F. Muell.
2022	Loranthaceae	Diplatia grandibractea (F. Muell.) Tieghem
2023	Poaceae	Triodia basedowii Pritzel
2024	Chenopodiaceae	Enchylaena tomentosa R.Br.
2025	Myrtaceae	Eucalyptus sp.(no buds or fruit) Probably E.microtheca F. Muell.
2025'	Myrtaceae	Eucalyptus microtheca F. Muell.
2026	Cyperaceae	Cyperus gymnocaulos Steudel
2027	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
2028	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
2029	Poaceae	Sporobolus mitchellii (Trin.) C. E. Hubb.
2030	Mimosaceae	Acacia victoriae Benth.
2031	Chenopodiaceae	Atriplex eardleyae Aellen
2032	Chenopodiaceae	Atriplex nummularia Lindley

2033	Solanaceae	Nicotiana velutina Wheeler
2034	Euphorbiaceae	Phyllanthus sp. aff. lacunarius F. Muell.
2035	Chenopodiaceae	Sclerolaena intricata (R. Anderson) A. J. Scott
2036	Chenopodiaceae	Atriplex sp. aff. eardleyae Aellen
2037	Euphorbiaceae	Phyllanthus fuernrohrii F. Muell.
2038	Papilionaceae	Tephrosia sphaerospora F. Muell.
2039	Chenopodiaceae	Atriplex leptocarpa F. Muell.
2040	Portulacaceae	Portulaca intraterranea J. Black
2041	Chenopodiaceae	Atriplex leptocarpa F. Muell.
2042	Portulacaceae	Portulaca intraterranea J. Black
2043	?Apiaceae	Trachymene glaucifolia (F. Muell.) Benth. Immature.
2044	Chenopodiaceae	Salsola kali L.
2045	Zygophyllaceae	Tribulus occidentalis R.Br.
2046	Goodeniaceae	Lechenaultia divaricata F. Muell.
2047	Chenopodiaceae	Babbagia acroptera F. Muell. & Tate
2048	Scrophulariaceae	Morgania floribunda Benth.
2049	Asteraceae	Epaltes australis Less.
2050	Chenopodiaceae	Sclerolaena intricata (R. Anderson) A. J. Scott
2051	Chenopodiaceae	Atriplex leptocarpa F. Muell.
2052	Chenopodiaceae	Atriplex spongiosa F. Muell.
2053	Frankeniaceae	Frankenia cinerea A. DC.
2054	Euphorbiaceae	Sauropus trachyspermus (F. Muell.) Airy Shaw
2055	Cyperaceae	Cyperus gymnocaulos Steudel
2056	Asteraceae	Senecio gregorii F. Muell.
2057	Geraniaceae	Erodium aureum Carolin
2058	Chenopodiaceae	Enchylaena tomentosa R.Br.
2059	Chenopodiaceae	Halosarcia indica (Willd.) Paul G. Wilson ssp. leiostachya (Benth.) Paul G. Wilson
2060	Chenopodiaceae	Sclerolaena intricata (R. Anderson) A. J. Scott
2061	Chenopodiaceae	Sclerolaena diacantha (Nees) Benth.
2062	Poaceae	Sporobolus mitchellii (Trin.) C. E. Hubb.
2063	Convulvulaceae	Convulvulus erubescens Sims
2064	Asteraceae	Senecio cunninghamii DC.
2065	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
2066	Marsileaceae	Marsilea drummondii A. Braun
2067	Asteraceae	Senecio lautus Forst. f. ex Willd. ssp. maritimus Ali
2068	Papilionaceae	Trigonella suavissima Lindley
2069	Asteraceae	Calotis ancyrocarpa J. Black
2070	Chenopodiaceae	Atriplex sp.
2071	Solanaceae	? Nicotiana sp.Immature - possibly N. velutina Wheeler
2072	?Ranunculaceae	Ranunculus sp. Insufficient material.
2073	Poaceae	Insufficient material for further identification.
2074	Not sufficient material for identification.	
2075	Asteraceae	? Calotis sp.
2076	Cyperaceae	Eleocharis pallens (Benth.) S. T. Blake
2077	?Haloragaceae	Haloragis sp. Insufficient material.
2078	Asteraceae	Sonchus oleraceus L.
2079	Asteraceae	Helipterum moschatum (A.Cunn. ex DC.) Benth.
2080	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
2081	Chenopodiaceae	Salsola kali L.
2082	Asteraceae	Brachycome ciliaris (Labill.) Less. var. lanuginosa (Steetz) Benth.
2083	Brassicaceae	Blennodia pterosperma (J. Black) J. Black
2084	Asteraceae	Senecio gregorii F. Muell.
2085	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
2086	Zygophyllaceae	Zygophyllum howittii F. Muell.
2087	Amaranthaceae	Amaranthus mitchellii Benth.
2088	Loranthaceae	Amyema preissii (Miq.) Tieghem
2089	Boraginaceae	Omphalolappula concava (F. Muell.) Brand

2090	Sapindaceae	Atalaya hemiglauca (F. Muell.) F. Muell. ex Benth.
2091	Malvaceae	Abutilon sp. ? fraseri (Hook.) Hook. ex Walp.
2092	Zygophyllaceae	Zygophyllum sp. ? terrestris L.
2093	Mimosaceae	Acacia oswaldii F. Muell.
2094	Poaceae	Enneapogon avenaceus (Lindley) C. E. Hubb.
2095	Zygophyllaceae	Zygophyllum howittii F. Muell.
2096	Convulvulaceae	Convulvulus erubescens Sims
2097	Tetragoniaceae	Tetragonia tetragonioides (Pallas) Kuntze
2098	Euphorbiaceae	Euphorbia tannensis Spreng. ssp. eremophila (A. Cunn.) Hassall var. eremophila
2099	Asteraceae	Helipterum moschatum (A. Cunn. ex DC.) Benth.
2100	Poaceae	Aristida contorta F. Muell.
2101	Poaceae	Eragrostis dielsii Pilger
2102	Poaceae	Enneapogon cylindricus N. Burb.
2103	Poaceae	Triraphis mollis R.Br.
2104	Liliaceae	Bulbine alata Baijnath
2105	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
2106	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. zygophylla (Benth.) Benth.
2107	Chenopodiaceae	Sclerolaena diacantha (Nees) Benth.
2108	Malvaceae	Sida sp.
2109	Papilionaceae	Swainsona phacoides Benth.
2110	Chenopodiaceae	Salsola kali L.
2111	Brassicaceae	Blennodia pterosperma (J. Black) J. Black
2112	Asteraceae	Ixiolaena brevicompta F. Muell.
2113	Chenopodiaceae	Atriplex sp. aff. holocarpa F. Muell.
2114	Chenopodiaceae	Chenopodium nitrariaceum (F. Muell.)F. Muell. ex Benth.
2115	Mimosaceae	Acacia tetragonaphylla F. Muell.
2116	Poaceae	Aristida browniana Henr.
2117	Euphorbiaceae	Euphorbia tannensis Spreng. ssp. eremophila (A. Cunn.) Hassall var. eremophila
2118	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
2119	Boraginaceae	Trichodesma zeylanicum (Burman. f.) R.Br.
2120	Myoporaceae	Eremophila longifolia (R.Br.) F. Muell.
2121	Loranthaceae	Lysiana exocarpi (Behr) Tieghem ssp. exocarpi
2122	Loranthaceae	Amyema preissii (Miq.) Tieghem
2123	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
2124	Solanaceae	Solanum oligacanthum F. Muell.
2125	Poaceae	Eragrostis australasica (Steudel) C. E. Hubb.
2125a	Malvaceae	Lavatera plebeia Sims
2126	Meliaceae	Owenia acidula F. Muell.
2127	Chenopodiaceae	Einadia nutans (R.Br.) A. J. Scott
2128	Chenopodiaceae	Chenopodium auricomum Lindley
2129	Chenopodiaceae	Salsola kali L.
2130	Mimosaceae	Acacia stenophylla A. Cunn. ex Benth.
2131	Haloragaceae	Haloragis aspera Lindley
2132	Proteaceae	Grevillea striata R.Br.
2133	Papilionaceae	Swainsona oroboides F. Muell. ex Benth.
2134	Chenopodiaceae	Atriplex angulata Benth.
2135	Lamiaceae	Teucrium racemosum R.Br. var. racemosum
2136	Chenopodiaceae	Salsola kali L.
2137	Chenopodiaceae	Maireana aphylla (R.Br.) Paul G. Wilson
2138	Chenopodiaceae	Sclerolaena bicornis Lindley
2139	Chenopodiaceae	Salsola kali L.
2140	Goodeniaceae	Lechenaultia divaricata F. Muell.
2141	Chenopodiaceae	Dissocarpus paradoxa (R.Br.) F. Muell. ex Ulbr. var. latifolius (J. Black) Ulbr.
2142	Poaceae	Aristida contorta F. Muell.

2143	Plantaginaceae	Plantago varia R.Br.
2144	Poaceae	Enneapogon avenaceus (Lindley) C. E. Hubb.
2145	Malvaceae	Sida sp. D (Fl. C. Aust. p.218) Brown-green specimen.
2145'	Malvaceae	Sida ammophila F. Muell. ex J. H. Willis 2 grey-leaved specimens.
2146	Papilionaceae	Swainsona phacoides Benth.
2147	Tetragoniaceae	Tetragonia tetragonioides (Pallas) Kuntze
2148	Caesalpinaceae	Lysiphyllum gilvum (Bailey) Pedley
2149	Asteraceae	Calotis erinacea Steetz
2150	Asteraceae	Minuria denticulata (DC.) Benth.
2151	Chenopodiaceae	Sclerolaena ventricosa (J. Black) A. J. Scott
2152	Chenopodiaceae	Atriplex limbata Benth.
2153	Goodeniaceae	Goodenia sp. aff. havilandii Maiden & Betche
2154	Brassicaceae	Brassica tournefortii Gouan
2155	Brassicaceae	Brassica tournefortii Gouan
2156	Asteraceae	Sonchus asper (L.) Hill
2157	Polygonaceae	Rumex sp. (Probably Rumex crystallinus Lange)
2158	Malvaceae	Lavatera plebeia Sims (Immature)
2159	Asteraceae	Gnaphalium indicum L.
2160	Zygophyllaceae	Zygophyllum ammophilum F. Muell.
2161	Mimosaceae	Acacia oswaldii F. Muell.
2162	Myoporaceae	Eremophila sp.
2163	Santalaceae	Santalum lanceolatum R.Br.
2164	Haloragaceae	Haloragis aspera Lindley
2165	Myoporaceae	Eremophila bignoniiflora (Benth.) F. Muell.
2166	Chenopodiaceae	Neobassia proceriflora (F. Muell.) A. J. Scott
2167	Chenopodiaceae	Sclerolaena intricata (R. Anderson) A. J. Scott
2168	Pittosporaceae	Pittosporum phylliraeoides DC. var. microcarpa S.Moore
2169	Asteraceae	Sonchus oleraceus L.
2170	Mimosaceae	Acacia salicina Lindley
2171	Asteraceae	Calotis ancyrocarpa J. Black
2172	Amaranthaceae	Ptilotus polystachus (Gaudich.)F. Muell. var. polystachus
2173	Rubiaceae	Dentella pulvinata Airy Shaw var. pulvinata
2174	Chenopodiaceae	Atriplex sp.
2175	Chenopodiaceae	Einadia nutans (R.Br.) A. J. Scott
2176	Haloragaceae	Haloragis aspera Lindley
2177	Apiaceae	Trachymene glaucifolia (F. Muell.) Benth.
2178	Meliaceae	Owenia acidula F. Muell.
2179	Asteraceae	Senecio cunninghamii DC.
2180	Loranthaceae	Lysiana exocarpi (Behr) Tieghem ssp. exocarpi
2181	Pittosporaceae	Pittosporum phylliraeoides DC. var. microcarpa S.Moore
2182	Malvaceae	Sida sp. ? fibulifera Lindley (Insufficient material)
2183	Asteraceae	Gnephosis eriocarpa (F. Muell.) Benth.
2184	Papilionaceae	Swainsona phacoides Benth.
2185	Poaceae	Aristida contorta F. Muell.
2186	Poaceae	Eragrostis eriopoda Benth.
2187	Santalaceae	Santalum lanceolatum R.Br.
2188	Chenopodiaceae	Atriplex lindleyi Moq.
2189	Chenopodiaceae	Atriplex velutinella F. Muell.
2190	Chenopodiaceae	Salsola kali L.
2191	Asteraceae	Helipterum strictum (Lindley) Benth.
2192	Sapindaceae	Dodonaea angustissima DC.
2193	Aizoaceae	Gunniopsis quadrifida (F. Muell.) Pax
2193'	Poaceae	Panicum whitei J. Black
2194	Asteraceae	Minuria rigida J. Black
2195	Malvaceae	Abutilon otocarpum F. Muell.
2196	Zygophyllaceae	Tribulus hystrix R. Br.
2197	Papilionaceae	Crotalaria eremaea F. Muell. var. eremaea

2198	Amaryllidaceae	Crinum flaccidum Herb.
2199	Aizoaceae	Trianthema triquetra Willd.
2200	Asteraceae	Calotis hispidula (F. Muell.) F. Muell.
2200'	Poaceae	Sporobolus actinocladus (F. Muell.) F. Muell.
2201	Poaceae	Eriochloa pseudo-acrotricha (Stapf ex Thell.) J. Black
2202	Chenopodiaceae	Chenopodium cristatum (F. Muell.) F. Muell.
2203	Poaceae	Eriochloa pseudo-acrotricha (Stapf ex Thell.) J. Black
2204	Poaceae	Dactyloctenium radulans (R.Br.) P. Beauv.
2205	Marsileaceae	Marsilea drummondii A. Braun
2206	Meliaceae	Owenia acidula F. Muell.
2207	Brassicaceae	Brassica tournefortii Gouan
2208	Poaceae	Eragrostis setifolia Nees
2209	Goodeniaceae	Goodenia lobata Ising
2210	Apiaceae	Daucus glochidiatus (Labill.) Fischer, C. Meyer & Ave Lall.
2211	Asteraceae	Helipterum microglossum (F. Muell.) Maiden & Betche
2212	Zygophyllaceae	Zygophyllum iodocarpum F. Muell.
2213	Geraniaceae	Erodium cygnorum Nees ssp. glandulosum Carolin
2214	Liliaceae	Bulbine alata Baijnath
2215	Asteraceae	Minuria denticulata (DC.) Benth.
2216	Asteraceae	Helipterum strictum (Lindley) Benth.
2217	Myoporaceae	Eremophila longifolia (R.Br.) F. Muell.
2218	Chenopodiaceae	Maireana coronata (J. Black) Paul G. Wilson
2219	Poaceae	Astrebla lappacea (Lindley) Domin
2220	Brassicaceae	Blennodia canescens R.Br.
2221	Myoporaceae	Eremophila longifolia (R.Br.) F. Muell.
2221'	Euphorbiaceae	Euphorbia parvicaruncula Hassall
2222	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. zygophylla (Benth.) Benth.
2223	Asteraceae	Pluchea tetranthera F. Muell.
2224	Poaceae	Eragrostis eriopoda Benth.
2225	Chenopodiaceae	Dissocarpus biflorus (R.Br.) F. Muell. var. cephalocarpa (F. Muell.) A. J. Scott
2226	Chenopodiaceae	Sclerolaena diacantha (Nees) Benth.
2227	Chenopodiaceae	Sclerolaena ventricosa (J. Black) A. J. Scott
2228	Papilionaceae	Psoralea australasica Schldl.
2229	Frankeniaceae	Frankenia angustipetala Summerh.
2230	Chenopodiaceae	Maireana georgei (Diels) Paul G. Wilson
2231	Myoporaceae	Eremophila maculata (Ker Gawler) F. Muell.
2232	Poaceae	Aristida anthoxanoides (Domin) Henr.
2233	Poaceae	Eragrostis leptocarpa Benth.
2234	Poaceae	Enneapogon avenaceus (Lindley) C. E. Hubb.
2235	Chenopodiaceae	Neobassia proceriflora (F. Muell.) A. J. Scott
2236	Chenopodiaceae	Sclerolaena costata (R. Anderson) A. J. Scott
2237	Lamiaceae	Teucrium racemosum R.Br. var. racemosum
2238	Poaceae	Aristida contorta F. Muell.
2239	Chenopodiaceae	Salsola kali L.
2240	Chenopodiaceae	Maireana aphylla (R.Br.) Paul G. Wilson
2241	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. zygophylla (Benth.) Benth.
2242	Papilionaceae	Tephrosia sphaerospora F. Muell.
2243	Myrtaceae	Eucalyptus camaldulensis Dehnh. var. obtusa (Dehnh.) Blakely
2244	Brassicaceae	Lepidium phlebopetalum (F. Muell.) F. Muell.
2245	Chenopodiaceae	Atriplex angulata Benth.
2246	Chenopodiaceae	Sclerolaena calcarata (Ising) A. J. Scott
2247	Chenopodiaceae	Atriplex velutinella F. Muell.
2248	Chenopodiaceae	Atriplex spongiosa F. Muell.

2249	Goodeniaceae	*Scaevola ovalifolia* R.Br.
2250	Chenopodiaceae	*Maireana pyramidata* (Benth.) Paul G. Wilson
2251	Chenopodiaceae	*Halosarcia indica* (Willd.) Paul G. Wilson *ssp. leiostachya* (Benth.) Paul G. Wilson
2252	Chenopodiaceae	*Atriplex lindleyi* Moq.
2253	Verbenaceae	*Verbena officinalis* L.
2254	Asteraceae	*Calocephalus platycephalus* (F. Muell.) Benth.
2255	?Polygonaceae	*Rumex crystallinus* Lange
2256	Aizoaceae	*Glinus lotoides* L.
2257	Chenopodiaceae	*Atriplex velutinella* F. Muell.
2258	Chenopodiaceae	*Atriplex velutinella* F. Muell.
2259	Asteraceae	*Epaltes australis* Less.
2260	Poaceae	*Eragrostis dielsii* Pilger
2261	Amaranthaceae	*Alternanthera nodiflora* R.Br.
2262	Mimosaceae	*Acacia stenophylla* A. Cunn. ex Benth.
2263	Lamiaceae	*Mentha sp.* (Probably *Mentha australis* R.Br.)
2264	Haloragaceae	*Haloragis aspera* Lindley
2265	Thymelaeaceae	*Pimelea continua* J. Black
2266	Chenopodiaceae	*Sclerolaena lanicuspis* (F. Muell.) Benth.
2267	Asteraceae	*Gnephosis foliata* (Sonder) H. Eichler
2268	Poaceae	*Eragrostis setifolia* Nees
2269	Chenopodiaceae	*Maireana coronata* (J. Black) Paul G.Wilson
2270	Chenopodiaceae	*Sclerolaena sp.* (between *S. bicornis* Lindley & *S. tricuspis* (F. Muell.) Ulbr.)
2271	Haloragaceae	*Haloragis aspera* Lindley
2272	Chenopodiaceae	*Atriplex spongiosa* F. Muell.
2272'	Chenopodiaceae	*Atriplex* sp. *aff. eardleyae* Aellen
2273	Poaceae	*Astrebla pectinata* (Lindley) F. Muell.
2274	Chenopodiaceae	*Sclerolaena lanicuspis* (F. Muell.) Benth.
2275	Chenopodiaceae	*Atriplex spongiosa* F. Muell.
2276	Asteraceae	*Calotis multicaulis* (Turcz) Druce
2277	Euphorbiaceae	*Euphorbia australis* Boiss.
2278	Malvaceae	*Sida trichopoda* F. Muell. (Ovary densely pubescent; carpels few).
2279	Portulacaceae	*Portulaca intraterranea* J. Black
2280	Poaceae	*Enneapogon avenaceus* (Lindley) C. E. Hubb.
2281	Chenopodiaceae	*Maireana aphylla* (R.Br.) Paul G. Wilson
2282	Poaceae	*Enneapogon avenaceus* (Lindley) C. E. Hubb.
2283	Asteraceae	*Streptoglossa adscendens* (Benth.) Dunlop
2284	Loranthaceae	*Amyema preissii* (Miq.) Tieghem
2285	Chenopodiaceae	*Atriplex vesicaria* Heward ex Benth.
2286	Chenopodiaceae	*Babbagia dipterocarpa* F. Muell.
2287	Chenopodiaceae	*Sclerolaena intricata* (R. Anderson) A. J. Scott
2288	Chenopodiaceae	*Dissocarpus biflorus* (R.Br.) F. Muell. *var. biflorus* (Abnormal fruits)
2289	Poaceae	*Eragrostis dielsii* Pilger
2290	Caesalpinaceae	*Cassia helmsii* Symon
2291	Caesalpinaceae	*Cassia phyllodinea* R.Br.
2292	Chenopodiaceae	*Sclerolaena bicornis* Lindley
2293	Lamiaceae	*Teucrium racemosum* R.Br. *var. racemosum*
2294	Chenopodiaceae	*Sclerolaena andersonii* (Ising) A. J. Scott
2295	Scrophulariaceae	*Peplidium sp.* D (Fl. C. Aust. p. 331)
2296	Poaceae	*Enneapogon avenaceus* (Lindley) C. E. Hubb.
2297	Poaceae	*Astrebla pectinata* (Lindley) F. Muell.
2298	Poaceae	*Sporobolus actinocladus* (F. Muell.) F. Muell.
2299	Chenopodiaceae	*Atriplex angulata* Benth.
2300	Papilionaceae	*Psoralea cinerea* Lindley
2301	Malvaceae	*Hibiscus krichauffianus* F. Muell.
2302	Papilionaceae	*Glycine canescens* F. J. Herm.

2303	Papilionaceae	Crotalaria eremaea F. Muell. ssp. eremaea
2304	Amaranthaceae	Ptilotus latifolius R.Br.
2305	Papilionaceae	Swainsona rigida (Benth.) J. Black
2306	Malvaceae	Sida ammophila F. Muell. ex J. H. Willis
2307	Zygophyllaceae	Tribulus occidentalis R.Br.
2308	Goodeniaceae	Scaevola ovalifolia R.Br.
2309	Poaceae	Eriachne aristidea F. Muell.
2310	Rubiaceae	Dentella pulvinata Airy Shaw var. pulvinata
2311	Proteaceae	Hakea eyreana (S. Moore) D. McGillivray
2312	Chenopodiaceae	Sclerolaena lanicuspis (F. Muell.) Benth.
2313	Frankeniaceae	Frankenia serpyllifolia Lindley
2314	Mimosaceae	Acacia victoriae Benth.
2315	Chenopodiaceae	Sclerolaena parallelicuspis (R. Anderson) A. J. Scott
2316	Chenopodiaceae	Maireana microcarpa (Benth.) Paul G. Wilson
2317	Chenopodiaceae	Atriplex lobativalvis F. Muell.
2318	Santalaceae	Santalum lanceolatum R.Br.
2319	Mimosaceae	Acacia oswaldii F. Muell.
2320	Proteaceae	Grevillea striata R.Br.
2321	Chenopodiaceae	Sclerolaena lanicuspis (F. Muell.) Benth.
2322	Chenopodiaceae	Einadia nutans (R.Br.) A. J. Scott
2323	Asteraceae	Minuria cunninghamii (DC.) Benth.
2324	Papilionaceae	Rhynchosia minima (L.) DC.
2325	Amaranthaceae	Alternanthera nodiflora R.Br.
2326	Gentianaceae	Centaurium spicatum (L.) Fritsch
2327	Poaceae	Echinochloa inundata Michael & Vickery
2328	Mimosaceae	Acacia dictyophleba F. Muell.
2329	Goodeniaceae	Scaevola depauperata R.Br.
2330	Myrtaceae	Eucalyptus terminalis F. Muell. (Fruits immature)
2331	Sapindaceae	Dodonaea viscosa Jacq.
2332	Myoporaceae	Eremophila maculata (Ker Gawler) F. Muell.
2333	Euphorbiaceae	Adriana hookeri (F. Muell.) Muell. - Arg.
2334	Proteaceae	Grevillea stenobotrya F. Muell. (Sterile leaf apex hooked)
2335	Liliaceae	Insufficient material for further identification.
2336	Amaranthaceae	Ptilotus polystachus (Gaudich.)F. Muell. var. polystachus
2337	Chenopodiaceae	Maireana microcarpa (Benth.) Paul G. Wilson
2338	Asteraceae	Calocephalus platycephalus (F. Muell.) Benth.
2339	Chenopodiaceae	Sclerolaena muricata (Moq.) Domin var. muricata
2340	Scrophulariaceae	Morgania glabra R.Br.
2341	Mimosaceae	Acacia farnesiana (L.) Willd.
2342	Mimosaceae	Acacia dictyophleba F. Muell.
2343	Malvaceae	Sida ammophila F. Muell. ex J. H. Willis
2344	Caesalpinaceae	Cassia pleurocarpa F. Muell. var. pleurocarpa
2345	Papilionaceae	Crotalaria smithiana A. Lee
2346	Loranthaceae	Lysiana exocarpi (Behr) Tieghem ssp. exocarpi
2347	Frankeniaceae	Frankenia uncinata Sprague & Summerh. ex Summerh.
2348	Thymelaeaceae	Pimelea trichostachya Lindley
2349	Sapindaceae	Dodonaea angustissima DC. (Leaves tending to broad)
2350	Poaceae	Eriachne aristidea F. Muell.
2351	Amaranthaceae	Alternanthera nodiflora R.Br.
2352	Poaceae	Eragrostis australasica (Steudel) C. E. Hubb.
2353	Asteraceae	Calotis multicaulis (Turcz.) Druce
2354	Chenopodiaceae	Atriplex lobativalvis F. Muell.
2355	Poaceae	Leptochloa digitata (R.Br.) Domin
2356	Poaceae	Diplachne fusca (L.) P. Beauv.
2357	Asteraceae	Centipeda cunninghamii (DC.) A. Br. & Aschers.
2358	Poaceae	Eragrostis dielsii Pilger
2359	Asteraceae	Calocephalus platycephalus (F. Muell.) Benth.

2360	Asteraceae	Centipeda minima (L.) A. Br. & Aschers.
2361	Polygonaceae	Polygonum plebeium R.Br.
2362	Asteraceae	Gnaphalium indicum L.
2363	Aizoaceae	Glinus lotoides L.
2364	Papilionaceae	Psoralea australasica Schldl.
2365	Amaranthaceae	Alternanthera nodiflora R.Br.
2366	Campanulaceae	Wahlenbergia sp.
2367	Poaceae	Eragrostis basedowii Jedwabn.
2368	Gentianaceae	Centaurium spicatum (L.) Fritsch
2369	Papilionaceae	?Psoralea sp.
2370	Asteraceae	Gnaphalium luteoalbum L.
2371	Poaceae	Eriachne aristidea F. Muell.
2372	Asteraceae	Calotis erinacea Steetz
2373	Poaceae	Echinochloa inundata Michael & Vickery
2374	Poaceae	Eragrostis speciosa (Roemer & Schultes) Steudel
2375	Cyperaceae	Cyperus cunninghamii (C. B. Clarke) C. Gardner
2376	Polygonaceae	Polygonum plebeium R.Br.
2377	Chenopodiaceae	Rhagodia spinescens R.Br.
2378	Myoporaceae	Eremophila macdonnellii F. Muell.
2379	Meliaceae	Owenia acidula F. Muell.
2380	Myoporaceae	Eremophila macgillivrayi J. Black
2381	Papilionaceae	Swainsona oroboides F. Muell. ex Benth.
2382	Caesalpinaceae	Cassia oligophylla F. Muell.
2383	Mimosaceae	Acacia stenophylla A. Cunn. ex Benth.
2384	Poaceae	Plagiosetum refractum (F. Muell.) Benth.
2385	Asteraceae	Pluchea tetranthera F. Muell.
2386	Myoporaceae	Eremophila longifolia (R.Br.) F. Muell.
2387	Boraginaceae	Heliotropium curassavicum L.
2388	Frankeniaceae	Frankenia uncinata Sprague & Summerh. ex Summerh.
2389	Myoporaceae	Eremophila maculata (Ker Gawler) F. Muell.
2390	Chenopodiaceae	Sclerolaena lanicuspis (F. Muell.) Benth. (Densely tomentose)
2391	Zygophyllaceae	Zygophyllum ammophilum F. Muell.
2392	Rubiaceae	Asperula gemella Airy Shaw & Turrill
2393	Apiaceae	Daucus glochidiatus (Labill.) Fischer, C. Meyer & Ave Lall.
2394	Poaceae	Agrostis avenacea J Gmelin
2395	Asteraceae	Calotis multicaulis (Turcz.) Druce
2396	Asteraceae	Helipterum floribundum DC.
2397	Chenopodiaceae	Sclerolaena sp. aff. tatei (F. Muell.) A. J. Scott
2398	Chenopodiaceae	Schlerochlamys brachyptera F. Muell.
2399	Chenopodiaceae	Neobassia proceriflora (F. Muell.) A. J. Scott
2400	Poaceae	Cynodon dactylon (L.) Pers.
2401	Capparidaceae	Capparis mitchellii Lindley
2402	Meliaceae	Owenia acidula F. Muell.
2403	Poaceae	?Paractaenum novae-hollandiae P. Beauv.
2404	Cyperaceae	Cyperus exaltatus Retz.
2405	Loranthaceae	Amyema preissii (Miq.) Tieghem
2406	Amaranthaceae	Ptilotus atriplicifolius (Cunn. ex Moq.) Benl var. atriplicifolius
2407	Poaceae	Echinochloa inundata Michael & Vickery
2408	Apiaceae	Eryngium supinum J. Black
2409	Chenopodiaceae	Sclerolaena calcarata (Ising) A, J. Scott
2410	Verbenaceae	Verbena officinalis L.
2411	Brassicaceae	Arabidella procumbens (Tate) E. Shaw
2412	Chenopodiaceae	Atriplex crassipes J. Black
2413	Poaceae	Agrostis avenacea J Gmelin
2414	Amaranthaceae	Alternanthera nodiflora R.Br.

2415	Poaceae	Panicum decompositum R.Br.
2416	Poaceae	Sporobolus mitchellii (Trin.) C. E. Hubb.
2417	Polygonaceae	Rumex crystallinus Lange
2418	Asteraceae	Myriocephalus rudallii (F. Muell.) Benth.
2419	Asteraceae	Craspedia chrysantha (Schldl.) Benth.
2420	Asteraceae	Brachycome sp. (Immature specimen)
2421	Asteraceae	Centipeda thespidioides F. Muell.
2422	Papilionaceae	Psoralea australasica Schldl.
2423	Asteraceae	Epaltes cunninghamii (Hook.) Benth.
2424	Frankeniaceae	Frankenia pseudo-flabellata Summerh.
2425	Boraginaceae	Heliotropium europaeum L.
2426	Poaceae	Plagiosetum refractum (F. Muell.) Benth.
2427	Papilionaceae	Crotalaria cunninghamii R.Br.
2428	Cucurbitaceae	Cucumis melo L. ssp. agrestis (Naudin) Grebensc.
2429	Malvaceae	Abutilon otocarpum F. Muell.
2430	Papilionaceae	Tephrosia sphaerospora F. Muell.
2431	Asteraceae	Minuria integerrima (DC.) Benth.
2432	Poaceae	Panicum decompositum R.Br.
2433	Poaceae	Agrostis avenacea J. Gmelin
2434	Asteraceae	Minuria rigida J. Black
2435	Poaceae	Diplachne fusca (L.) P. Beauv.
2436	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
2437	Onagraceae	Ludwigia peploides (Kunth) Raven ssp. montevidensis (Sprengel) Raven
2438	Goodeniaceae	Goodenia glauca F. Muell.
2439	Cyperaceae	Cyperus gymnocaulos Steudel
2440	Amaranthaceae	Ptilotus polystachus (Gaudich.)F. Muell. var. polystachus
2441	Loranthaceae	Lysiana exocarpi (Behr) Tieghem ssp. exocarpi
2442	Azollaceae	Azolla filiculoides Lam.
2443	Papilionaceae	Trigonella suavissima Lindley
2444	Poaceae	Panicum decompositum R.Br.
2445	Amaranthaceae	Ptilotus latifolius R.Br.
2446	Papilionaceae	Psoralea australasica Schldl.
2447	Proteaceae	Hakea leucoptera R.Br.
2448	Poaceae	Plagiosetum refractum (F. Muell.) Benth.
2449	Papilionaceae	Swainsona rigida (Benth.) J. Black
2450	Campanulaceae	Wahlenbergia sp.
2451	Papilionaceae	Aeschynomene indica L.
2452	Asteraceae	Craspedia chrysantha (Schldl.) Benth.
2453	Poaceae	Agrostis avenacea J. Gmelin
2454	Asteraceae	Ixiolaena brevicompta F. Muell.
2455	Poaceae	Sporobolus mitchellii (Trin.) C. E. Hubb.
2456	Chenopodiaceae	Halosarcia indica (Willd.) Paul G. Wilson ssp. leiostachya (Benth.) Paul G.Wilson
2457	Asteraceae	Senecio lautus Forst. f. ex Willd. ssp. maritimus Ali
2458	Amaranthaceae	Amaranthus mitchellii Benth.
2459	Mimosaceae	Acacia victoriae Benth.
2460	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. zygophylla (benth.) Benth.
2461	Asteraceae	Gnephosis foliata (Sonder) H. Eichler
2462	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
2463	Poaceae	Aristida browniana Henr.
2464	Myoporaceae	Eremophila longifolia (R.Br.) F. Muell.
2465	Scrophulariaceae	Morgania glabra R.Br.
3511	Myoporaceae	Eremophila bignoniiflora (Benth.) F. Muell.
3512	Myoporaceae	Eremophila bignoniiflora (Benth.) F. Muell.
3513	Myoporaceae	Eremophila bignoniiflora (Benth.) F. Muell.
3514	Poaceae	Eriachne aristidea F. Muell.

3515	Papilionaceae	Psoralea pallida N. Burb.
3516	Frankeniaceae	Frankenia angustipetala Summerh.
3517	Caesalpinaceae	Cassia pleurocarpa F. Muell.
3518	Caesalpinaceae	Cassia pleurocarpa F. Muell.
3519	Caesalpinaceae	Cassia pleurocarpa F. Muell.
3520	Myoporaceae	Eremophila maculata (Ker Gawler) F. Muell.
3521	Myoporaceae	Eremophila maculata (Ker Gawler) F. Muell.
3522	Myoporaceae	Eremophila maculata (Ker Gawler) F. Muell.
3523	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
3524	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
3525	Caesalpinaceae	Cassia nemophila A. Cunn. ex J. Vogel var. nemophila
3526	Convulvulaceae	Evolvulus alsinoides L. var. villosicalyx Ooststr.
3527	Convulvulaceae	Evolvulus alsinoides L. var. villosicalyx Ooststr.
3529	Goodeniaceae	Scaevola ovalifolia R.Br.
3530	Amaranthaceae	Ptilotus polystachus (Gaudich.)F. Muell. var. polystachus
3531	Amaranthaceae	Ptilotus polystachus (Gaudich.)F. Muell. var. polystachus
3532	Caesalpinaceae	Cassia oligophylla F. Muell.
3533	Caesalpinaceae	Cassia oligophylla F. Muell.
3534	Caesalpinaceae	Cassia helmsii Symon
3535	Caesalpinaceae	Cassia helmsii Symon
3536	Caesalpinaceae	Cassia helmsii Symon
3537	Papilionaceae	Crotalaria cunninghamii R.Br.
3538	Solanaceae	Nicotiana velutina Wheeler
3539	Solanaceae	Nicotiana velutina Wheeler
3540	Solanaceae	Nicotiana velutina Wheeler
3541	Chenopodiaceae	Halosarcia indica (Willd.) Paul G. Wilson ssp. leiostachya (Benth.) Paul G. Wilson
3542	Chenopodiaceae	Halosarcia indica (Willd.) Paul G. Wilson ssp. leiostachya (Benth.) Paul G. Wilson
3543	Asclepiadaceae	Cynanchum floribundum R.Br.
3544	Asclepiadaceae	Cynanchum floribundum R.Br.
3545	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
3546	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
3547	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
3548	Caesalpinaceae	Lysiphyllum gilvum (Bailey) Pedley
3549	Caesalpinaceae	Lysiphyllum gilvum (Bailey) Pedley
3550	Onagraceae	Ludwigia peploides (Kunth) Raven ssp. montevidensis (Sprengel) Raven
3551	Poaceae	Insufficient material for further identification.
3552	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
3553	Proteaceae	Grevillea striata R.Br.
3554	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
3555	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
3556	Aizoaceae	Gunniopsis quadrifida (F. Muell.) Pax
3557	Aizoaceae	Gunniopsis quadrifida (F. Muell.) Pax
3558	Santalaceae	Santalum lanceolatum R.Br.
3559	Santalaceae	Santalum lanceolatum R.Br.
3560	Loranthaceae	Lysiana exocarpi (Behr) Tieghem ssp. exocarpi
3561	Loranthaceae	Lysiana exocarpi (Behr) Tieghem ssp. exocarpi
3562	Mimosaceae	Acacia oswaldii F. Muell.
3563	Mimosaceae	Acacia oswaldii F. Muell.
3564	Rubiaceae	Dentella pulvinata Airy Shaw var. pulvinata
3565	Mimosaceae	Acacia victoriae Benth.
3566	Mimosaceae	Acacia victoriae Benth.
3567	Meliaceae	Owenia acidula F. Muell.
3568	Frankeniaceae	Frankenia angustipetala Summerh.
3569	Myoporaceae	Eremophila bignoniiflora (Benth.) F. Muell.
3570	Myoporaceae	Eremophila bignoniiflora (Benth.) F. Muell.

3571	Solanaceae	Nicotiana velutina Wheeler
3572	Asclepiadaceae	Cynanchum floribundum R.Br.
3573	Cyperaceae	Cyperus gymnocaulos Steudel
3574	Cyperaceae	Cyperus gymnocaulos Steudel
3575	Azollaceae	Azolla filiculoides Lam.
3576	Caesalpinaceae	Lysiphyllum gilvum (Bailey) Pedley
3577	Aizoaceae	Gunniopsis quadrifida (F. Muell.) Pax
3578	Aizoaceae	Gunniopsis quadrifida (F. Muell.) Pax
3579	Santalaceae	Santalum lanceolatum R.Br.
3580	Santalaceae	Santalum lanceolatum R.Br.
3581	Scrophulariaceae	Mimulus prostratus Benth.
3709	Sapindaceae	Atalaya hemiglauca (F. Muell.) F. Muell. ex Benth.
3710	Sapindaceae	Dodonaea angustissima DC.
3711	Mimosaceae	Acacia ligulata A. Cunn. ex Benth.
3712	Poaceae	Aristida browniana Henr.
3713	Euphorbiaceae	Euphorbia tannensis Spreng. ssp. eremophila (A. Cunn.) Hassall var. eremophila
3714	Poaceae	Triodia sp. (Probably T. basedowii Pritzel)
3715	Lamiaceae	Teucrium racemosum R.Br.
3716	Chenopodiaceae	Sclerolaena diacantha (Nees) Benth.
3717	Asteraceae	Calocephalus platycephalus (F. Muell.) Benth.
3718	Asteraceae	Calotis porphyroglossa F. Muell. ex Benth.
3719	Chenopodiaceae	Atriplex lobativalvis F. Muell.
3720	Asteraceae	Myriocephalus rudallii (F. Muell.) Benth.
3721	Asteraceae	Calocephalus platycephalus (F. Muell.) Benth.
3722	Mimosaceae	Acacia oswaldii F. Muell.
3723	Chenopodiaceae	Salsola kali L.
3724	Boraginaceae	Trichodesma zeylanicum (Burman. f.) R.Br.
3725	Euphorbiaceae	Euphorbia drummondii Boiss.
3726	Amaranthaceae	Ptilotus polystachus (Gaudich.)F. Muell. var. polystachus
3727	Chenopodiaceae	Sclerolaena diacantha (Nees) Benth.
3728	Chenopodiaceae	Atriplex velutinella F. Muell.
3729	Asteraceae	Helipterum moschatum (A. Cunn. ex DC.) Benth.
3730	Malvaceae	Abutilon otocarpum F. Muell.
3731	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
3732	Papilionaceae	Psoralea australasica Schldl.
3733	Amaranthaceae	Amaranthus grandiflorus (J. Black) J. Black
3734	Papilionaceae	Swainsona rigida (Benth.) J. Black
3735	Brassicaceae	Blennodia pterosperma (J. Black) J. Black
3736	Papilionaceae	Crotalaria eremaea F. Muell. ssp. eremaea
3853	Caesalpinaceae	Lysiphyllum gilvum (Bailey) Pedley
3854	Caesalpinaceae	Lysiphyllum gilvum (Bailey) Pedley
3855	Rubiaceae	Asperula gemella Airy Shaw & Turrill
3856	Myrtaceae	Eucalyptus camaldulensis Dehnh. var. obtusa (Dehnh.) Blakely
3857	Verbenaceae	Verbena officinalis L.
3858	Chenopodiaceae	Sclerolaena sp. (Between S. bicornis Lindley & S. tricuspis (F. Muell.) Ulbr.)
3859	Chenopodiaceae	Enchylaena tomentosa R.Br.
3860	Myrtaceae	Eucalyptus microtheca F. Muell.
3861	Santalaceae	Santalum lanceolatum R.Br.
3862	Zygophyllaceae	Zygophyllum ammophilum F. Muell.
3863	Myrtaceae	Eucalyptus microtheca F. Muell.
3864	Mimosaceae	Acacia stenophylla A. Cunn. ex Benth.
3865	Chenopodiaceae	Atriplex spongiosa F. Muell.
3866	Chenopodiaceae	Salsola kali L.
3867	Tetragoniaceae	Tetragonia tetragonioides (Pallas) Kuntze

3868	Asteraceae	Senecio lautus Forst. f. ex Willd. ssp. dissectifolius Ali
3869	Loranthaceae	Lysiana exocarpi (Behr) Tieghem ssp. exocarpi
3870	Loranthaceae	Lysiana exocarpi (Behr) Tieghem ssp. exocarpi
3871	Mimosaceae	Acacia stenophylla A. Cunn. ex Benth.
3872	Asteraceae	Sonchus oleraceus L.
3873	Haloragaceae	Haloragis glauca Lindley forma sclopetifera (F.Muell.) Orch.
3874	Asteraceae	Senecio lautus Forst. f. ex Willd. ssp. dissectifolius Ali
3875	Poaceae	Insufficient material for further identification (as 2073).
3876	Asteraceae	?Vittadinia sp. (Sterile)
3877	Papilionaceae	Trigonella suavissima Lindley
3878	Polygonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
3879	Malvaceae	Lavatera plebeia Sims
3880	Marsileaceae	Marsilea drummondii A. Braun
3881	Cyperaceae	Eleocharis acuta R.Br.
3882	Polgonaceae	Muehlenbeckia cunninghamii (Meisn.) F. Muell.
3883	Chenopodiaceae	Chenopodium auricomum Lindley
3884	Portulacaceae	Portulaca intraterranea J. Black
3885	Papilionaceae	?Medicago polymorpha L. (Small leaves)
3886	Geraniaceae	Erodium cygnorum Nees ssp. glandulosum Carolin
3887	Chenopodiaceae	Atriplex sp.
3888	Chenopodiaceae	Atriplex velutinella F. Muell.
3889	Asteraceae	Helipterum moschatum (A. Cunn. ex DC.) Benth.
3890	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
3891	Asteraceae	Gnephosis eriocarpa (F. Muell.) Benth.
3892	Asclepiadaceae	Cynanchum floribundum R.Br.
3893	Papilionaceae	Crotalaria eremaea F. Muell. ssp. eremaea
3894	Malvaceae	Lavatera plebeia Sims
3895	Poaceae	Echinochloa inundata Michael & Vickery
3896	Papilionaceae	Aeschynomene indica L.
3897	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
3898	Liliaceae	Bulbine alata Baijnath
3899	Apiaceae	Trachymene glaucifolia (F. Muell.) Benth.
3900	Papilionaceae	Crotalaria eremaea F. Muell. ssp. eremaea
3901	Brassicaceae	Blennodia pterosperma (J. Black) J. Black
3902	Papilionaceae	Crotalaria eremaea F. Muell. ssp. eremaea
3903	Solanaceae	Nicotiana velutina Wheeler
3904	Chenopodiaceae	Atriplex spongiosa F. Muell.
3905	Mimosaceae	Acacia ligulata A. Cunn. ex Benth.
3906	Zygophyllaceae	Zygophyllum howittii F. Muell.
3907	Chenopodiaceae	Sclerolaena diacantha (Nees) Benth.
3908	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
3909	Zygophyllaceae	Tribulus occidentalis R.Br.
3910	Solanaceae	Nicotiana velutina Wheeler
3911	Boraginaceae	Trichodesma zeylanicum (Burman. f.) R.Br.
3912	Poaceae	Eragrostis dielsii Pilger
3913	Convulvulaceae	Convulvulus erubescens Sims
3914	Chenopodiaceae	Enchylaena tomentosa R.Br.
3915	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
3916	Malvaceae	Sida ammophila F. Muell. ex J. H. Willis
3917	Asteraceae	Helipterum moschatum (A. Cunn. ex DC.) Benth.
3918	Poaceae	Tragus australianus S. T. Blake
3919	Poaceae	Aristida browniana Henr.
3920	Euphorbiaceae	Phyllanthus lacunarius F. Muell.
3921	Malvaceae	Abutilon otocarpum F. Muell.
3922	Zygophyllaceae	Tribulus occidentalis R.Br.
3923	Chenopodiaceae	Chenopodium cristatum (F. Muell.) F. Muell.
3924	Asteraceae	Senecio gregorii F. Muell.

3925	Euphorbiaceae	Euphorbia tannensis Spreng. ssp. eremophila (A. Cunn.) Hassall var. eremophila
3926	Papilionaceae	Tephrosia sphaerospora F. Muell.
3927	Liliaceae	Bulbine alata Baijnath
3928	Brassicaceae	Blennodia sp. aff. canescens R.Br.
3929	Zygophyllaceae	Tribulus occidentalis R.Br.
3930	Portulacaceae	Portulaca intraterranea J. Black
3931	Chenopodiaceae	Salsola kali L.
3932	Asteraceae	Helipterum floribundum DC.
3933	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
3934	Apiaceae	Trachymene glaucifolia (F. Muell.) Benth.
3935	Poaceae	Zygochloa paradoxa (R.Br.) S. T. Blake
3936	Mimosaceae	Acacia oswaldii F. Muell.
3937	Mimosaceae	Acacia tetragonaphylla F. Muell.
3938	Loranthaceae	Amyema preissii (Miq.) Tieghem
3939	Mimosaceae	Acacia ligulata A. Cun. ex Benth.
3940	Mimosaceae	Acacia oswaldii F. Muell.
3941	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
3942	Papilionaceae	Tephrosia sphaerospora F. Muell.
3943	Mimosaceae	Acacia murrayana F. Muell. ex Benth.
3944	Chenopodiaceae	Atriplex sp.
3945	Asteraceae	Myriocephalus stuartii (F. Muell. & Sond. ex Sond.)Benth.
3946	Euphorbiaceae	Phyllanthus lacunarius F. Muell.
3947	Malvaceae	Sida sp.
3948	Chenopodiaceae	Atriplex nummularia Lindley
3949	Chenopodiaceae	Atriplex spongiosa F. Muell.
3950	Chenopodiaceae	Sclerolaena intricata (R. Anderson) A. J. Scott
3951	Haloragaceae	Haloragis aspera Lindley
3952	Chenopodiaceae	Atriplex nummularia Lindley
3953	Chenopodiaceae	Babbagia acroptera F. Muell. & Tate
3954	Chenopodiaceae	Sclerolaena diacantha (Nees) Benth.
3955	Chenopodiaceae	Atriplex angulata Benth.
3956	Chenopodiaceae	Sclerolaena intricata (R. Anderson) A. J. Scott
3957	Liliaceae	Bulbine alata Baijnath
3958	Asteraceae	Senecio gregorii F. Muell.

Appendix M

APPENDIX M - Plants species (subspecies and varieties) collected within the Cooper Creek Environmental Association 8.4.4 during the present survey, with an indication of the habitat preferences and status of each.

Column 1 - Families and species (subspecies and varieties) of plants collected this survey.

2 - Habitat Preferences - habitats in which species (subspecies and varieties) were encountered during this survey (see also individual entries, Appendix R).

3 - Status - VC - very common
C - common
FC - fairly common
U - uncommon

(see title page of Appendix R for means used to determine the status of species (subspecies and varieties) of plants).

1.	2.	3.
AIZOACEAE		
Glinus lotoides	Channel edge and floodout	U
Gunniopsis quadrifida	Claypan edges, salt lake edges, interdunes and sand/floodout interface	U
Trianthema triquetra	Channel edge	U
Zaleya galericulata	Channel edge	U
AMARANTHACEAE		
Alternanthera nodiflora	Adjacent to channels, floodout & gibber	C
Amaranthus grandiflorus	Dune	U
A. mitchellii	Dune and channel	FC
Ptilotus atriplicifolius var. atriplicifolius	Sand plain	FC
P. latifolius	Dune	FC
P. obovatus var. obovatus	Dune	FC
P. polystachus var. polystachus	Dune, undulating dune and sand plain	VC
AMARYLLIDACEAE		
Crinum flaccidum	Claypans; clayey interdunes and dune slopes	C
APIACEAE		
Daucus glochidiatus	channel edge, gibber plain, ovoid inter-dune and floodout - ephemeral herbfield & chenopod shrubland	FC
Eryngium supinum	Channel edge	U
Trachymene glaucifolia	Dune and undulating dune	C
ASCLEPIADACEAE		
Cynanchum floribundum	Dune - crests and slopes	C
Rhyncharrhena linearis	Dune	U
ASTERACEAE		
Brachycome ciliaris var. lanuginosa	?Dune	U
Calocephalus platycephalus	Near channels, on floodouts or in interdunes.	VC
Calotis ancyrocarpa	Floodout and swamp.	FC
C. erinacea	Dune slope and floodout	FC
C. hispidula	Floodouts - under lignum or old man saltbush communities, and in interdunes	VC
C. multicaulis	Interdune, channel edge and floodout	FC
C. porphyroglossa	Floodout - saltbush and ephemeral herb-fields, channel edge, interdune and interdune claypan	C
Centipeda cunninghamii	Channel edge.	U
C. minima	Channel edge, floodout and swamp	FC
C. thespidioides	Channel and interdune claypan	FC
Craspedia chrysantha	Channel and ephemeral lake bed	U
Epaltes australis	Floodout and interdune	FC
E. cunninghamii	Channel and ephemeral lake bed	U
Gnaphalium indicum	Floodout - saltbush & lignum, and channel edge.	FC
G. luteoalbum	Channel edge	FC
Gnephosis eriocarpa	Dune, undulating dune, channel edge, ephemeral channel and open gibber clay flat	C
G. foliata	Dune/floodplain, gibber - ephemeral herbfield, claypan edge, interdune, lake channel and ephemeral lake bed	C

Helipterum floribundum	Dune interdune, undulating dune, channel edge and open gibber clayflat	C
H. microglossum	Floodout	U
H. moschatum	Dune slope, interdune, undulating dune, Channel and swamp margin.	VC
H. strictum	Gibber areas and floodout	C
Ixiolaena brevicompta	Ephemeral lake bed and swamp margin	U
Minuria cunninghamii	Gibber plain run-on area	C
M. denticulata	Floodout, interdune claypan, ephemeral lake bed and sand plain.	C
M. integerrima	Ephemeral lake bed	U
M. rigida	Ephemeral lake bed and floodout	FC
Myriocephalus rudallii	Interdune claypan (ovoid)	U
M. stuartii	Most frequent on dunes & sand plains, but occurs on all habitats except gibber.	VC
Pluchea tetranthera	Ephemeral lake bed & bore drain outlet	U
1 Senecio cunninghamii	Floodout and channel edge in chenopod communities.	FC
S. gregorii	Dune interdune claypan, floodout channel edge & ephemeral channel	VC
S. lautus ssp. dissectifolius	Swamp.	U
S. lautus ssp. maritimus	Swamp, ephemeral lake bed	FC
*Sonchus asper	Swamp	U
S. oleraceus	Channel edge, dune and swamp	FC
Streptoglossa adscendens	Gibber plain	U
Vittadinia sp.	Swamp	U
AZOLLACEAE		
Azolla filiculoides	Swamps, more permanent W.H.s and lakes - in water	FC
BORAGINACEAE		
*Heliotropium curassavicum	Bore drain outlet	U
*H. europaeum	Lake channel & ephemeral lake bed	FC
Omphalolappula concava	Undulating dune	U
Trichodesma zeylanicum	Dune	VC
BRASSICACEAE		
Arabidella procumbens	Swamp	U
Blennodia canescens	Dune slope	U
B sp. aff. canescens	Dune	U
B. pterosperma	Dune	FC
*Brassica tournefortii	Swamp, floodout	FC
Lepidium muelleriferdinandii	Open gibber clay flat & channel edge	U
CAESALPINACEAE		
Cassia helmsii	Gibber plain	U
C. nemophila var. nemophila	Dune, hard interdune, undulating dune sand plain, floodout & ephemeral channel	VC
C. nemophila var. zygophylla	Dune, dune slope, interdune, undulating dune, sand plain and floodout	C
C. oligophylla	Dune / channel edge	FC
C. phyllodinea	Gibber areas, interdune & claypan edges	FC
1 Pterocaulon sphacelatum	Channel edge	U

Cassia pleurocarpa var. *pleurocarpa*	Dune	FC
Lysiphyllum gilvum	Floodout and channel edge	VC
CAMPANULACEAE		
Wahlenbergia sp.	Near channels ; floodouts	FC
CAPPARACEAE		
Capparis mitchellii	Floodout	U
CHENOPODIACEAE		
Atriplex angulata	Floodout, ephemeral lake, channel edge, interdune, interdune claypan and gibber	VC
A. crassipes	Swamp/channel	U
A. eardleyae	Floodout	U
A. sp. aff. *eardleyae*	Floodout	U
A. sp. aff. *holocarpa*	Swamp	U
A. leptocarpa	Floodout, dune, clay flat, dune/swampy floodout.	C
A. limbata	Floodout	U
A. lindleyi	Floodout and ephemeral lake	U
A. lobativalvis	Interdune, swamp/channel & floodout	FC
A. muelleri	Swamp & floodout.	FC
A. nummularia	Floodout, ephemeral lake, dune/swamp, dune/gibber & channel edge.	VC
A. spongiosa	Floodouts and clayey interdunes most frequently, but on all other habitats also except dunes.	VC
A. velutinella	Dune, floodout, channel edge & interdune claypan	VC
A. vesicaria	Gibber, floodout and ephemeral lakebed	C
Babbagia acroptera	Clayey interdunes, ephemeral lake beds and associated dunes.	FC
B. dipterocarpa	Gibber, dune.	U
Chenopodium auricomum	Floodout, channel edge, swamp, gibber, interdune and interdune claypan	VC
C. cristatum	Dune and channel edge	U
C. nitrariaceum	Floodout, swamp, ephemeral lake, plain and clay flat.	C
Dissocarpus biflorus var. *biflorus*	Gibber and swampy areas in gibber	U
D. biflorus var. *cephalocarpa*	Ephemeral lake bed	U
D. paradoxa var. *latifolius*	Floodout & sand plain.	U/FC
Einadia nutans	Channel edge, undulating dune, sand plain and swampy gibber area	FC
Enchylaena tomentosa	Channel edge and floodout generally, also dune, interdune, undulating dune, sand plain, ephemeral lake and dune/floodout.	VC
Halosarcia indica ssp. *leiostachya*	Claypans, saltpans & areas of floodplain	C
Maireana aphylla	Gibber, floodout, interdune, undulating dune and sand plain.	C
M. coronata	Floodout, gibber and dune	C
M. georgei	Floodout/interdune interface	U
M. microcarpa	Dune base and interdune	FC
M. pyramidata	Dune base and floodout	U
Neobassia proceriflora	Floodout, channel edge, gibber plain and undulating dune	C
Rhagodia gaudichaudiana	Channel edge	U
R. spinescens	Interdune border (ovoid)	U
Salsola kali	Dune, undulating dune, sand plain, ephemeral lake and floodout	VC

Schlerochlamys brachyptera	Channel edge	U
Sclerolaena andersonii	Gibber plain and ? ephemeral lake bed	U
S. bicornis	Floodout, channel edge, ephemeral lake, claypan edge, interdune, gibber & dune/floodout	VC
S. calcarata	Dune and swamp/channel interface	U
S. costata	Floodout	U
S. diacantha	Floodout, ephemeral lake, channel edge, dune, interdune, undulating dune & sand plain	VC
?S. holtiana	Channel edge	U
S. intricata	Floodout, ephemeral lake, channel edge, dune and interdune	VC
S. lanicuspis	Gibber areas, dune/floodplain interface and channel edge.	FC
S. muricata var. muricata	Interdune	U
S. parallelicuspis	Dune and dune/floodplain interface.	U
S. sp. aff. tatei	Channel edge	U
S. sp. (between S. bicornis & S. tricuspis)	Floodout and open gibber clay flat.	U
S. ventricosa	Ephemeral lake bed, floodout and dune	U
CHLOANTHACEAE		
Dicrastylis costelloi	Interdune	U
CONVULVULACEAE		
Convulvulus erubescens	Floodout - ephemeral herbfield, channel edge, dune, interdune, claypan, undulating dune and open gibber clay flat.	C
Evolvulus alsinoides var. villosicalyx	?	U
CUCURBITACEAE		
Cucumis melo ssp. agrestis	Gibber plain and ephemeral lake channel	U
Mukia maderaspatana	Dune dune/floodout interface and Undulating dune.	FC
CYPERACEAE		
Cyperus cunninghamii	Floodout /channel interface	U
C. sp. aff. cunninghamii	Channel edge	U
C. exaltatus	Bordering channels in swamp & floodout	U
C. gymnocaulos	Floodout and bordering lakes and channels.	FC
Eleocharis acuta	Swamp	U
E. pallens	Swamp and interdune	FC
EUPHORBIACEAE		
Adriana hookeri	Dune	U
Euphorbia australis	Gibber	U
E. drummondii	Dune	U
E. parvicaruncula	Floodout and ? gibber plain gutter and dune/floodout interface	U
E. tannensis ssp. eremophila var. eremophila	Dune (slopes), interdune, undulating dune, sand plain, floodout and gibber areas.	VC
E. wheeleri	Open gibber clay flat.	U
Phyllanthus fuernrohrii	Dune and undulating dune	C
P. lacunarius	Dune, lake margin, floodout & claypan	C
P. sp. aff. lacunarius	Sand sheet/swampy floodout and pale dune.	FC

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Sauropus trachyspermus	Claypan/floodout area near a dry salty lake.	U
FRANKENIACEAE		
Frankenia angustipetala	Interdune	U
F. cinerea	Interdune-disturbed clayey run-on area	U
F. pseudo-flabellata	Ephemeral lake bed	U
F. serpyllifolia	Gibber	U
F. uncinata	Claypan edge and moist clays near a bore overflow.	FC
GENTIANACEAE		
Centaurium spicatum	Swampy interdune, interdune claypan	U
GERANIACEAE		
*Erodium aureum	Dry salty lake	U
E. crinitum	Swamp	FC
E. cygnorum ssp. glandulosum	Swamp, floodout and ? ephemeral lake bed.	U
GOODENIACEAE		
Goodenia glauca	Channel edge	FC
G. sp. aff. havilandii	Floodout	U
G. lobata	Floodout and ?ephemeral lake bed	U
Lechenaultia divaricata	Dune, undulating dune & floodout	C
Scaevola aemula	Dune	U
S. depauperata	Dune	U
S. ovalifolia	Dune	FC
HALORAGACEAE		
Haloragis aspera	Floodout	C
H. glauca forma sclopetifera	Swamp.	U
LAMIACEAE		
Mentha australis	Adjacent to channels	U
Teucrium racemosum var. racemosum	Gibber, floodout, interdune & claypan	VC
T. racemosum var. tripartitum	Sand plain	U
LILIACEAE		
Bulbine alata	Floodout - particularly in A. nummularia and lignum communities, dune undulating dune and clayflat.	C
LORANTHACEAE		
Amyema preissii	On Santalum spp., Cassia spp., Acacia spp. and Eucalyptus microtheca - see hosts for preferred habitats.	C
Diplatia grandibractea	Coolibahs lining channels and in floodouts.	C
Lysiana exocarpi ssp. exocarpi	On Santalum, Atalaya, Owenia, Eucalyptus Pittosporum and Muehlenbeckia - see hosts.	VC
MALVACEAE		
Abutilon fraseri	Dune, undulating dune	FC
A. otocarpum	Dune, undulating dune, sand plain, dune/floodout interface	C
Hibiscus krichauffianus	Dune	FC

Lavatera plebeia	Floodout, lining channels, in swamps and rarely on dunes.	C
Sida ammophila	Dune, sand plain and floodout	C
S. corrugata	Dune / floodout interface	U/R
S. cunninghamii	Dune	U/R
S. fibulifera	Undulating dune	U/R
S. sp. D	Floodout	U
S. trichopoda	Gibber plain	U
MARSILEACEAE		
Marsilea drummondii	Swamp, channel edge, gibber, interdune and interdune claypan	VC
MELIACEAE		
Owenia acidula	Channel edge, floodout, dune sandplain and in some interdunes	C
MIMOSACEAE		
Acacia cyperophylla	Sand plain	U
A. dictyophleba	Dune	U
A. farnesiana	Ephemeral creek edge	U
A. ligulata	Dune, undulating dune, uncoordinated dune and sand plain	VC
A. murrayana	Dune and sand plain	VC
A. oswaldii	Dune (slopes), undulating dune, sand plain, channel edge and floodout	C
A. salicina	Channel edge and floodout	C
A. stenophylla	Channel edge, floodout, swamp and less often interdune and ephemeral lake	VC
A. tetragonophylla	Dune, interdune and undulating dune	C
A. victoriae ssp. arida	Floodout or plain and gibber areas	FC
A. victoriae ssp. victoriae	Dune, interdune, undulating dune, sand plain, channel, floodout and swampy	FC
MYOPORACEAE		
Eremophila bignoniiflora	Floodout, channel edge, ephemeral lake margin, interdune & claypan edge.	VC
E. longifolia	Dune, sand plain & gibber plain gutter	C
E. macdonnellii	Sand plain and ovoid interdune	FC
E. macgillivrayi	Ovoid interdune	U
E. maculata	Dune, interdune, sand plain, open gibber clay flat and floodout.	C
MYRTACEAE		
Eucalyptus camaldulensis var. obtusa	Bordering deep channel & lakes and on adjacent floodouts.	C
E. microtheca	Channel edge, floodout & swamp	VC
E. terminalis	Northern gibber channels, dune and interdune.	FC
ONAGRACEAE		
*Ludwigia peploides ssp. montevidensis	Channel edge	FC
PAPILIONACEAE		
Aeschynomene indica	Adjacent to channels and dune	U
Crotalaria cunninghamii	Dune - a coloniser	C
C. eremaea ssp. eremaea	Dune - a coloniser	VC

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Crotalaria smithiana	Ephemeral channel	FC
Glycine canescens	Dune slope	U
Lotus cruentus	Ovoid interdune claypan	U
*?Medicago polymorpha	Swamp	U
Psoralea australasica	Channel edge, floodout and dune	FC
P. cinerea	Gibber plain and dune	U
P. pallida	Dune	U
Rhynchosia minima	Gibber plain	U
Swainsona oroboides	Interdune, channel edge & floodout	FC
S. phacoides	Undulating dune, floodout and hard claypan.	FC
S. rigida	Dune	FC
?Templetonia egena	Channel	U
Tephrosia sphaerospora	Claypan, dune and lake margin	C
Trigonella suavissima	Ephemeral lake, swamp and channel edge.	FC
PITTOSPORACEAE Pittosporum phylliraeoides var. microcarpa	Floodout and undulating dune	FC
PLANTAGINACEAE Plantago varia	Floodout - ephemeral herbfield and under lignum and old man saltbush communities, and gibber plain	C
POACEAE Agrostis avenacea	Swamp and channel edge	FC
Aristida anthoxanoides	Sand plain and floodout	FC
A. browniana	Dune and ephemeral lake bed	VC
A. contorta	Dune, interdune, undulating dune and floodout	C
Astrebla lappacea	Floodout	U
A. pectinata	Gibber areas, adjacent dunes and on claypans in interdunes	C/VC
Cynodon dactylon	Adjacent to channels	FC
Dactyloctenium radulans	Gibber areas and channel edge	FC
Diplachne fusca	Channel edge and ephemeral lake bed	FC
Echinochloa inundata	Channel edge, swamp and dune	FC
Enneapogon avenaceus	Gibber areas, undulating dune, channel edge and floodout	C
E. cylindricus	Undulating dune	U
E. polyphyllus	Sand plain	U
Eragrostis australasica	Floodout, gibber plain claylens, interdune, channel edge & ephemeral lake bed	C
E. basedowii	Channel edge.	U
E. dielsii	Gibber plain, channel edge, interdune interdune claypan, dune & undulating dune	C
E. eriopoda	Gibber plain, undulating dune, sand plain and ephemeral lake bed	FC
E. leptocarpa	floodout and ? swamp/channel	U
E. setifolia	Gibber areas, floodout, channel, sand plain, dune and interdune	VC
E. speciosa	Adjacent to channel	U
Eriachne aristidea	Gibber plain, interdune and dune	C

Eriochloa pseudo-acrotricha	Channel edge	U
Leptochloa digitata	Channel edge and ovoid interdune clay-pan	FC
Panicum decompositum	Lake channel and ephemeral lake bed	FC
P. whitei	Dune / floodout interface	U
Paractaenum novae-hollandiae	Dune and ?swamp, channel and sand plain	U
Plagiosetum refractum	Dune	FC
Sporobolus actinocladus	Gibber plain	U
S. mitchellii	Floodout - ephemeral forbland, channel edge, ephemeral lake bed and claypan	FC
Tragus australianus	Dune	FC
Triodia basedowii	Dune slopes and interdunes	VC
Triraphis mollis	Dune, undulating dune, sand plain and lake margin.	C
Zygochloa paradoxa	Dune, undulating dune, uncoordinated dune & sand plain.	VC
POLYGONACEAE		
Muehlenbeckia cunninghamii	swamp, channel edge and more regularly inundated parts of floodouts, lake margin, interdune, interdune claypan and gibber	VC
Polygonum plebeium	Adjacent to channels	FC
Rumex crystallinus	Floodout channel edge, swamp and lake channel	C
PORTULACACEAE		
Calandrinia remota	Dune	U
Portulaca intraterranea	Dune, undulating dune, swamp, clay-flat, channel edge & ephemeral lake margin	VC
PROTEACEAE		
Grevillea stenobotrya	Dune	FC
G. striata	Dune, undulating dune, sand plain, floodout/channel and dune/floodout	C
Hakea eyreana	Ovoid interdune, sand plain and dune / floodplain interface	FC
H. leucoptera	Dune (slopes), interdunes, undulating dune and sand plain	C
RUBIACEAE		
Asperula gemella	Channel edge and swamp	FC
Dentella pulvinata var. pulvinata	Clayey interdunes, dune, gibber and undulating dune	FC
SANTALACEAE		
Santalum lanceolatum	Channel edge, undulating dune and gibber plain gutters.	C
SAPINDACEAE		
Atalaya hemiglauca	Dune (slope), interdune, undulating dune, sand plain, gibber plain gutter, channel edge and floodout.	VC
Dodonaea angustissima	Dune (slope), interdune, undulating dune, sand plain, claypan edge and ephemeral channel edge.	C
D. viscosa	Dune	U
SCROPHULARIACEAE		
Mimulus prostratus	?	U
Morgania floribunda	Bordering claypans, dry lakes, channels and on dunes and in interdunes	FC
M. glabra	Gibber plain, interdune and channel edge	FC
Peplidium sp. D	Gibber plain	U

SOLANACEAE *Nicotiana velutina*	Dune (slopes), floodout, channel edge, swamp, interdune claypan and sand sheet / swampy floodout interface.	VC
Solanum oligacanthum	Floodout - ephemeral herbfield, clay-flat (in interdune) and channel edge.	C
TETRAGONIACEAE *Tetragonia tetragonioides*	Floodout - under saltbush and lignum / coolibah communities also ephemeral herbfields, channel and channel edge, dune, interdune and undulating dune.	VC
THYMELAEACEAE *Pimelea simplex ssp. continua*	Open gibber clay flat, gibber plain.	U
P. trichostachya	Dune, sand plain.	U
VERBENACEAE **Verbena officinalis*	Floodout - borrow pit, swamp/channel interface and floodout.	FC
ZYGOPHYLLACEAE *Tribulus hystrix*	Dune / floodout interface	U
T. occidentalis	Dune and lake margin	C
**T. terrestris*	Undulating dunes	U
Zygophyllum ammophilum	Dune, channel edge and floodout	C
Z. howittii	Dune, undulating dune, sand plain and floodout.	FC
Z. iodocarpum	Floodout	U

Appendix N

APPENDIX N

[1]Principal Survey Site Locations, Major Vegetation Types Sampled at the Nine Permanent Sites and Details of Aerial Photographs Covering Survey Sites

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[1] Principal survey site locations as depicted in Fig. 7. In the vicinity of each of these survey sites several (up to four) habitats were sampled. Full details of locations of habitats sampled at each principal site can be found in data sheets and geological maps held by the Survey and Research Section, N.P.W.S.

Principal Survey Site Locations:

\# - Permanent Site; * - Sites selected but not surveyed due to inaccessibility or time constraints.

\#1 - Gibber (8.4.4.5): 5 km SSW of Lake Moorayepe (26°23'S / 139°59'E).

*2 - Parallel Dunefields (8.4.4.4): 2 km ENE of the SE corner of Lake Padripooreninie (26°37'S / 140°10'E).

*3 - Gibber (8.4.4.5): 3 km south of Dickinna Hill (26°45'S / 139°55'E).

\#4 - Junction of Gibber (8.4.4.5), Parallel Dunefields (8.4.4.4) and Uncoordinated Drainage Dunefield (8.4.4.7): Orange dune 0.8 km east of Mudcarnie W.H. (26°52'S / 140°32'E).

*5 - Parallel Dunefields (8.4.4.4): 1 km NW of the SE corner of salt lake with centre 15 km west of Mudcarnie W.H. (26°51'S / 140°32'E).

\#6 - Parallel Dunefields (8.4.4.4): Red interdune 8.5 km just E of N of Karawinnie W.H. (27°07'S / 139°43'E).

\#7 - Uncoordinated Drainage Dunefield (8.4.4.7): Orange-red dune in the vicinity of King Lookout (26°56'S / 140°38'E).

7A - Uncoordinated Drainage Dunefield (8.4.4.7): Red dune 3 km south of Tooroowatchie W.H. (27°05'S / 140°39'E).

8 - Cooper Creek Floodplain (8.4.4.1): Pale dune 28.75 km north of Kudriemitchie Outstation (on the east margin of Kudriemitchie W.H.) (27°07'S / 140°11'E).

8A - Cooper Creek Floodplain (8.4.4.1): Orange dune/interdune 18 km NNW of Coongie (27°01'S / 140°06'E).

8A'- Cooper Creek Floodplain (8.4.4.1): Appanburra Channel and associated dunes (26°57'S / 140°11'E).

9 - Cooper Creek Floodplain (8.4.4.1): Low white dune on the western margin of Lake Oolgoopiarie (27°07'S / 139°50'E).

10 - Parallel Dunefields (8.4.4.4): Orange dune dominated by Z. paradoxa 8 km NW of Karawinnie W.H. (27°08'S / 139°42'E).

11 - Cooper Creek Floodplain (8.4.4.1): Samphire flat on the western margin of Coongie Lake (includes nearby dunes) (27°11'S / 140°09'E).

*12- North-eastern Dunefield and Floodplain (8.4.4.6): Derawalkillie W.H. (27°12'S / 140°33'E).

13 - Cooper Creek Floodplain (8.4.4.1):White silty, clay floodout in the SE corner of Tirrawarra Swamp; 68.5 km NW of Innamincka (27°25'S / 140°09'E).

\#14- Cooper Creek Floodplain (8.4.4.1): Grey silty, clay channel edge 2 km SW of Chillimookoo W.H. (27°25'S / 139°58'E).

\#15- Cooper Creek Floodplain (8.4.4.1): White sand floodout adjacent to Tirrawarra W.H.; 65 km NW of Innamincka (27°25'S / 140°10'E).

16 - Cooper Creek Floodplain (8.4.4.1): Consolidated deep white dune dominated by Z. paradoxa SE of Boggy Lake (27°31'S / 139°50'E).

17 - Cooper Creek Floodplain (8.4.4.1): Sand dune adjacent to Bookabourdie W.H. (27°33'S / 140°28'E).

18 - Cooper Creek Floodplain (8.4.4.1): Floodout bordering the channel between Darby's W.H. and Cuttapirie Corner W.H. (27°34'S / 139°52'E).

19 - Cooper Creek Floodplain (8.4.4.1): Orange sand dune on the western edge of Embarka Swamp (27°38'S / 140°07'E).

20 - Cooper Creek Floodplain (8.4.4.1): Scrubby Camp W.H. (27°40'S / 140°25'E).

21 - Cooper Creek Floodplain (8.4.4.1): Orange sand dune 10 km west of Gidgealpa Homestead on the western edge of Embarka Swamp (27°40'S / 140°07'E).

22 - Cooper Creek Floodplain (8.4.4.1): Gently sloping orange sand dunes 15 km WSW of Innamincka near Minkie W.H. (27°47'S / 140°38'E).

#23- Cooper Creek Floodplain (8.4.4.1): Grey silty, clay swamp margin on the southern edge of Embarka Swamp (27°43'S / 140°08'E).

24 - Cooper Creek Floodplain (8.4.4.1): Pale to yellow sand plain 6 km ESE of Scrubby Camp W.H. (north side of the Coongie Rd.) (27°41'S / 140°27'E).

#25- Cooper Creek Floodplain (8.4.4.1): Edge of dry infrequently flooded channel of the Cooper Creek 5 km NE of Pilalchilpna W.H. (SSE of Lake Perigundi) (27°53'S / 139°27'E).

*26- Parallel Dunefields (8.4.4.3): 12 km SSW of Moomba (28°12'S / 140°09'E).

*27- Parallel Dunefields (8.4.4.3): Dunes 8 km south of the centre of Lake Warrakalanna (28°17'S / 139°19'E).

#28- Strzelecki Creek Floodplain (8.4.4.2): Floodout 0.8 km west of Toolache W.H. (28°21'S / 140°25'E).

29 - Parallel Dunefields (8.4.4.3): White sand dune 56 km SSW of Moomba Gas Plant and 11 km SE of Wancoocha #1 Well (28°37'S / 140°03'E).

30 - Strzelecki Creek Floodplain (8.4.4.2): Orange dune east of Mundibarcooloo W.H. (28°40'S / 140°13'E).

(cont'd...N4).

Major Vegetation Types Sampled at the Nine Permanent Sites:

Site 1 - *Astrebla pectinata* open grassland

Site 4 - *Triodia basedowii* hummock grassland with a very open overstorey of *Grevillea stenobotrya* and *Acacia murrayana*

Site 6 - *Triodia basedowii* hummock grassland with an overstorey of *Acacia ligulata* low open shrubland

Site 7 - *Zygochloa paradoxa* hummock grassland

Site 14 - *Eucalyptus microtheca* - *Acacia stenophylla* - *Lysiphyllum gilvum* - *Eucalyptus camaldulensis* open woodland

Site 15 - *Eucalyptus microtheca* ± *E. camaldulensis* open woodland and *Muehlenbeckia cunninghamii* shrubland

Site 23 - *Muehlenbeckia cunninghamii* low shrubland

Site 25 - *Eucalyptus microtheca* - *Acacia stenophylla* open woodland

Site 28 - *Atriplex nummularia* low open shrubland

Details of Aerial Photographs Covering Survey Sites:

Site	Survey	Photo No.	1:250 000 Sheet	Date	Scale	Altitude
1	2779	18	Cordillo	1 xii 81	1:87 000	7250 m
2	2779	62	Cordillo	1 xii 81	1:87 000	7250 m
3	2779	112	Cordillo	2 xii 81	1:87 000	7270 m
4	2779	98	Cordillo	2 xii 81	1:87 000	7270 m
5	2779	102	Cordillo	2 xii 81	1:87 000	7270 m
6	2451	44	Innamincka	28 viii 79	1:88 000	7530 m
7	2779	74	Cordillo	2 xii 81	1:87 000	7270 m
7A	2451	94	Innamincka	28 viii 79	1:88 000	7530 m
8	2451	104	Innamincka	28 viii 79	1:88 000	7530 m
8A & 8A'	2779	62	Cordillo	2 xii 81	1:87 000	7270 m
9	2451	48	Innamincka	28 viii 79	1:88 000	7530 m
10	2451	44	Innamincka	28 viii 79	1:88 000	7530 m
11	2451	56	Innamincka	28 viii 79	1:88 000	7530 m
12	2451	64	Innamincka	28 viii 79	1:88 000	7530 m
13	2451	72	Innamincka	28 viii 79	1:88 000	7530 m
14	2451	76	Innamincka	28 viii 79	1:88 000	7530 m
15	2451	72	Innamincka	28 viii 79	1:88 000	7530 m
16	2466	73	Innamincka	15 x 79	1:88 400	7560 m
17	2466	57	Innamincka	15 x 79	1:88 400	7560 m
18	2466	73	Innamincka	15 x 79	1:88 400	7560 m
19	2466	18	Innamincka	15 x 79	1:88 400	7560 m
20	2466	26	Innamincka	15 x 79	1:88 400	7560 m
21	2466	18	Innamincka	15 x 79	1:88 400	7560 m
22	2466	113	Innamincka	15 x 79	1:88 400	7560 m
23	2466	18	Innamincka	15 x 79	1:88 400	7560 m
24	2466	26	Innamincka	15 x 79	1:88 400	7560 m
25	2473	52	Gason	24 x 79	1:88 000	7530 m
26	2552	70	Strzelecki	1 iv 80	1:88 750	7590 m
27	2566	50	Kopperamanna	1 v 80	1:88 750	7590 m
28	2548	66	Strzelecki	28 iii 80	1:88 750	7590 m
29	2548	30	Strzelecki	28 iii 80	1:88 750	7590 m
30	2548	100	Strzelecki	27 iii 80	1:88 750	7590 m

Appendix O

APPENDIX O - Preliminary list of fauna specimens collected during the present survey; mostly derived from data sheet entries.

1113		*Lerista*
1114		*Ctenotus laeve*
1150	♂	*Oreoica guttaralis*
1151	♂	*Cacatua roseicapilla*
1152	♀	*Cacatua roseicapilla*
1153	♂	*Colluricincla harmonica*
1154	♂	*Falco berifora*
115-4		*Psephotus haematonotus*
115-5		*Psephotus haematonotus*
1155	♂ Pair	*Psephotus haematonotus*
1156	♀	*Psephotus haematonotus*
1157	♀	*Psephotus haematonotus*
1158	♀	*Geopelia cuneata*
1159	♀	*Corvus coronoides*
1160	♀	*Ocyphaps lophotes*
1161	♀	*Peltohyas australis*
1162	♂	*Amytornis goyderi*
1163	♀	*Amytornis goyderi*
1164	♂	*Recurvirostra novae-hollandiae*
1165	♂	*Dendrocygna eytoni*
1166	♂	*Hydroprogne caspia*
1167	♂	*Pomatostomus ruficeps*
1168	♂	*Geopelia*
1169		*Litoria latopalmata*
1170		*Ranidella deserticola*
1171		*Peltohyas australis*
1172	♀	*Ocyphaps lophotes*
1173		*Ocyphaps lophotes*
1174	♂	*Northiella haematogaster*
1175	juv.	*Pomatostomus ruficeps*
1176	juv.	*Pomatostomus ruficeps*
1177		*Climacterus picumnus*
1178		*Psephotus haematonotus*
1179		*Mirafra javanica*
1180		*Amytornis goyderi*
1181		*Mirafra javanica*
1182		*Ashbyia lovensis*
1183		*Mirafra javanica*
1184		*Charadrius*
1185		*Charadrius*
1186		*Tribonyx*
1187		*Cacatua sanginea*
1188		*Corvus coronoides*
1189		*Climacterus picumus*
1190		*Barnardius barnardii*
1191		*Pomatostomus ruficeps*
1192		*Malurus lamberti*
1200		*Sminthopsis macroura*
1201		*Eremiascincus fasciolatus*
1202		*Eremiascincus fasciolatus*
1203		*Amphibolurus pictus*
1204		*Lucasium damaeum*
1205		*Amphibolurus pictus*
1206		*Gehyra*
1207		*Amphibolurus pictus*

1208 Skink (?*Leiolopisma*)
1209 *Morethia*
1210 *Ctenotus schomburgkii*
1211 *Lerista*
1212 *Lucasium damaeum*
1213 *Morethia boulengeri*
1215 *Lucasium damaeum*
1216 *Varanus gouldii*
1217 Ticks from 1216
1218 *Eremiascincus fasciolatus*
1219 *Lerista labialis*
1220 *Amphibolurus vitticeps*
1221 *Menetia*
1222 *Lucasium damaeum*
1223 *Rhynchoedura*
1224 *Nephrurus*
1225 *Heteronotia*
1226 *Ctenotus*
1227 *Gehyra*
1228 *Rhynchoedura*
1229 *Planigale*
1230 *Nephrurus*
1231 *Lucasium*
1232 *Diplodactylus ciliaris*
1233 *Mus musculus*
1234 *Mus musculus*
1235 *Mus musculus*
1236 ?*Diplodactylus conspicillatus*
1237 ?*Diplodactylus conspicillatus*
1238 *Diplodactylus conspicillatus*
1239 *Amphibolurus pictus*
1240 Skink
1241 Skink
1242 Skink
1243 *Ctenotus*
1244 Skink (?*Ctenotus*)
1245 Skink (?*Leiolopisma*)
1246 *Mus musculus*
1247 *Rhynchoedura*
1248 *Rhynchoedura*
1249 *Planigale*
1250 *Morethia*
1251 *Heteronotia*
1252 *Morethia*
1253 *Morethia*
1254 *Gehyra*
1255 *Diplodactylus tessalatus*
1256 *Lerista labialis*
1257 *Lerista labialis*
1258 *Lerista labialis*
1259 *Lerista labialis*
1260 *Heteronotia*
1261 *Sus scrofa* (pig jaw)
1262 *Felis cattus* (skull)
1263 *Amphibolurus vitticeps*
1264 *Amphibolurus vitticeps*
1264' *Vulpes vulpes* (fox skull)
1265 *Menetia*
1266 *Morethia adelaidensis*

1267	*Nephrurus*
1268	*Eremiascincus fasciolatus*
1268'	*Canis familiaris* (skull)
1269	?*Heteronotia*
1270	*Heteronotia binoei*
1271	*Gehyra*
1272	*Gehyra*
1273	*Gehyra*
1274	*Sminthopsis crassicaudata*
1275	*Heteronotia*
1276	*Heteronotia*
1277	*Diplodactylus tessalatus*
1278	*Diplodactylus tessalatus*
1279	*Heteronotia*
1280	*Heteronotia*
1281	*Sminthopsis crassicaudata*
1282	*Eremiascincus fasciolatus*
1283	*Eremiascincus fasciolatus*
1285	*Vulpes vulpes* (lower jaw)
1288	*Varanus gouldii*
1289	*Ctenotus*
1289'	*Ctenotus*
1290	*Ctenotus*
1290'	Diplodactylus *tessalatus*
1291	*Mus musculus*
1292	Phyllurus
1293	*Diplodactylus stenodactylus*
1294	*Diplodactylus stenodactylus*
1300	*Mus musculus*
1301	*Eremiascincus fasciolatus*
1302	*Eremiascincus fasciolatus*
1303	*Diporiphora*
1304	*Cryptoblephorus plagiocephalus*
1304'	*Ctenotus brooksii*
1306	*Nephrurus laevis*
1307	*Eremiascincus fasciolatus*
1308	*Eremiascincus fasciolatus*
1309	*Eptisecus sp.*
1310	*Nyctophilus geoffreyi*
1311	*Eptisecus sp.*
1312	*Lucasium damaeum*
1313	*Gehyra variegata*
1314	*Heteronotia binoei*
1315	*Rhamphotyphlops*
1331	*Eremiascincus fasciolatus*
1332	*Lucasium damaeum*
1333	*Egernia inornata*
1334	Small dragon *Diporiphora*
1335	*Ctenotus*
1336	*Diporiphora*
1337	*Pseudomys hermannsburgensis*
1338	Gecko
1339	Gecko
1340	Owlet Nightjar (escaped)
1341	Peaceful Dove
1341'	*Eremiascincus fasciolatus*
1342	*Lichenostomus penicillatus*
1343	Little Brown Bat
1344	Little Brown Bat

1345	Legless Lizard / Snake *Delina sp.* *?tincta*
1347	*Sphenomorphus* (=*Eremiascincus*)
1348	*Amphibolurus pictus*
1349	Large tadpole
1350	*Amphibolurus vitticeps*
1351	*Gehyra*
1352	*Ctenotus*
1353	*Ctenotus*
1354	*Pseudomys hermannsburgensis*
1355	*Amphibolurus pictus*
1356	*Eremiascincus fasciolatus*
1357	*Pseudomys hermannsburgensis*
1358	*Pseudomys hermannsburgensis*
1359	*Pseudonaja sp.* (juvenile snake)
1360	*Eremiascincus fasciolatus*
1376	*Mus musculus*
1377	*Sphenomorphus* (=*Eremiascincus*) *fasciolatus*
1378	*Ctenotus*
1379	*Ctenotus*
1381	*Mus musculus*
1382	*Rhynchoedura*
1383	*Nephrurus laevis*
1384	*Amphibolurus pictus*
1385	*Ctenotus brooksii*
1386	*Ctenotus brooksii*
1387	*Morethia sp.*
1388	*Nephrurus*
1391	Rat Skull (? Long Haired Rat)
1392	Myall Snake
1393	?*Sminthopsis*
1398	Gecko
1399	Gecko
1400	Skink ?*Ctenotus*
1401	Sandswimmer (=*Eremiascincus fasciolatus*)
1402	Sandswimmer
1403	Gecko
1404	Gecko
1405	Gecko
1406	*Ctenotus sp.*
1407	*Pseudomys hermannsburgensis*
1408	*Ctenotus sp.*
1411	Gecko
1412	Gecko
1413	*Sphenomorphus*
1414	Gecko
1421	Gecko
1422	Gecko
1423	Skink
1424	*Eremiascincus fasciolatus*
1425	Gecko
1426	Gecko
1427	Skink
1428	Australian Raven *Corvus coronoides*
1430	Knob-tailed Gecko
1433	Gecko
1433'	Gecko
1434	*Lerista*
1434'	Skink #1
1434"	Skink #2
1434"'	Geckoes (2)

1435	Lucasium damaeum
1436	Diplodactylus ?stenodactylus
1437	Eremiascincus fasciolatus
1437'	Pseudomys hermannsburgensis
1438	Eremiascincus fasciolatus
1440	Mus musculus
1441	Snake (lost)
1442	Underwoodisaurus
1444	Lerista
1445	Heteronotia binoei
1446	Leggadina forresti (to Bill Breed)
1447	Sminthopsis crassicaudata (to Chris Watts)
1448	Amphibolurus nuchalis
1449	Gehyra variegata
1450	Heteronotia binoei
1451	Rhynchoedura
1452	Heteronotia
1453	Lerista labialis
1454	Eremiascincus fasciolatus
1455	Lerista labialis
1456	Rhynchoedura
1483	Pseudomys hermannsburgensis
1483'	Sminthopsis macroura
1484	Leggadina forresti
1486	Pseudomys hermannsburgensis
1487	Pseudomys hermannsburgensis
1488	Pseudomys hermannsburgensis
1489	Pseudomys hermannsburgensis
1491	Pseudomys hermannsburgensis
1492	Sminthopsis macroura
1493	Mus musculus
1494	Mus musculus
1495	Mus musculus
1496	Mus musculus
1497	Leggadina forresti
1498	Pseudomys hermannsburgensis
1499	♀ Pseudomys hermannsburgensis
1500	Dasyuroides byrnei
1501	Cyclorana platycephalus
1502	Rhynchoedura ornata
1503	Ctenotus
1504	Diplodactylus
1505	Diplodactylus
1506	Diplodactylus
1507	Ctenotus
1508	Rhynchoedura ornata
1509	Neobatrachus
1510	Gehyra variegata
1511	Amphibolurus nuchalis
1512	Diporiphora
1513	Nephrurus laevis
1514	Rhynchoedura ornata
1515	Eremiascincus fasciolatus
1516	Eremiascincus fasciolatus
1517	Eremiascincus fasciolatus
1518	Lerista labialis
1519	Neobatrachus
1519'	Lerista labialis
1520	Pseudomys hermannsburgensis

1521 *Pseudomys hermannsburgensis*
1522 *Eremiascincus fasciolatus*
1523 *Diplodactylus ciliaris*
1524 *Typhlina*
1525 *Pseudechis australis*
1526 *Lerista labialis*
1527 *Lerista labialis*
1528 *Menetia*
1529 *Lialis bicitanis*
1531 *Ctenotus sp.*
1532 *Morethia*
1533 Skink
1534 Skink
1535 *Menetia*
1536 *Ctenotus*
1537 *Ctenotus*
1538 *Sminthopsis crassicaudata*
1539 *Sminthopsis crassicaudata*
1540 *Eremiascincus fasciolatus*
1541 *Diplodactylus stenodactylus*
1542 *Eremiascincus fasciolatus*
1543 ♀*Sminthopsis crassicaudata*

Site 1 (No number - N.N.)

N.N. *Notomys cervinus*
N.N. *Notomys cervinus*

Site 8A (No number - N.N.)

N.N. *Ctenotus brooksii*
N.N. *Ctenotus brooksii*
N.N. *Ctenotus sp.?cf. piamiai*
N.N. *Eremiascincus fasciolatus*
N.N. *Eremiascincus fasciolatus*
N.N. *Ctenotus brooksii*
N.N. *Diporiphora winneckeri*
N.N. *Amphibolurus pictus*
N.N. *Eremiascincus fasciolatus*
N.N. *Ctenotus brooksii*
N.N. *Ctenotus sp.* (similar to *C. robustus* or *C. saxatilis*)
N.N. *Ctenotus sp.* (similar to *C. robustus* of *C. saxatilis*)

Site 21 (No number - N.N.)

N.N. *Eremiascincus fasciolatus*
N.N. *Eremiascincus fasciolatus*
N.N. *Eremiascincus fasciolatus*
N.N. *Nephrurus laevis*

Site 24 (No number - N.N.)

N.N. *Ctenotus*
N.N. *Gehyra*
N.N. *Rhynchoedura*
N.N. *Lerista*

No number *Pseudomys australis* (to Bill Breed).

Additional Note: *Litoria caerulea* in Embarka W.H. (Lawrie O'toole, Pers. comm.).

Appendix P

Appendix P - Numerical Results (i.e. censusing data)

Censusing data on 79 species are presented in two tables for sites 1, 4, 6, 14, 23, 25 (two landforms censused : 25 and 25') and 28.

In Table 1 the following information is presented

- the number of five minute counts that were conducted at each site.
- the number of species that were recorded while conducting the five minute counts at each site.
- the number of species recorded while conducting the census, and the figure includes observations made while travelling between five minute census-points at each site.
- the total number of individuals (summed for all species) that were recorded within 50 metres of the observer during five minute counts at each site.
- the total number of individuals that were recorded within 100 metres (the first unbracketed figure), and the total number of individuals recorded at any distance (the second bracketed figure) from the observer during five minute counts at each site. These two figures and the previous figure (number of individuals within 50 metres) have been standardised to offset the effect of different sampling effort at sites where a number other than 20 five minute counts were made (i.e. sites 4, 14, 23, 25 and 25').

In Table 2 the 79 species are presented with the numerical data arranged in five rows (a, b, c, d, e) per species for each site

- a "√" in row a indicates that this species was recorded while conducting a census but only between five minute counts. If numbers appear in row a the first (unbracketed) number indicates the number of individuals of that species which were recorded within 50 metres of the observer during the five minute counts, while the bracketed number is the total number of individuals that were recorded within 100 metres of the observer (i.e. including the number seen within 50 metres as well) during the five minute counts.
- in row b the total number of individuals of that species that were recorded (at any distance) during the five minute counts is presented.
- in row c the number of five minute counts in which that species was recorded is indicated. This indicated how regularly the species was encountered in the course of the census exercise.
- in row d a density estimate is given for all species that were recorded within 50 metres of the observer and based on figures for a 50 metre radius around the observer.
- in row e a density estimate based on the average of the row d estimate and the 100 metre radius estimate is presented if the resulting estimate is greater than or equal to 0.10 birds per hectare.

SITE	1	4	6	14	23	25	25′	28
No. of counts conducted	20	18	20	17	15	26	17	20
No. of spp. during counts	23	25	14	34	33	28	27	31
No. of spp. during census period	23	32	16	39	37	28	27	31
No. of individuals within 50 metres	10	112	34	161	141	88	47	191
No. individuals within 100m (& any distance)	22 (213)	181 (302)	69 (103)	325 (476)	284 (411)	205 (388)	175 (439)	290 (325)

SPECIES \ SITE	1	4	6	14	23	25	25′	28
Dromaius novaehollandiae				✓ O				
Platalea flavipes					1 (3) 4 4 ·08			
Anas superciliosa					1 (1) 1 1 ·08			
Anas gibberifrons				✓ O	13 (13) 15 3 1·10 ·69			
Anas rhyncotis					✓ O			
Malacorhynchus membranaceus					5 (6) 10 9 ·42 ·28			
Chenonetta jubata				O (3) 4 4				

a
b
c
d
e

SPECIES \ SITE	1	4	6	14	23	25	25′	28
Milvus migrans			6(7) 21 6 ·38 ·25	0(3) 6 6	0(1) 10 7	1(2) 3 3 ·05		1(6) 9 7 ·06
Hamirostra melanosternon								2(6) 6 4 ·13 ·12
Haliaster sphenurus				2(5) 5 5 ·15 ·12	0(1) 3 3			
Aquila audax				2(3) 3 2 ·15 ·11	✓ 0	0(1) 2 2	0 1 1	
Hieraaetus morphnoides				0 1 1	0 1 1			1(1) 1 1 ·06
Circus aeruginosus					✓ 0			
Falco berigora		2(2) 3 3 ·14	2(2) 3 3 ·13		0 1 1			
Falco cenchroides	0 2 2	0 1 1	0(1) 1 1			0 1 1	0 2 2	
Porzana fluminea					7(22) 22 11 ·59 ·53			
Gallinula ventralis				0(1) 1 1	12(4) 42 14 1·02 ·95			
Porphyrio porphyrio					0(1) 1 1			
Grus rubicundus	0 7 3	0 4 2						
Erythrogonys cinctus					4(4) 4 2 ·34 ·21			

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SPECIES \ SITE	1	4	6	14	23	25	25′	28
Charadrius melanops				✓ 0				
Gallinago hardwickii					0(4) 4 1			
Stiltia isabella	1(2) 17 13 ·06				4(4) 9 4 ·34 ·21			
Larus novaehollandiae	0(1) 3 3							
Chlidonias hybrida	3(3) 3 1 ·19 ·12							
Gelochelidon nilotica					0 3 1			
Hydroprogne caspia					✓ 0			
Geopelia striata		0 1 1		1(6) 22 13 ·07		14(27) 66 19 ·69 ·51		
Geopelia cuneata		2(3) 4 3 ·14 ·10		0 1 1		3(3) 5 3 ·15 ·10	0(1) 2 2	
Ocyphaps lophotes	0 8 4	0(3) 3 3	0(1) 1 1	2(8) 13 10 ·15 ·15	7(13) 14 9 ·59 ·44	43(85) 124 20 2·10 1·57	7(4) 110 9 ·52 ·65	14(21) 24 13 ·89 ·71
Cacatua roseicapilla	0 45 9	5(6) 16 5 ·35 ·23		10(16) 25 9 ·75 ·53		2(7) 16 9 ·10 ·10	0 4 2	29(43) 49 17 1·85 1·27
Cacatua pastinator		0(1) 7 3		2(7) 20 8 ·15 ·14	3(3) 3 1 ·25 ·16	0 28 7	0 11 3	6(8) 8 1 ·38 ·26
Melopsittacus undulatus	1(1) 30 10 ·06	3(5) 15 5 ·21 ·15	8(8) 8 1 ·50 ·32	0 1 1	5(5) 5 1 ·42 ·27			

SPECIES \ SITE	1	4	6	14	23	25	25′	28
Psephotus haematonotus				7(28) 39 13 ·52 ·52		1(2) 2 2 ·05		4(4) 4 2 ·25 ·16
Northiella haematogaster				2(2) 2 1 ·15 ·10		0 10 5	0(2) 3 3	0(1) 1 1
Chrysococcyx basalis		2(2) 2 1 ·14		0 1 1	0 1 1			
Aegotheles cristatus						2(2) 4 4 ·10	0(1) 1 1	
Halcyon pyrrhopygia			0(1) 2 2					3(5) 7 6 ·19 ·14
Merops ornatus	0 2 2	1(2) 3 3 ·07		0 1 1	1(1) 2 2 ·08		0(1) 2 2	10(17) 20 15 ·64 ·46
Mirafra javanica	1(1) 1 1 ·06							
Cheramoeca leucosternum	3(5) 9 6 ·19 ·14	3(5) 7 5 ·21 ·15	0(2) 2 1					5(5) 5 2 ·32 ·20
Cecropsis nigricans				7(11) 15 10 ·52 ·37	9(9) 9 3 ·76 ·48	6(8) 8 8 ·29 ·20	3(3) 3 2 ·22 ·14	17(19) 19 11 1·08 ·69
Cecropsis ariel	0 1 1	8(8) 40 9 ·57 ·36		42(42) 62 7 3·15 1·97				7(7) 7 3 ·45 ·28
Anthus novaeseelandiae	0 3 3	✓ 0			0(2) 2 1		0(1) 1 1	
Coracina novaehollandiae				✓ 0				2(2) 2 2 ·13
Lalage sueurii		✓ 0	✓ 0			0(1) 1 1		5(12) 13 8

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SPECIES \ SITE	1	4	6	14	23	25	25′	28
Colluricincla harmonica				4 (15) 26 16 ·30 ·29		0 5 4	0 1 1	
Oreoica gutturalis						0 4 2	0 7 4	
Myiagra inquieta				0 (1) 1 1				
Rhipidura leucophrys		0 (1) 1 1		1 (7) 8 7 ·07 ·10		0 (10) 25 20	0 (9) 19 12	16 (26) 26 15 1·02 ·72
Psophodes cristatus				1 (1) 3 3 ·07	0 (3) 13 8	0 (11) 28 15	2 (3) 23 12 ·15 ·11	0 (4) 6 6
Cinclosoma cinnamoneum	0 (2) 3 2							
Pomatostomus ruficeps						3 (3) 4 2 ·15 ·10	0 4 4	5 (11) 12 7 ·32 ·25
Acrocephalus stentoreus					4 (17) 37 10 ·34 ·35			
Megalurus gramineus					3 (15) 29 15 ·25 ·29			
Cinclorhamphus cruralis					0 (1) 3 3			
Malurus lamberti		6 (15) 16 7 ·42 ·35	8 (8) 8 2 ·50 ·32	✓ 0	4 (6) 6 3 ·34 ·24	3 (5) 5 2 ·15 ·11	3 (6) 6 4 ·22 ·17	
Malurus leuconotus	0 9 4	3 (6) 8 4 ·21 ·16	6 (7) 7 3 ·38 ·25		5 (9) 9 5 ·42 ·31		4 (5) 5 2 ·30 ·20	
Amytornis goyderi	0 3 2	✓ 0						

SPECIES / SITE	1	4	6	14	23	25	25′	28
Acanthiza uropygialis								4(4) 4 2 ·25 ·16
Aphelocephala leucopsis								0(2) 2 1
Aphelocephala nigricincta			√ 0					
Climacteris picumnus				11(19) 21 14 ·82 ·59				
Manorina flavigula		0 7 3		2(5) 7 5 ·15 ·12		0(3) 6 6	0(5) 16 7	6(8) 9 8 ·38 ·26
Acanthagenys rufogularis				0(6) 6 4				
Lichenostomus virescens		1(1) 2 2 ·07	1(3) 10 7 ·06					
Lichenostomus penicillatus		0 2 2		9(26) 39 14 ·67 ·58		31(82) 113 23 1·52 1·26	15(61) 94 17 1·12 1·13	18(28) 28 15 1·15 ·80
Ephthianura tricolor		2(2) 2 1 ·14					5(6) 6 2 ·37 ·24	
Ephthianura aurifrons					6(9) 10 5 ·51 ·35			
Ashbyia lovensis	0(1) 1 1							
Pardalotus rubricatus		0(1) 1 1		2(7) 7 6 ·15 ·14		0(1) 7 5	0 6 6 ·19 ·17	3(9) 10 9
Poephila guttata	1(1) 43 8 ·06	62(96) 109 14 4·39 3·05	0(16) 17 3 0 ·13	2(2) 2 1 ·15 ·10	12(17) 17 8 1·02 ·69			3(3) 3 3 ·19 ·12

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SPECIES \ SITE	1	4	6	14	23	25	25′	28
Grallina cyanoleuca	0 6 2	0 3 2		2(16) 21 14 ·15 ·28	1(1) 1 1 ·08	0 1 1		2(7) 8 6 ·13 ·12
Artamus leucorhynchus		1(1) 2 2 ·07		6(8) 8 6 ·45 ·30		3(8) 8 6 ·15 ·13		7(11) 13 9 ·45 ·32
Artamus personatus	0 2 1	✓ 0		20(20) 20 1 1·50 ·94				
Artamus cinereus		0(3) 9 6	2(7) 8 4 ·13 ·12	2(2) 4 2 ·15 ·10		3(5) 5 5 ·15 ·11	1(4) 7 3 ·07	12(16) 19 10 ·76 ·51
Gymnorhina tibicen	0 9 6	✓ 0	0 5 2	0 1 1		0 5 5	0 6 3	0 1 1
Corvus coronoides		0(1) 4 2		0(6) 11 9	0(7) 17 7	0(1) 14 12	0 24 8	1(1) 4 4 ·06
Corvus bennetti	0(5) 10 5	✓ 0	1(2) 10 6 ·06		0 1 1	0 5 5	0 9 4	3(3) 5 5 ·19 ·12

Notes Relating to Appendix P

Details of habitat description and times when censuses were conducted at the seven permanent sites surveyed by the Consultants.

Site 1 - Censusing was conducted on an area of gibber some four square kilometres to the north of the permanent peg. Largely devoid of woody vegetation, clay lenses and other small pockets carried up to 40% herbaceous cover, while most of the gibber was practically bare. Several counts were made alongside a large lone dune (Zygochloa and Triodia dominated).

1 XI 83 : 10 counts were made between 0800 and 0940*
2 XI 83 : " " " " " 0620 and 0750*

Site 4 - Mudcarnie Creek (irregularly arranged large dunes). Dunes were censused over an area of some five square kilometres to the east and south-west of the permanent peg, and the principal plant species were Zygochloa and Triodia. Scattered emergent shrubs and tall shrubs included Grevillea stenebotrya, Atalaya hemiglauca, several species of wattle, Cassia nemophila and Owenia acidula. Between the dominant grasses, there was a moderate cover of senescent ephemeral species, e.g. Crotalaria spp. and see Section 4.3.3.1.2.

5 XI 83 : 10 counts were made between 0700 and 0910*
6 XI 83 : 8 " " " " 0630 and 0820*

Site 6 - North-western Dunefields (parallel lines of uniform dunes). Censusing was conducted in the first three dunes to the east of camp between c 1.5 km north and 1.0 km south of the camp. The dominant plant on the dunes was Zygochloa (≤ 30% cover), and there were sparsely scattered wattles and a moderate amount of small ephemerals.

27 X 83 : 10 counts were made between 0630 and 0810
28 X 83 : " " " " " 0630 and 0840

Site 14 - Chillimookoo W.H. L. Pedler conducted counts along the northern margin of the Cooper (a full well defined waterhole) between the camp and c 2.0 km to the ENE, where shotline MGJ '82 meets the Cooper. A discontinuous line of River Red Gums grew along the bank with a dense strip of smaller coolibah over patches of lignum and wattles. Away from the bank, the open coolibah woodland contained scattered Grevillea striata, Atalaya hemiglauca, Acacia salicina and A. stenophylla.

26 IX 83 : 11 counts were made between 0700 and 0850
27 IX 83 : 6 " " " " 0650 and 0750

Site 23 - Embarka Swamp. Counts were conducted around the permanent peg in flooded lignum on the south-western margin of the swamp. The habitat was fairly uniform with water covering c one half the ground to a maximum depth of 50 cm.

23 IX 83 : 11 counts were made between 0740 and 1020
25 IX 83 : 4 " " " " 0720 and 0800 (by L. P. Pedler)

Site 25 - SSE of Lake Perigundi. The censuses were conducted along the Cooper from the permanent peg to c 3.0 km south. the definition of the Cooper's channel(s) and associated vegetation varied considerably along this 3.0 km stretch, as is typical of the lower Cooper. Near the peg on the edge of a well defined W.H., the Cooper consisted of a single well defined channel. Coolibahs lined the channel (up to 30% cover), with Acacia stenophylla and lignum also present. Further south, the Cooper lost its clear definition as it entered a floodout - a wide network of small shallow channels. Coolibahs became scattered of formed isolated groves, the occurrence of coolibah also became patchy and clumped, while lignum became the dominant plant. There were some areas fairly devoid of vegetation.

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* central standard time

18 IX 83 : 14 counts were made between 0700 and 0900
19 IX 83 : 12 " " " " 0640 and 0820

A second set of censuses was carried out in a north-south direction c 1.5 km west of the Cooper in floodplain habitat; there was generally less vegetation and the coolibahs were more scattered.

18 IX 83 : 10 counts were made between 0920 and 1045
19 IX 83 : 12 " " " " 0700 and 0815

Site 28 - Toolache W.H. L. Pedler conducted counts along the northern edge of Strzelecki Creek between the camp and c 2.0 km to the west. The habitat was fairly uniform, consisting of open coolibah woodland (≤ 20% cover) with an open shrub stratum of *Atriplex nummularia* (≤ 10% cover) and a small amount of low herbage and litter.

29 IX 83 : 14 counts were made between 0700 and 0930
30 IX 83 : 6 " " " " 0700 and 0800

Notes on the Point-Census Technique

It is recorded on the census sheet whether individuals, that are recorded at 60s and subsequent minute intervals, have previously been recorded in that five minute census period. For birds, that fly straight through the sampled area during the five minute period, their presence is recorded once at the distance that they passed closest to the observer.

All individuals noticed at any distance in each censusing period are recorded. As well, species of birds noticed while moving between census points are recorded on the census sheets.

Although the total number of individuals recorded within 50 m of the observer are standardised between sites, other figures are not directly comparable in their current form (as some are based on a different number of counts performed per site).

Density estimates are given for the more common species recorded while censusing, and these figures are directly comparable between sites.

In hindsight, it is worth noting that the point censusing technique is not optimally efficient for censusing bird populations in desert landscapes where the vegetation consists of low shrublands and grasslands - in such habitats, birds tend to retreat to distances greater than 50 m from the observer. Under such conditions transect counts would be more effective, because birds are counted as they are first encountered (often flushed, which does not occur with point censusing), and more birds are encountered per unit time investment which is an advantage in land systems that support a low density population. Nevertheless, the point census technique was satisfactory in woodland habitats , and the data gained for more open habitats (dunefield and gibber) are amenable to future comparisons. The analysis of the data shows that the bird communities censused in different habitats are quite distinctive.

Appendix Q

Appendix Q

A complete list of birds observed in the vicinity (approximately within 10 km) of the 9 permanent sites and some other sites is presented in the following table. A qualitative assessment of the abundance of species encountered at the seven permanent sites surveyed by the consultants is also made –:
1. low numbers,
2. moderate numbers,
3. moderately high numbers,
4. large numbers.

Also
* denotes a breeding record,
? denotes a dubious or uncertain record,
ev. denotes evidence detected of a species former presence.

SITES	1	4	6	7 7A	8 11	9 10	12	13 15	14	16 18	19 21 23	20 24	25	28	29	30
N° SPECIES PER SITE	45	43	26	20	54	29	24	47	61	29	86	55	65	51	7	24
Emu	1.	1.	1.	✓			✓	✓	1.		1.	✓	1.	1.	✓	
Hoary-headed Grebe											3.*					
Australasian Grebe											1.					
Australian Pelican					✓			✓			1.	✓	1.			
Great Cormorant											1.					
Little Pied Cormorant											1.					
Pacific Heron					✓			✓					1.			
White-faced Heron		1.			✓				1.		2.	✓	2.	1.		
Great Egret					✓						1.					
Rufous Night Heron								✓								
Glossy Ibis											1.					
Royal Spoonbill					✓								1.			
Yellow-billed Spoonbill					✓			✓		✓	2.*		1.			
Plumed Whistling-Duck					✓						1.					
Black Swan					✓						2.		1.			
Pacific Black Duck					✓			✓		✓	3*	✓	2.			
Grey Teal		1.			✓				1*	✓	4*		3.			
Chestnut Teal										✓						
Australasian Shoveler											1.					
Pink-eared Duck					✓				1.	✓	4.*		1.			
Hardhead	1.										3*		1.			
Maned Duck	1.							✓	1.		1.	✓	2.			
Blue-billed Duck											?					
Musk Duck									1.		1.					
Letter-winged Kite						ev.										
Black Kite	2.	3.	3.	✓	✓	✓	✓	✓*	3.	✓	4.	✓	3.	3.	✓	✓
Square-tailed Kite								?								
Black-breasted Buzzard						✓*			1.				1	1*		
Whistling Kite	1.		1.		✓			✓	2.		3.	✓	1.	1.		

Q2

SITES	1	4	6	7 7A	8 11	9 10	12	13 15	14	16 18	19 21 23	20 24	25	28	29	30
Wedge-tailed Eagle	1.		1.	✓	✓				1.		1	✓	2.	1.		
Little Eagle		1.*			✓			✓	1.		1.	✓	1.	1.		
Spotted Harrier													1.			
Marsh Harrier					✓						1.					
Black Falcon						✓						✓		1.		
Australian Hobby					✓							✓				
Grey Falcon										✓						✓
Brown Falcon	1.	2.	2.		✓*	✓	✓	✓			1.	✓	2.	2.		
Australian Kestrel	2.	2.	1.			✓	✓	1.				✓	2.	1.		
Australasian Crake											4.					
Black-tailed Native-hen		2.		✓	✓		✓		1.	✓	4.	✓				
Dusky Moorhen											1.					
Purple Swamphen					✓						2.					
Eurasian Coot											1.					
Brolga	1.	1.									1.					
Masked Lapwing											3.*		1.			
Banded Lapwing											2.					
Red-kneed Dotterel											2.					
Red-capped Plover											3.*					
Black-fronted Plover		1.			✓				2.	✓						
Inland Dotterel	1.								1.					1*		
Black-winged Stilt									1.		2.					
Red-necked Avocet											4.*					
Greenshank											1.		1.			
Latham's Snipe											1.					
Australian Pratincole	3.	1.			✓		✓				2.*		2.			
Silver Gull	1.										3.					
Whiskered Tern	1.							✓								
Gull-billed Tern	1.										3.		2.			
Caspian Tern					✓				1.		3.		1.			
Peaceful Dove		1.				✓	✓		4.	✓	2.		4.			
Diamond Dove	2.	3.		✓	✓		✓	✓	4.		2.	✓	3.	1.		✓
Flock Bronzewing																
Crested Pigeon	3.	2.	2.	✓	✓	✓	✓	✓	4.*	✓	4.	✓	4.	4.	✓	✓
Galah	3.	3.	2.	✓	✓	✓	✓	✓	4.*	✓	4.	✓	4.	4.*		✓
Little Corella		4.			✓	✓	✓		4.*	✓	3.	✓	4.	3.		✓
Cockatiel					✓											
Budgerigah	3.	3.	2.	✓	✓	✓	✓		2.		2.	✓	2.	2.		✓
Mallee Ringneck								✓	1.			✓				
Red-rumped Parrot					✓			✓	4.*	✓	2.	✓	3.	3.		✓
Bluebonnet					✓	✓		✓	3.	✓	1.*	✓	4.	2.		
Bourke's Parrot								✓								
Pallid Cuckoo	1.															
Horsefield's Bronze-Cuckoo		1.						✓	1.		2.	✓	2.	1.		
Barking Owl					✓			✓								

SITES	1	4	6	7 7A	8 11	9 10	12	13 15	14	16 18	19 21 23	20 24	25	28	29	30
Barn Owl													ev.			
Tawny Frogmouth									1.		1.			1.		✓
Australian Owlet-nightjar		1.			✓			✓	1.	✓	1.	✓	3.	1.*		✓
Fork-tailed Swift	2.															
Red-backed Kingfisher		1.	2.		✓	✓	✓		1.	✓	1.	✓	1.	3.		✓
Sacred Kingfisher								✓				✓				
Rainbow Bee-eater	1.	2.		✓	✓	✓	✓	✓	2.	✓	2	✓	2.	4.		✓
Singing Bushlark	3.	2.														
White-backed Swallow	3.	3.	2.	✓		✓		✓	1.		2.		2.	2.	✓	
Tree Martin	1.			✓*	✓		✓	✓	4.	✓	4.	✓	3.	3.*		✓
Fairy Martin	1.	3.			✓			✓	4.	✓	3.	✓		3.		✓
Richard's Pipit	3.	2.	2.	✓		✓	✓		1.		3.	✓	2.	2.		
Black-faced Cuckoo-shrike					✓			✓	1.	✓		✓		1.*		
White-winged Triller	1.	2.	1.					✓	1.		1.	✓	2.	3.		
Red-capped Robin												✓				
Rufous Whistler								?								
Grey Shrike-thrush								✓	4.*	✓		✓	3.			
Crested Bellbird									1.			✓	3.			
Restless Flycatcher								✓	1.							
Willie Wagtail		2.	1.	✓	✓	✓*	✓	✓*	3.	✓	1.*	✓	4.	4.*		✓
Chirruping Wedgebill					✓	✓		✓			3.	✓	4.	3.		
Cinnamon Quail-thrush	2.		2.						2.	✓	2.		2.	1.	✓	
Chestnut-crowned Babbler									2.		1.	✓	3.	3.		
Clamorous Reed-Warbler											4.					
Little Grassbird											4.					
Rufous Songlark								✓								
Brown Songlark	1.										2.					
Variegated Fairy-wren	2.	4.	3.		✓	✓		✓	2.		4.	✓	4.	2.		✓
White-winged Fairy-wren	4.	4.	3.		✓		✓		2.	✓	4.	✓	4.	3.	✓	
Eyrean Grasswren	2.	2.	1.										2.			
Chestnut-rumped Thornbill														2.		
Yellow-rumped Thornbill								?								
Southern Whiteface									2.			✓	2.	2.		
Banded Whiteface			1.													
Brown Treecreeper					✓			✓	4		1.	✓				
Spiny-cheecked Honeyeater					✓			✓	3.	✓		✓	2.			
Yellow-throated Miner	2.	2.			✓	✓	✓	✓	3.	✓	2.	✓	4.	3.		✓
Singing Honeyeater	1.	3.	3.						1.		2.	✓	2.			
White-plumed Honeyeater		3.			✓	✓		✓	4.		2.	✓	4.	4.		✓
Criminal Chat	3.	1.				✓			1.		1.		2.	3.		
Orange Chat	1.			✓	✓		✓				2.			1.	✓	
Gibberbird	2.								1.							
Mistletoebird														1.		
Red-browed Pardalote	1.	1.						✓	3.		1.	✓	3.	3.		
Zebra Finch	4.	4.	2.	✓	✓	✓	✓	✓	3.		3.	✓	2.	2.		✓

Q4.

SITES	1	4	6	7 7A	8 11	9 10	12	13 15	14	16 18	19 21 23	20 24	25	28	29	30
Australian Magpie-lark	2.	2.		✓	✓	✓	✓	✓	4.		2.	✓	2.	3.		✓
White-breasted Woodswallow		2.	1.		✓	✓		✓	3.		1.	✓	3.	3.*		✓
Masked Woodswallow	3.	1.	1.				✓	?	2.		1.		2.	1.		✓
White-browed Woodswallow									1.							
Black-faced Woodswallow	3.	4.	3.	✓	✓	✓		✓	3.	✓	3.*	✓	4.	4.*		✓
Australian Magpie	1.	1.	2.			✓	✓		2.		2.	✓	3.	2.		
Australian Raven		3.			✓	✓		✓	3.	✓	4.*	✓	4.	3.	✓	✓
Little Crow	2.	2.	2.*	✓		✓					2.*	✓	4.	3.*		

Appendix R

APPENDIX R - ANNOTATED LIST OF PLANT SPECIES ENCOUNTERED IN THE COOPER CREEK ENVIRONMENTAL ASSOCIATION (8.4.4) [1] PREVIOUSLY OR COLLECTED DURING THE PRESENT SURVEY.

Records go back to 1885, but time constraints preclude tracing the progress of all species through the hands of taxonomists since the specimens were collected. Suffice it to say, a lesser degree of confidence should be held in the records of those species collected prior to 1925, even though they are related in published works by workers such as Messrs R. Tate, J.M. Black and J.B. Cleland, except where these records are referred to in more recent works,e.g. Jessop (1982). The older the records, the less confidence should be held in them as many more species are known now than were known in the past.

Jessop (1983) recommended that the recent list of vascular plants of S.A. not be used to update older lists. This list and others like it though provide the only means for such updating apart from checking all original specimens, which would take a considerable time. Only where discrepancies were found to exist have the original specimens been sought or if this has no been possible, a statement that the species may possibly be misidentified is included in its appendix entry.

Time constraints preclude a complete search and documentation of species encountered in the study area since its occupation. Errors may exist in this appendix, but synonyms are included so further checking can be done if the need arises.

An assessment of each species probable present status is included in appendix entries. The following framework was used, viz. the status of a particular species in the Cooper Creek Environmental Association (8.4.4) is assessed in this appendix in the following manner.

very common.........(VC)	- encountered at greater than 10 localities in this survey
common..............(C)	- encountered at 5-10localities in this survey; if at 5 localities, must have been found to have been common in at least one of these localities (based on collection book entries)
fairly common.......(FC)	- encountered at 2-5 localities in this survey; if at 2 localities, must have been found to be common in at least one of these localities
uncommon............(U)	- encountered at 1 or 2 localities in this surve
rare................(R)	- not encountered this survey, but collected since 1924
very rare...........(VR)	- not encountered since 1924, but encountered in that year or previously
very rare if not locally extinct...(VR/E)	- not encountered since last century

[1] It is assumed in this appendix that specimens collected in the 1975 N.C.S. S.A. survey in the Clifton Hills area were encountered in the study area - this may not be the case ; there was insufficient time to check these records. Some of the records in E.R. & P.G. (1980), may also come from outside the study area ; it was not possible to check these.

ACANTHACEAE

Rostellularia pogonanthera. R. pogonanthera (syn. Justica procumbens) was recorded in the study area from around Innamincka and along the Strzelecki Creek last century (Tate, 1889) and near the edge of watercourses in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It is not otherwise known from the study area. Status uncertain - probably very rare.

ADIANTACEAE

Cheilanthes tenuifolia sensu Tate (1889). Rock fern. Recorded from the area of Innamincka last century (Tate, 1889), Black (1943-57) considered C. tenuifolia to occur all over the State, however Jessop (1981,1983) considers that C. tenuifolia does not occur in the NE. There are forms of C. tenuifolia and C. sieberi, which are difficult to distinguish (Jessop, 1981), so Tate's C. tenuifolia may be a misidentified form of C. sieberi, which occurs in the NE. Status uncertain - probably very rare if not locally extinct.

C. vellea sensu Tate (1889). Recorded from around Innamincka last century by Tate (1889), yet Jessop (1981) considers that this species only occurs in the NW of the State and Jessop (1983) is unsure of this. It was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974). Not recorded in the study area since last century. Status uncertain - probably very rare if not locally extinct.

AIZOACEAE

Glinus lotoides. G. lotoides (syn. Mollugo glinus) was collected at Innamincka, along the Strzelecki Creek and along the Cooper Creek last century (Tate, 1889). G. lotoides (syn. Mollugo hirta) was considered uncommon near Innamincka in 1916 (Black, 1917). G. lotoides was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Black,1943-57). Specimens were collected in the Coongie and Clifton Hills area during the 1975 N.C.S.S.A. survey (Jessop, 1982). On clayish soils, often in river beds (Jessop, 1981), specimens were collected during this survey from the edge of Mudcarnie W.H. (near Site 4)and from a floodout of the Cooper Creek overflow west of Cartoonganie W.H. (west of Coongie). Status uncommon.

G. orygioides. G. orygioides (syn. Mollugo orygioides)was reported from along the Cooper Creek last century (Tate, 1889). Considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974)and rare on clayish soils in depressions (Jessop, 1981), it only occurs in the NE of S.A. (Jessop, 1981, 1983) and appears not to have been collected in the study area this century. Status uncertain - probably very rare if not locally extinct.

Gunniopsis quadrifida. G. quadrifida (syn. Aizoon quadrifidum) was reported from along the Strzelecki Creek last century (Tate, 1889) and the sandhills between Cuttapirie Corner and Kanowana in 1916 (Black, 1917). Collected in the Clifton Hills area in 1975 (Jessop, 1982) it is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey it was collected south of Coongie Lake, on a sand dune / floodout interface SSW of Chillimookoo W.H (north of Cuttapirie Corner) and observed on Big Lake Moonba SE of Moomba. Status uncommon.

Mollugo cerviana. Collected in the Clifton Hills area in 1975 (Jessop,1982), it is a species of sandy loams in river beds and was previously only encountered in the NW of the State (Jessop, 1981). Not collected this survey. Status rare.

Trianthema pilosa. A species of sand soils often on dunes(Jessop,1981), it wa collected in the study area from 25 miles south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Not collected here since. Status uncertain - probably very rare.

T. triquetra. Red spinach. T. triquetra (syn. T. crystallina) was collected near Cordillo Downs Homestead and 25 miles south of it in 1924 (Cleland et al., 1925). A widespread species, usually on sandy soils (Jessop, 1981) it was collected in the Clifton Hills area in 1975 (Jessop, 1982). One specimen was collected from a channel edge SW of Chillimookoo W.H. (it was locally common here - SW of Coongie) during the present survey. Status uncommon.

Zaleya galericulata. Hogweed. Z. galericulata (syn. Z. decandra) was recorded from near the Cooper Creek to the east of the study area last century (Tate, 1889). Z. galericulata (syn. Trianthema decandra) was collected in the area of Cordillo Downs Homestead and 25 miles south thereof in 1924 (Cleland et al., 1925). It occurs in a wide range of habitats, but usually in sandy or gravelly soils in the NE and NW of S.A. (Jessop, 1981). The species was collected during the present survey from the Apanburra Channel (north of Coongie). Status uncommon.

AMARANTHACEAE

Alternanthera nodiflora. Common joyweed. A. nodiflora (syn. A. triandra) was recorded from along the Strzelecki Creek last century (Tate, 1889). A. nodiflora was stated to be a common plant - found in or close to water - on the Strzelecki Creek near Innamincka in 1916 (Black, 1917) and may have been collected in the area of Cordillo Downs Homestead (Alternanthera sp.) in 1924 (Cleland et al., 1925). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). The species occupies swamp, relict channel and undulating dune habitats in the vicinity of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed on a gibber plain and in gibber plain gutters SE of Lake Moorayepe, on the channel edges of Mudcarnie and Brady's W.H.s and an adjacent ovoid interdune, on a floodout west of Cartoonganie W.H., in the area of the Appanburra channel, in a channel and on the lake bed of Lake Apachirie, in the vicinity of a channel in Tirrawarra Swamp and in a floodout of the Strzelecki Creek SSW of Merty Merty Homestead (Site 30). Status common.

Amaranthus grandiflorus. Considered to be depleted with a population originally widespread, but now reduced in area and needing constant monitoring in 1974 (Specht et al., 1974), it was thought to be present in the NE of S.A. in Central Australia in 1981 (Jessop, 1981) and is now considered to be much more widespread in S.A. (Jessop, 1983). A specimen was collected during the present survey from an orange parallel dune on the western edge of Embarka Swamp (Site 19). Status uncommon.

A. mitchellii. Chick weed, boggabri. A. mitchellii (syn. Euxolus mitchellii) was recorded from along the Strzelecki Creek and in the area of Innamincka last century (Tate, 1889). A species, which was considered to be depleted with the population originally widespread, but now reduced in area and needing constant monitoring in 1974 (Specht et al., 1974) it has not been recorded in the study area again till the present survey. It was collected from a channel in the NE corner of Lake Apachirie, an orange dunefield NNW of Coongie and a dune near Lake Hope (it was uncommon here). Status fairly common.

Ptilotus atriplicifolius var. atriplicifolius. Silvertails. Recorded in the Clifton Hills area in 1975 (Jessop, 1982) it is included in the Cooper Basin list (E.R. & P.G.,1980). In the present survey it was collected on pale grey sand plains NW of Scrubby Camp W.H. (it was relatively common here) and on pale to yellow sand plains ESE of Scrubby Camp W.H. (Site 24). It is generally found throughout its range on red sand dunes, in loamy sand near creeks and in coarse gravels and it is sometimes locally predominant (Jessop, 1981). Status patchy and fairly common.

P. latifolius. Tangled mulla mulla. Recorded from the Strzelecki Creek last century (Tate, 1889) and reported to be generally distributed on stony tablelands in the area of the Cooper and Strzelecki Creeks in 1916 (Black, 1917), it was collected in sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925).In 1975, it was collected in the Clifton Hills area (Jessop, 1982). It is generally found on dunes and in swales (Jessop, 1981), as was the case for specimens found this survey, on a red dune SE of Lake Moorayepe (it was common here), an orange dune east of Mudcarnie W.H. (Site 4), an orange-red dune near King Lookout (Site 7), a pale sand dune on the western edge of Coongie Lake and red dunes 10 km west of the lake. Status patchy and fairly common in the northern half of the study area - it may no longer occur along the Strzelecki Creek.

P. murrayi. Considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974) it is known in the NE of S.A. from 5 collections in the Clifton Hills area -not recorded prior to 1930 or since 1960 (Jessop, 1982). Apparently extremely localised , in red sandy loam, heavy clay and in shallow watercourse situations (Jessop, 1981), it was not encountered during the present survey. Status uncertain - probably very rare.

P. obovatus var. obovatus. Smokebush, silver bush, silver tails, white foxtail. P. obovatus var. obovatus (syn. Trichinium obovatum) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Further collections were made during the 1975 N.C.S.S.A. survey in the Clifton Hills and Innamincka areas (Jessop, 1982). During the present survey, specimens were collected or the species was observed on a red dune north of Karawinnie W.H. (near Site 6), on a red dune 10 km west of Coongie Lake and on an orange dune 15 km WSW of Innamincka (Site 22). Status patchy and fairly common.

P. polystachus var. polystachus. Fox brush, pussytails. There are two forms recognised, viz. P. polystachus var. polystachus forma polystachus (Long tails, bottle washers, Prince of Wales feather) and P. polystachus var. polystachus forma rubricatus (Red pussytail). P. polystachus (syn. P. alopecuroides) was first recorded in the study area from the area of Innamincka last century (Tate, 1889). P. polystachus (syn. Trichinium alopecuroideum) was found to be common in sandhills around Murteree (=Merty Merty) in 1916 (Black, 1917) and was encountered in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). P. polystachus was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It has recently been found to occupy dunes bordering Embarka Swamp (S.E.A., 1982). During the present survey, the species was collected or observed at 16 localities on orange or red parallel dunes, undulating dunes and sand plains. It may not occur in the SW of the study area and may no longer occur along the Strzeleck

Creek. Both forms of the species were collected with the red pussytail P. polystachus var. polystachus forma rubricatus being represented by one specimen only from the Uncoordinated Drainage Dunefields of the NE part of the study area. Status widespread and very common in most parts, but may have declined in abundance in some areas.

AMARYLLIDACEAE

Calostemma luteum. Wilcannia lily. C. luteum (syn. C. luteolum) was recorded from the Cooper Creek last century (Tate, 1889) and has not been collected in the study area since. It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). Status uncertain - probably very rare if not locally extinct.

Crinum flaccidum. Murray lily, Darling lily. First recorded in the study area from the Cooper and Strzelecki Creeks last century (Tate, 1889), it was collected in the Clifton Hills area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). The species was considered depleted with a population originally widespread, but now reduced in area and needing constant monitoring in 1974 (Specht et al., 1974). In this survey, it was collected from a dune/floodout interface 13 km SSW of Chillimookoo W.H. (it was common here) and observed to be present on an orange dune (Site 4) and ovoid interdune near Mudcarnie W.H., a red dune slope 1 km north of Kernacoopina W.H., undulating dunes north of Chillimookoo W.H., and in interdune and claypan areas along the Strzelecki Creek near Toolache W.H. Status patchy and common.

C. luteolum. C. luteolum (syn. C. pedunculatum) was encountered in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925 - say it was probably C. pedunculatum). Not collected in the study area since. Jessop (1981) excludes it from the NE, but Jessop (1983) is unsure whether it occurs here. Status uncertain - probably very rare, but may have been misidentified.

APIACEAE (UMBELLIFERAE)

Daucus glochidiatus. Australian carrot. D. glochidiatus (syn. D. brachiatus) was first recorded in the study area from along the Strzelecki Creek last century (Tate, 1889). It is included in the Cooper Basin list (E.R. & P.G., 1980) and occupies a range of habitats, such as swamps, lakes, relict channels and channels,in the area of Embarka Swamp (S.E.A., 1982). During the present survey, specimens were collected from the southern end of Queerbidie W.H. near Innamincka (it was common here) and from a floodout west of Toolache W.H., Strzelecki Creek (Site 28 - it was common here). The species was also observed to be present on a gibber plain south of Lake Moorayepe (Site 1) and in an ovoid interdune near Mudcarnie W.H. Status patchy and fairly common.

Eryngium plantagineum. Blue devil. First collected from the study region in the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), the State Herbarium holds one record from the Clifton Hills area, which was collected in 1930 (Jessop, 1982). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). Not collected this survey,it is considered unlikely that the species is still present in the area of Innamincka or along the Strzelecki Creek. Status uncertain - probably very rare.

E. supinum. Reported to occur on flooded ground along the Cooper Creek

(Black, 1943-57), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and there were no records in the State Herbarium (Jessop, 1982), it appears, till the present survey , although the species is included in recent lists for the NE (Jessop, 1981, 1983). One specimen was collected from a channel edge in Tirrawarra Swamp, where it was found to be common, in this survey. Leigh et al. (1981), consider it to be a poorly known species, which was suspected of being threatened or rare and known to have a maximum geographic range of over 100 km in 1981. Status locally common at one locality, which may be its last stronghold in the State - needs adequate protection - status in study area is uncommon overall.

Trachymene glaucifolia. Blue parsnip , wild carrot. T. glaucifolia (syn. Didiscus glaucifolius) was first recorded in the study area from along the Strzelecki Creek last century (Tate, 1889). It was collected in damp sand in the Strzelecki Creek bed near Tinga Tingana early this century (Black, 1917). Reported from the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of the south-western dunes (E.R. & P.G., 1980). During the survey it was observed or collected on an orange dune (Site 4) and red dune crest near Mudcarnie W.H., an orange-red dune near King Lookout (Site 7), a stable orange dune crest (Site 10) and red interdune (Site 6) near Karawinnie W.H., a red dune slope 1 km north of Kernacoopina W.H., undulating dunes north of Chillimookoo W.H., a deep white dune SE of Boggy Lake (Site 16) and an orange dune 15 km WSW of Innamincka (Site 22). Status common.

ASCLEPIADACEAE

Cynanchum floribundum. Pear. This species was recorded in the study area from the Cooper Creek last century (Tate, 1889) and in sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980). The species was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). C. floribundum was observed or collected at a number of localities during the present survey; always associated with dunes. Along the crest of pale mobile dunes west of the Strzelecki Creek and near Site 25, it formed the dominant component of a low open shrubland community. Possibly replaces Zygochloa paradoxa in heavily grazed areas. Status widespread and common - occupies dune areas of more recent deposition.

Rhyncharrhena linearis. The determination of this species from a collection made in parallel dunefields NW of Coongie (Site 8A) appears to be the first record for the study area. It has previously been considered to occur in the NE (Jessop, 1981), but has since been considered not to occur in the region (Jessop, 1983). Status uncertain - probably uncommon.

Sarcostemma australe. Caustic vine, milk bush, tableland caustic bush. Included in the Cooper Basin list (E.R. & P.G., 1980), it was not collected this survey. Status uncertain - probably rare.

ASPLENIACEAE

Pleurosorus rutifolius. Blanket fern. P. rutifolius (syn. Grammitis rutaefolia) was reported from the area of Innamincka last century (Tate, 1889). No more recent collections are known from the study area. Status uncertain - probably very rare if not locally extinct.

ASTERACEAE

Brachycome campylocarpa. Large white brachycome. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). Status rare.

B. ciliaris. Variable daisy, daisy. First reported in the study area from the vicinity of Innamincka and along the Strzelecki Creek last century (Tate, 1889) it was collected in the Innamincka area in 1975 (Jessop, 1982). Status rare.
B. ciliaris var. lanuginosa was collected in the study area,from north of Lake Hope, during the present survey. Status uncommon.

B. lineariloba. Dwarf brachycome. B. lineariloba (syn. B. pachyptera) was reported from the area of Innamincka last century (Tate, 1889). It has not been collected in the study area since. Status uncertain - probably very rare if not locally extinct.

B. melanocarpa. Reported in the study area from the Strzelecki Creek last century (Tate, 1889; see also Black, 1943-57), it is not represented by a specimen in the State Herbarium (Jessop, 1982). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and has apparently not been collected in the study area since last century. Status uncertain - probably very rare if not locally extinct.

Calocephalus knappii. Collected in the Clifton Hills area in 1972 (Jessop, 1982), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). The species was reported to be present on Embarka Swamp in 1982 (S.E.A., 1982), but this requires confirmation by the author. Status rare.

C. platycephalus. Billybuttons. Reported from along the Strzelecki Creek last century (Tate, 1889), it was said to be a small bush 12-18 inches high, forming great masses over a wide area , on Kanowana early this century (Black, 1917). C. platycephalus (syn. C. dittrichii) was collected in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey, the species was collected or observed at 11 localities in the study area, all from north of 28°S latitude; near channels, on floodouts or in interdunes Status very common , but may no longer occur along the Strzelecki Creek.

Calotis ancyrocarpa. Known in the study region from the Innamincka area, based on a specimen in the State Herbarium collected last century (Black, 1943-57; Jessop, 1982), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and is included in the Cooper Basin list (E.R. & P.G., 1980). Specimens were collected during the present from a floodout near Chillimookoo W.H. (it was locally common here), the western edge of Embarka Swamp (Site 21) and the southern edge of Embarka Swamp (Site 23). Status fairly common.

C. cymbacantha. Burr-daisy. This species was reported to be present in the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889). It is not otherwise known from the study area. Status uncertain - probably very rare if not locally extinct.

C. erinacea. Tangled burr-daisy. Reported from the area of Innamincka last century (Tate, 1889), it was reported this century, from Lake Perigundi and Kanowana in 1916 (Black, 1917), from the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and the Clifton Hills area in 1975 (Jessop, 1982). The two specimens collected during the present survey were from a red dune slope near Mudcarnie W.H. and a floodout 10 km south of Gidgealpa Homestead. The species was common at both localities. Status fairly common.

Calotis hispidula. Hairy burr-daisy, bogan-flea, bindyi. This species was reported from the area of Innamincka last century (Tate, 1889). It is included in the Cooper Basin list (E.R. & P.G., 1980) and occupies swamp, lake and river habitats in the area of Embarka Swamp (S.E.A., 1982). During the present survey it was generally encountered throughout the study area, mostly on floodouts or in interdunes. Status very common.

C. multicaulis. Daisy. C. multicaulis (syn. C. plumulifera) was reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), and to be growing in tufts (4-5 inches high) on flooded ground at Murteree (=Merty Merty) early this century (Black, 1917). It was collected in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). Specimens were collected during the present survey from an interdune 2 km NNW of Mudcarnie W.H. on swamp canegrass clayflats and from the southern end of Queerbidie W.H. and the species was reported on a data sheet from a swamp canegrass low shrubland 16 km NNW of Toolache. Where collected it was common. Status fairly common.

C. porphyroglossa. First reported in the study region from the area of Innamincka last century (Tate, 1889), its distribution includes the Strzelecki Creek (Black, 1943-57). It was collected in the Clifton Hills area in 1962 and the Innamincka area in 1968 and 1972 (Jessop, 1982) and was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). It is included in the Cooper Basin list (E.R. & P.G., 1980). A survey of Embarka Swamp indicated its presence in swamp and river habitats (S.E.A., 1982). During the present survey, it was collected on a gibber plain south of Lake Moorayepe (Site 1 - it was common here) and was reported on data sheets to be present in an interdune NW of Mudcarnie W.H., an ovoid interdune claypan area 4.5 km south of Tooroowatchie W.H., on the channel edge of Kudriemitchie W.H., the southern end of Queerbidie W.H. and on a floodout north of Toolache W.H. Status widely spaced and common.

Centipeda cunninghamii. Common sneezeweed. First collected in the study area from along the Strzelecki Creek last century (Tate, 1889), it was reported to be an unpleasant smelling plant in many waterholes near Innamincka in 1916 (Black, 1917) and was collected in watercourses in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925). The species was collected in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey it was collected from a channel edge adjacent to Mudcarnie W.H., where it was found to be common. Status uncommon - may no longer occur around Innamincka and along the Strzelecki Creek.

C. minima. Spreading sneezeweed. C. minima (syn. C. orbicularis) was collected in the area of Innamincka last century (Tate, 1889) and in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey it was collected from the channel edge of Mudcarnie W.H. (it was common here) and observed to be present near a channel in Tirrawarra Swamp, at the southern end of Queerbidie W.H. and on the southern edge of Embarka Swamp. Status fairly common.

Centipeda thespidioides. Desert sneezeweed. First collected in the study area from along the Strzelecki Creek last century (Tate, 1889), it appears not to have been encountered in the study area again until the present survey. Two specimens were collected, one from an interdune claypan 3.0 km south of Tooroowatchie W.H. and the other from a channel leading into the NE corner of Lake Apachirie (it was common here). Status fairly common.

Chrysocoryne pusilla. C. pusilla (syn. Angianthus pusillus) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and is not otherwise known from the study area. Status uncertain - probably very rare.

Craspedia chrysantha. Golden billybuttons. C. chrysantha was first recorded in the study region from the area of Innamincka last century (Tate, 1889), and was noted to grow thickly in places in the region of Cuttapirie Corner on the Cooper Creek early this century (Black, 1917). In 1975 it was collected in the Clifton Hills area (Jessop, 1982) and it is included in the Cooper Basin list (E.R. & P.G., 1980). In the vicinity of Embarka Swamp, it is thought to occupy lake habitats (S.E.A., 1982), but this requires confirmation by the author. During the present survey, two specimens were collected , one from a channel leading into the NE corner of Lake Apachirie (it was common here) and the other from the bed of the lake. Status uncommon.

C. pleiocephala. Soft billy-buttons. Recorded from the area of Innamincka last century (Tate, 1889) and to grow very thickly in places as a carpet in the area of the Cooper and Strzelecki Creeks in 1916 (Black, 1917), it is included in the Cooper Basin list (E.R. & P.G., 1980). It is not otherwise known from the study area. Status uncertain - probably very rare.

Epaltes australis. Spreading nut-heads. First encountered in the study region from the area of Innamincka last century (Tate, 1889), it was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). The species was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). During the present survey, it was collected from a floodout west fo Cartoonganie W.H., where it was found to be common, and a clay interdune 1 km north of Yalcuma W.H., where it was uncommon. Status fairly common.

E. cunninghamii. Tall nut-heads. Collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982), it occupies swamp, relict channel and river habitats in the area of Embarka Swamp (S.E.A., 1982). The only collection during the present survey was from the bed of Lake Apachirie, where it was common; it also occupied a channel leading into the NE corner of the lake. Status uncommon overall, but locally common in parts.

Erodiophyllum elderi. Koonamore daisy. Reported from along the Strzelecki Creek last century (Tate, 1889; see also Black, 1943-57), it does not appear to have been collected in the study area since and may not now occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct.

Gnaphalium indicum. Indian cudweed. Previously considered to occur beyond Cooper's Creek (Black, 1943-57), it was collected this survey from the channel edge of Mudcarnie W.H., where it was common, and a floodout of the Cooper Creek near Gigealpa Homestead, where it was uncommon. Status fairly common.

G. indutum. A specimen collected in a watercourse in the area of Cordillo Downs Homestead in 1924 was attributed to this species,...," probably (very young) ",..., by Cleland et al. (1925). It is not otherwise known from the study area and is not now considered to occupy the NE (Jessop, 1983). Status uncertain - probably very rare if not misidentified.

Gnaphalium luteoalbum. Jersey cudweed. Reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), a specimen collected in a watercourse in the area of Cordillo Downs Homestead in 1924 was attributed to this species,...," probably (very young) ",..., by Cleland et al.(1925). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). In the vicinity of Embarka Swamp it is reported to occupy swamp, relict channel and river habitats (S.E.A., 1982), but this requires confirmation by the author. During the present survey it was collected from the channel edge of Mudcarnie W.H., where it was common, and from the channel edge of Brady's W.H. (Site 7). Status fairly common.

Gnephosis eriocarpa. Reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), it was reported to be growing in great quantities on flooded ground along the Cooper and Strzelecki Creeks early this century (Black, 1917). Collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980). In the region of Embarka Swamp it occupies swamp and lake habitats (S.E.A., 1982). It was observed or collected at 8 localities during the present survey in dune, undulating dune, channel edge, ephemeral channel and open gibber clay flat habitats. Where collected it was common. It was not encountered south of 28°S latitude and may no longer occur along the Strzelecki Creek. Status patchy and common.

G. foliata. G. foliata (syn. G. arachnoides) was reported to be present along the Strzelecki Creek last century (Tate, 1889). G. foliata (syn. G. cyathopappa) was said to be a common plant, mostly on land subject to flooding, around Innamincka early this century (Black, 1917). It was collected in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey the species was observed or collected at 8 localities in the vicinity of 4 sites (1, 4, 6 & 11) on claypan edges, interdunes, gibber plains, open gibber clay flats, dune/gibber and dune/floodout interfaces, lake channel and lake bed habitats. Status patchy and common - may no longer occur along the Strzelecki Creek or in the area of Innamincka.

Helichrysum ambiguum. This species was collected in sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills area in 1975 (Jessop, 1982). It was not collected in the study area during the present survey. Status rare.

H. apiculatum. Reported from the area of Innamincka last century (Tate, 1889), it was collected in sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). There are no other records relating to the study area and it was not collected this survey. Status uncertain - probably very rare.

H. basedowii. Reported from the area of Innamincka last century (Tate, 1889), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). There are no other records relating to the study area and it was not collected this survey. Status uncertain - probably very rare if not locally extinct.

H. podolepidium. With a distribution, which in the past included the Strzelecki Creek (Black, 1943-57), it was collected in the Clifton Hills area in 1975 (Jessop, 1982). Not otherwise known from the study area, it was not encountered during the present survey. Status rare.

Helichrysum semifertile. First recorded in the study region from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), it was said to be found,on tablelands and flooded country alike, over a great range of country,along the Cooper Creek between Innamincka and Kanowana early this century (Black, 1917; see also Black, 1943-57). No other records are available relating to the study area. Status uncertain - probably very rare.

Helipterum corymbiflorum. Small white paper daisy. Reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), it was collected from sandhills 15 miles west of Innamincka early this century, occurs,..., " mostly in sandy country where it was very plentiful"(Black, 1917). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

H. demissum. H. demissum (syn. H. exiguum) was reported from along the Strzelecki Creek last century (Tate, 1889). It is now not considered to occur in the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

H. floribundum. Large white sunray, paper daisy. H. floribundum was reported to be widely distributed in the area of the Cooper and Strzelecki Creeks early this century,...," mostly in sandhill country"(Black, 1917). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). The species occupies swamp, lake and dune habitats in the area of Embarka Swamp (S.E.A., 1982). It was collected or observed at 8 localities during the present survey, all between 27°S and 28°S latitude, in undulating dune, dune, interdune, channel edge and open gibber clay flat habitat. Where collected it was common Status patchy and common.

H. hyalospermum. Reported from the area of Innamincka last century (Tate, 1889), it is not otherwise known from the study area and was not collected this survey. It is not now considered to occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct, but may have been misidentified.

H. microglossum. Included in the Cooper Basin list (E.R. & P.G., 1980), it occupies undulating dunes in the vicinity of Embarka Swamp (S.E.A., 1982). During the present survey one specimen was collected from a floodout 0.7 km west of Toolache W.H. (Site 28), where it was found to be common. Status uncommon overall, but locally common in parts.

H. moschatum. Musk sunray. First reported in the study region from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), it was reported from Murteree (=Merty Merty), Innamincka and Kanowana, as a widely distributed plant, which was in many places thick and in large masses, early this century (Black, 1917). In 1975, it was collected in the Clifton Hills and Innamincka areas (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It occupies lake and dune habitats near Embarka Swamp (S.E.A., 1982). During the present survey it was collected or observed at 18 localities, all except three between 27°S and 28°S latitude, in dune (most frequently), undulating dune, sand plain, channel and swamp margin habitats. Where collected it was common. Status very common

H. pterochaetum. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is not otherwise known from the study area. Status rare.

Helipterum strictum. Reorted to occur between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889) and north of Coopers Creek this century (Black, 1943-57), it is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey it was collected or observed at 6 localities near 4 sites (1, 6, 14 & 28), in gibber plain, gibber plain gutter and floodout habitats. It was common near Toolache W.H. Status widely dispersed and common.

H. troedelii. This species was found in many places throughout the country to form thick masses, including the area of Murteree (=Merty Merty) and along the Strzelecki Creek, early this century (Black, 1917; see also Black, 1943-57). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

H. uniflorum. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it is only known in the study area from a collection made in the Innamincka area in 1968 (Jessop, 1982). Status rare.

Ixiolaena brevicompta. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al, 1974), it appears to have been collected from the study area for the first time during this survey. Two collections were made, one from the bed of Lake Apachirie and the other from the SW margin of Embarka Swamp. Status uncommon.

I. leptolepis. Plover daisy, stalked ixiolaena. Recorded from the area of Innamincka last century (Tate, 1889) and to be widely distributed in the area of the Cooper and Strzelecki Creeks early this century (Black, 1917), it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Leptorhychos tetrachaetus. L. tetrachaetus (syn. L. pulchellus) was reported from along the Strzelecki Creek last century (Tate, 1889). It is no longer considered to occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

Millotia greevesii. Reported in the study region from the area of Innamincka last century (Tate, 1889), the State Herbarium holds no records from the far NE (Jessop, 1982), but its distribution includes the NE (Jessop, 1983). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). Status uncertain - probably very rare if not locally extinct.

Minuria cunninghamii. Bush minuria. Collected from the study area for the first time during the present survey, it was collected in open coolibah woodland on moist red clays of a gibber plain run-on area 3.5 km SE of Lake Moorayepe. Status uncommon.

M. denticulata. Woolly minuria. This species was collected in a washout in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982). It is included in the Cooper Basin list (E.R. & P.G., 1980) and in the vicinity of Embarka Swamp it occupies swamp and lake habitats (S.E.A., 1982). During the present survey it was collected or observed in an interdune claypan (ovoid) 3.0 km south of Tooroowatchie W.H. (Site 7A), on the bed of Lake Apachirie, on a floodout 10 km south of Gidgealpa Homestead, on a sand plain 6.0 km ESE of Scrubby Camp W.H. (Site 24) and a floodout near Toolache W.H. (Site 28). It was common at the latter locality. Status common.

Minuria integerrima. Smooth minuria. Reported from the area of Innamincka last century (Tate, 1889), from sandy creeks east of Mungeranie in 1916 (Black, 1917) and from the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), M. integerrima was collected from the moist bed of Lake Apachirie during the present survey. It was common here. Status uncommon overall, but locally common in parts.

M. leptophylla. Minnie daisy. This species was reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889) and was collected in the Clifton Hills area in 1975 (Jessop, 1982). It was not collected this survey. Status rare - may no longer occur along the Strzelecki Creek or in the area of Innamincka.

M. rigida. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was collected during the present survey from the ephemeral lake bed of Lake Apachirie,near Coongie, and from a floodout SW of Chillimookoo W.H. It was common at both localities. Status fairly common.

Myriocephalus rudallii. Reported to be present along the Strzelecki Creek last century (Tate, 1889), it was collected in the Innamincka area in 1934 (see Black, 1943-57; Jessop, 1982). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and was collected during the present survey from interdune claypans 3.0 and 4.5 km south of Tooroowatchie W.H. (Site 7A). Data sheet entries for other parts of the study area are considered doubtful. Status uncommon.

M. stuartii. Billy or batchelor button, poached egg, poached-egg plant. Reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889) and to be flowering in abundance all over the sandy country around Lake Perigundi in 1916 (Black, 1917), it was collected from 25 miles south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). In 1975, it was collected in the Clifton Hills area (Jessop, 1982) and the species is included in the Cooper Basin list (E.R. & P.G., 1980). It occupies swamp, dune and undulating dune habitats in the area of Embarka Swamp (S.E.A., 1982). During the present survey, the species was observed or collected at over 40 localities on all habitat types,except gibber plains. Status very common.

Pluchea rubelliflora.P. rubelliflora (syn. P. eyrea) was reported to occur between sandhills along the Strzelecki Creek last century (Tate, 1889) and was collected south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; see also Black, 1943-57). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and was collected in the Clifton Hills area in 1975 (Jessop, 1982). The species is included in the Cooper Basin list (E.R. & P.G., 1980), but was not collected during the present survey. Status rare.

P. tetranthera. This species was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974). It was collected in the Clifton Hills and Coongie areas in 1975 and was also collected in the Innamincka area in 1959 (Jessop, 1982). During the present survey it was collected from Big Lake Moonba (SW of Moomba), where it was uncommon, and from near a bore drain outlet of Mudcarnie Well. Status uncommon.

Podolepis arachnoidea. P. arachnoidea (syn. P. rutidochlamys) was collected on the Cooper Creek in 1884 (Jessop, 1981) from the area of Innamincka (Tate, 1889) and it was apparently rare (Black, 1943-57). It is not otherwise known from the study area and was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974). Status uncertain - probably very rare if not locally extinct.

Podolepis canescens. Grey podolepis. P. canescens was reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct.

P. capillaris.Wiry podolepis. P. capillaris (syn. P. siemssenia) was recorded from along the Strzelecki Creek last century (Tate, 1889). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct.

P. muelleri. Podolepis. P. muelleri (syn. P. lessonii) was said to be an uncommon species of flooded ground along the Strzelecki and Cooper Creeks in 1916 (Black, 1917). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Pterocaulon serrulatum. P. serrulatum (syn. P. glandulosum)was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and was collected in the Clifton Hills area in 1975 - this record was considered significant (Jessop, 1982), because it added significantly to the known range of the species (Jessop, 1981, 1983). It is not otherwise known from the study area. Status rare.

P. sphacelatum. Apple-bush. Reported in the study region from the area of Innamincka last century (Tate, 1889), several large bushes were seen in one locality near Innamincka in 1916 (Black, 1917). It was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). In the area of Embarka Swamp it is reported to occupy lake and undulating dune habitats (S.E.A., 1982), but this requires confirmation by the author. It was collected during the present survey from the channel edge of Brady's W.H. Status uncommon.

Rutidosis helichrysoides. Yellow top, grey wrinklewort. Recorded from the area of Innamincka last century (Tate, 1889), it was found in many places, often to 3 feet high, along the Cooper and Strzelecki Creeks in 1916 (Black, 1917) and was collected near a watercourse in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; see also Black, 1943-57). In 1975, the species was collected in the Clifton Hills, Coongie and Innamincka areas (Jessop, 1982) and it is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected during the present survey. Status rare.

Senecio cunninghamii. Groundsel. First recorded in the study region from the area of Innamincka last century (Tate, 1889), a possible variety, i.e. S. sp. aff. cunninghamii (S. cunninghamii sensu Black, 1917 - between S. cunninghamii and S. odoratus), reaching a height of 18 inches to 2 feet was common along the Strzelecki Creek in 1916 (Black, 1917). A densely tomentose form is recognised (Jessop, 1981). S. sp. aff. cunninghamii has not been collected in the study area since 1916, as far as is known, so its status is uncertain - probably very rare. S. cunninghamii, however was collected during the present survey from a floodout adjacent to Chillimookoo W.H., where it was common, a floodout of the Cooper east of Boggy Lake (Site 18) and a floodout 3.0 km south of Lake Perigundi, where it was locally common. It was observed on channel edges of Chillimookoo W.H., in Tirrawarra Swamp and near Site 25.Status common - may be restricted to the central and south-western parts of the study area.

S. glossanthus. Slender groundsel. S. glossanthus (syn. S. brachyglossus) was reported from the area of Innamincka last century (Tate, 1889). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct.

Senecio gregorii. Fleshy groundsel, annual yellow top. This species was reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889) and was collected in the area of Cordillo downs Homestead in 1924 (Cleland et al., 1925). In 1975, it was collected in the Clifton Hills area (Jessop, 1982) and it is included in the Cooper Basin list (E.R. & P.G., 1980). It occupies swamp, lake and undulating dune habitats in the area of Embarka Swamp (S.E.A., 1982). During the present survey S. gregorii was collected or observed at 18 localities in the vicinity of 10 sites(7,8, 10,14,16, 21, 22, 23, 25 & 28). It was common at one site of collection, a dune near Lake Hope, and uncommon at another, a claypan/floodout area on the edge of a salt lake. It was found on dune, floodout, channel edge, ephemeral channel and interdune claypan habitats in other parts of the study area. The claypan/floodout area was near Site 25. Status very common.

S. lautus. Variable groundsel, mustard. S. lautus was reported from the area of Innamincka last century (Tate, 1889) and to be widely distributed (and 4-12 inches high) in sandy country between Innamincka and Kanowana early this century (Black, 1917). It was collected in the Clifton Hills area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). In the area of Embarka Swamp, it occupies swamp and river habitats (S.E.A., 1982). Two subspecies were collected during the present survey viz. S. lautus ssp. dissectifolius and S. lautus ssp. maritimus.

- S. lautus ssp. dissectifolius was collected from lignum swamp habitat at the western edge of Embarka Swamp (Site 21). Status uncommon.
- S. lautus ssp. maritimus is a species of coastal areas and was collected in the study area from lignum swamp habitat at the western and southern edges of Embarka Swamp (it was common at the southern edge of the swamp) and from the bed of Lake Apachirie,near Coongie. Status fairly common.

S. lautus may now be restricted to the central Cooper Creek Floodplain.

S. odoratus. Scented groundsel. Collected in the Coongie area in 1975 (Jessop 1982), it is not otherwise known form the study area and was not collected during the present survey. Status rare. (Note : S. sp. aff. cunninghamii exhibited some characteristics of this species - see above)

Sonchus asper. Naturalised: Rough (or prickly) sow-thistle. Collected during the present survey from the western edge of Embarka Swamp, it is not otherwise known from the study area. Status uncommon.

S. megalocarpus. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is not otherwise known from the study area. Status rare.

S. oleraceus. Naturalised: (Common) sow-thistle. This species was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey, it was found to be uncommon on a bank edge adjacent to Chillimookoo W.H. (a disturbed site), in dunes on the western edge of Embarka Swamp and in lignum swamp at the southern edge of Embarka Swamp. Status fairly common.

Streptoglossa adscendens. S. adscendens (syn. Pterigeron adscendens) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills area in 1975 (Jessop, 1982). A species mostly of cracking clay soils (Jessop, 1981), it was found during the present survey on red duplex soil of a gibber plain 3.5 km south of Lake Moorayepe, where it was uncommon, and in low open coolibah woodland on a gibber/dune interface 3.0 km south of the lake. Status uncommon.

Vittadinia dissecta var. hirta. Fuzzweed. V. dissecta var. hirta (syn. V. triloba) was collected in the Clifton Hills area in 1975 (Jessop, 1982). It is not otherwise known from the study area and was not collected this survey. The species is not included in the 1983 list for the NE (Jessop, 1983). Status rare.

V. pterochaeta. Reported to occupy lake habitat near Embarka Swamp (S.E.A., 1982). This requires confirmation by the author. It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and is not considered to occupy the NE (Jessop, 1983). Status uncertain - probably rare if not misidentified.

Vittadinia sp. An unidentified species of Vittadinia was collected during the present survey from lignum swamp habitat on the western edge of Embarka Swamp (Site 21). Further collections for accurate determination need to be made before a positive statement can be made about status - possibly uncommon.

AZOLLACEAE

Azolla filiculoides. Pacific azolla. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was collected from water at the edge of Coongie Lake, where it was common, and from NW of Innamincka during the present survey. The species was also observed in water of Kudriemitchie W.H.(as a dens mat), a channel in Tirrawarra Swamp, on the SW edge of Embarka Swamp and within Embarka Swamp. Status common - always in water and associated with regularly inundated swamps and more permanent waterholes and lakes.

BORAGINACEAE

Coldenia procumbens. Not redicovered since collected along the Cooper Creek last century (Tate, 1889; Black, 1943-57). Thought to be extinct (probably) in 1974 (Specht et al., 1974). Status uncertain - probobly very rare if not locally extinct.

Cynoglossum australe var. drummondii. C. australe var. drummondii (syn. C. drummondii) was recorded from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889; Black, 1943-57). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct.

Heliotropium curassavicum. Naturalised: Smooth heliotrope. This species was collected in the Coongie area in 1975 (Jessop, 1982) and was found to be common on moist clays surrounding a bore drain outlet adjacent to Mudcarnie Well during the present survey. Status uncommon overall, but locally common in parts.

H. europaeum. Naturalised species. Found on the bed of Lake Apachirie, where it was common, and in a channel leading into the NE corner of the lake in the present survey. Status fairly common.

H. filaginoides. Collected along the Cooper Creek last century (Tate, 1889), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). It is not otherwise known from the study area and was not collected during the present survey. Status uncertain - probably very rare if not locally extinct.

Heliotropium ovalifolium. Reported from near the Cooper Creek in the area of Innamincka last century (Tate, 1889; Black, 1943-57), it was considered to be extinct (probably) in S.A. in 1974 (Specht _et al_., 1974). It was recently considered not to occur in the NE (Jessop, 1981), but has since been included in a list for the area (Jessop, 1983). Status uncertain - probably very rare if not locally extinct.

H. undulatum. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht _et al_., 1974), it was collected in the Innamincka area in 1975 - a significant collection as it was previously only known from further west (Jessop, 1982). It is included in the Cooper Basin list (E.R. & P.G., 1980). In Central Australia, _H. undulatum_ (syn. _H. bacciferum_) was considered to occur in the N.T. and possibly W.A. in 1981 (Jessop, 1981), but is now also included in a list for the NE (Jessop, 1983). Status rare.

Omphalolappula concava. Reported to be present in the country between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889), it was found in quantity at high water mark on the edge of Lake Perigundi early this century (Black, 1917). During the present survey, one specimen was collected in undulating dune habitat on the eastern edge of Lake Marrakoonamooka. Status uncommon.

Trichodesma zeylanicum. Camel bush, cattle bush, water bush. _T. zeylanicum_ (syn. _Pollichia zeylanicum_) was reported from along the Cooper and Strzelecki Creeks last century (Tate, 1889). T. zeylanicum was an uncommon plant between Innamincka and Kanowana in 1916 (Black, 1917) and was collected in sandhills in the area of Cordillo Downs Homestead and 25 miles south of here in 1924 (Cleland _et al_., 1925). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes (E.R. & P.G., 1980). During the present survey, it was collected or observed at 19 localities in the area of 16 sites (1, 4, 6, 7, 7A, 8, 8A, 10, 11, 13, 16, 17, 19, 21, 22 & 23); generally in parallel dune habitat. Status very common.

BRASSICACEAE (CRUCIFERAE)

Alyssum linifolium. Naturalised: Flax-leaved alyssum. Collected 25 miles south of Cordillo Downs Homestead in 1924 (Cleland _et al_., 1925), it was considered depleted (and presumably a native) with a population originally widespread, but now reduced in area and needing constant monitoring in 1974 (Specht _et al_., 1974). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Arabidella eremigena. _A. eremigena_ (syn. _Blennodia eremigena_) was collected in the Innamincka area in 1924 (Cleland _et al_., 1925). _A. eremigena_ was collected in the same area in 1916, 1960, 1962 and 1968 and in the Clifton Hills area in 1934, 1960 and 1975 (Jessop, 1982). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht _et al_., 1974), it is included in the Cooper Basin list (E.R. & P.G., 1980). The species was not collected during the present survey. Status rare.

A. glaucescens. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is not otherwise known from the study area and was not collected this survey. Status rare.

Arabidella procumbens. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), a specimen collected from lignum tall shrubland adjacent to a channel in Tirrawarra Swamp, where it was common, was determined(probably)as this species. Status locally common in part, but uncommon overall.

A. trisecta. A. trisecta (syn. Sisymbrium trisectum) was reported from along the Cooper Creek last century (Tate, 1889). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct.

Blennodia canescens. B. canescens (syn. Erysimum blennodia) was reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889). B. canescens was collected in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey it was collected in an Acacia ligulata shrubland on a red dune slope 5 km north of Toolache W.H. Status uncommon.

B. sp. aff. canescens. A specimen collected from a deep white dune SE of Boggy Lake (Site 16), was given the above determination. Status uncommon.

B. pterosperma. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was found to be common on a grey-red dune near Brolga #2 well site during the present survey. It was also collected from an orange dune on the western edge of Embarka Swamp (Site 19) and a deep white dune SE of Boggy Lake (Site 16). Status fairly common.

Brassica tournefortii. Naturalised: Turnip-weed. This species was collected from the study area,during the present survey,from the western edge of Embarka W.H. and adjacent to Toolache W.H. It was common at both localities. Status fairly common.

Harmsiodoxa blennodioides. Hairy cress. H. blennodioides (syn. Erysimum lasiocarpum) was collected along the Strzelecki Creek last century (Tate, 1889). H. blennodioides (syn. Blennodia lasiocarpa) was found at Murteree (=Merty Merty) and Tinga Tingana along the Strzelecki Creek and in sand-hills 15 miles west of Innamincka early this century,...," had a wide range and was met with allover the sandhill country" (Black, 1917). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

H. brevipes var. brevipes. H. brevipes var. brevipes (syn. Erysimum brevipes) was collected along the Strzelecki Creek last century (Tate, 1889). It is not otherwise known from the study area and may no longer occupy the NE (Jessop, 1983). Status uncertain - probably very rare if not locally extinct.

Lepidium muelleriferdinandii. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was observed on an open gibber clay flat 8 km NW of Site 6 (silicula only present) and collected from a channel edge of Brady's W.H. (Site 7) during the present survey. Status uncommon.

Lepidium papillosum. Collected from between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889), it was found in the area of Innamincka in 1916 and said to be widely distributed throughout the country, with much size variation (Black, 1917). It is not otherwise known from the study area and is not now considered to occupy the NE (Jessop, 1983). Status uncertain - probably very rare , but may have been misidentified.

L. rotundum. Collected in the Innamincka area in 1975 (Jessop, 1982), it is otherwise only known in S.A. from Yorke Peninsula (Jessop,1983), but it does occur in adjacent areas of Qld (Dawson and Boyland, 1974). No other records relate to the study area. Status rare.

Menkea crassa. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills area in 1975 and previously in the Clifton Hills area in 1939 and 1955 and in the Innamincka area in 1968 (Jessop, 1982). The species is also included in the Cooper Basin list (E.R. & P.G., 1980), but was not collected during the present survey. Status rare.

Pachymites cardaminoides. P. cardaminoides (syn. Sisymbrium cardaminoides) was reported from along the Strzelecki Creek and the area of Innamincka last century (Tate, 1889). P. cardaminoides (syn. Blennodia cardaminoides) was said to be a common plant (eaten by stock) at Tinga Tingana and along the Strzelecki Creekearly this century Black, 1917). It has not been collected in the study area since and is no longer considered to occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare, but possibly misidentified.

?Scambopus curvipes. A specimen collected from between Cordillo Downs Homestead and Innamincka in 1924 was said to be near S. curvipes (syn. Blennodia curvipes),.., " too young",..., by Cleland et al. (1925). It is not otherwise known from the study area and is not now considered to occupy the NE (Jessop, 1983). Status uncertain - probably very rare, but possibly misidentified.

Stenopetalum lineare. S. lineare (syn. S. croceum) was collected in the area of Innamincka last century (Tate, 1889). S. lineare was also collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected during the present survey. Status rare.

S. nutans. Reported from between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889) and near Cooper's Creek (Black, 1943-57), it is not otherwise known from the study area and was not collected this survey. The species was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). Status uncertain - probably very rare if not locally extinct.

S. velutinum. Exactly as for S. nutans, above.

CAESALPINACEAE

Cassia artemisioides. Silver cassia, dense cassia, puntee. Collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Cassia desolata. Collected at the southern end of the Strzelecki Creek last century (Tate, 1889) and from the area of Cordillo Downs Homestead and between here and Innamincka in 1924 (Cleland et al., 1925), it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

C. desolata var. planipes. C. desolata var. planipes (syn. C. sturtii var. planipes) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Cassia helmsii. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was collected from a gibber plain south of Lake Moorayepe (Site 1 - it was rare here) and from NW of Innamincka during the present survey. Status uncommon.

C. nemophila. C. nemophila (syn. C. eremophila = Turpentine bush) was said to be a common shrub near Murteree (=Merty Merty) along the Strzelecki Creek early this century (Black, 1917). Two of the recognised varieties are known to be present in the study area, viz. C. nemophila var. nemophila and C. nemophila var. zygophylla.

- C. nemophila var. nemophila. Desert cassia. Collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes, gibber downs, river channels and floodplains (E.R. & P.G., 1980). Near Embarka Swamp, it occupies dune and undulating dune habitats (S.E.A., 1982). It was collected or observed at 20 localities in the area of 13 sites(1, 4, 6, 7, 8A, 11, 14, 20, 22, 23, 24, 25, & 28) during the present survey, on dune (most frequently), undulating dune, sand plain, dune/floodout interface, ephemeral channel and hard interdune habitats. Where collected it was common. Status very common and widespread.
- C. nemophila var. zygophylla. C. nemophila var. zygophylla (syn. C. zygophylla) was collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982). C. nemophila var. zygophylla is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes, gibber downs, river channels and floodplains (E.R. & P.G., 1980). It occupies dune and undulating dune habitats near Embarka Swamp (S.E.A., 1982). Of the 8 collections or observations during the present survey, 3 were in interdune habitats, 2 on dunes or slopes of dunes, and one each were on undulating dune, sand plain and floodout habitats. Where collected it was common. Status common.

C. oligophylla. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). C. oligophylla was also found to occupy undulating dune habitat in the area of Embarka Swamp in 1982 (S.E.A., 1982). In the present survey it was collected from a dune east of Mudcarnie W.H. (Site 4), where it was found to be common, and observed at the channel edge of Mudcarnie W.H. It was also collected NW of Innamincka. Status fairly common.

C. phyllodinea. Silver cassia. This species was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey the species was observed or collected on a gibber plain, gibber plain clay lens and dune/floodout interface south of Lake Moorayepe (at and near Site 1)& on a claypan edge and interdune border near Mudcarnie W.H. Where collected it was common. Status fairly common in the northern part of the study area; often associated with gibber.

C. pleurocarpa var. pleurocarpa. Stripe pod cassia, fire bush, native senna. Collected from sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). During the present survey the species was observed or collected on a dune near Mudcarnie W.H. (Site 4), a red dune crest in the same area and NW of Innamincka. Where collected it was locally common at one locality. Status fairly common.

Cassia pruinosa. White cassia. Found between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889), it was considered to be a species of geographical importance with a disjunct or isolated distribution in 1974 (Specht et al., 1974). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct.

C. sturtii. Bird's-eye cassia. Reported last century from along the Strzelecki Creek (Tate, 1889), it was found near Murteree (=Merty Merty) along the Strzelecki Creek in 1916,..., " many bushes were observed " (Black, 1917), and in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Lysiphyllum gilvum. Queensland bean, bean tree, Strzelecki bean, bauhinia. L. gilvum (syn. Bauhinia carronii) was collected," towards Cooper Creek ", last century (Tate, 1889). It,..., " was met with along the Strzelecki Creek for the first time at Birkett's Woolshed W.H., after which it was plentiful all the way to the Cooper and for a considerable way down it ", ..., in 1916 (Black, 1917) and was encountered in creeks from about 10 miles below Tinga Tingana, on the Strzelecki Creek, and up to Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of gibber downs, rivers and floodplains (E.R. & P.G., 1980). It occupies river habitats in the area of Embarka Swamp (S.E.A., 1982). In the present survey it was collected or observed at 12 localities; always on floodouts or channel edges. Where collected it was common. Status very common in the central-eastern Cooper Creek floodplain and locally common along the Strzelecki Creek.

CALLITRICHACEAE

Callitriche stagnalis. Water starwort. C. stagnalis (syn. C. verna) was collected from a damp bank of a drying watercourse in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It is now no longer considered to occupy the NE (1983) and is not otherwise known from the study area. Status uncertain - probably very rare, but possibly misidentified (may be C. sonderi).

CAMPANULACEAE

Isotoma petraea. I. petraea was found growing amongst rocks in the area of Innamincka early this century (Black, 1917). It is not otherwise known from the study area and was not collected this survey. The species was previously not considered to occupy the NE (Jessop, 1981), but this is no longer the case (Jessop, 1983). Status uncertain - probably very rare.

Pratia puberula. P. puberula (syn. Lobelia benthamii) was reported from along the Cooper Creek last century (Tate, 1889; Black, 1943-57). It was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974) and may now not occur in the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct.

Wahlenbergia gracilis. Native bluebell. Reported from the area of Innamincka and along the Strzelecki Creek last century (Tate,1889), it was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It is not otherwise known from the study area. Status uncertain - possibly very rare.

Wahlenbergia sieberi. Native bluebell. This species was collected in the Coongie and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was recently not considered to occupy the NE (Jessop, 1981), but has since been included in a list for the area (Jessop, 1983). Status possibly rare.

Wahlenbergia sp. Three specimens and an observation of a specimen at a fourth site were determined as Wahlenbergia sp. These were from a channel edge near Mudcarnie W.H., a small ephemeral channel near King Lookout, a floodout near Kudriemitchie W.H. and the southern end of Queerbidie W.H. Until the proper identity of these specimens can be determined nothing can be said about their status in a positive way, although they can be provisionally classed as fairly common because where collected they were common. Possibly include W. gracilis and W. sieberi.

CAPPARACEAE

Capparis mitchellii. Native orange, bumble. C. mitchellii was reported from along the Cooper Creek last century (Tate, 1889). Several trees were encountered along the Cooper,..., " generally on the edge of sandy country " ,..., by Capt. S.A. White in 1916 (Black, 1917) and in 1924 it was found growing in the garden of Cordillo Downs Homestead and was said to also occur wild in this area (Cleland et al., 1925). The species was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and was collected in the Clifton Hills area in 1975 (Jessop, 1982). A specimen was collected during the present survey from adjacent to Scrubby Camp W.H. (Site 20), where it was locally common; an area subject to intense grazing pressure in the past (Mr. J. Vickery, pers. comm.) and now a focus for recreational pursuits. Status uncommon.

Cleome viscosa. This species is here used in accordance with Jessop (1983), where it is placed in the family CLEOMACEAE, however in the FLORA OF AUSTRALIA (Vol. 8, 1982) it is included in the family CAPPARACEAE.

CARYOPHYLLACEAE

Polycarpaea arida. P. arida (syn. P. corymbosa- see Jessop, 1983)was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), collected in the Clifton Hills area in 1975 and the Innamincka area in 1960 and 1968 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). The species was not collected during the present survey. Status rare.

P. indica sensu Tate (1889). Reported from along the Strzelecki Creek last century (Tate, 1889), it may be synonymous with P. arida (syn. P. corymbosa) as Tate (1889) distinguishes P. spirostylis ssp. glabra (syn. P. synandra sensu Tate, 1889) from his P. indica. Until its identity is clarified, nothing can be said about its status.

P. spirostylis ssp. glabra. P. spirostylis ssp. glabra (syn. P. synandra) was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and was collected in the Innamincka area in 1975 (Jessop, 1982). It is included in the Cooper Basin list (E.R. & P.G., 1980), but wasn't encountered during the present survey. Status rare.

CHENOPODIACEAE

Atriplex angulata. Fan saltbush. A. angulata (syn. A. angulatum) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills area in 1975 (Jessop, 1982). Included in the Cooper Basin list (E.R. & P.G., 1980), the species has been found to occupy lake habitats in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed at 16 localities in the vicinity of 8 sites (1, 4, 6, 8A, 14, 23, 25 & 28), in floodout, ephemeral lake, channel edge, interdune, interdune claypan, gibber plain, gibber plain clay lens and open gibber clay flat habitats. Where collected it was common. Status very common.

A. crassipes. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was collected during the present survey from adjacent to a channel in Tirrawarra Swamp. It is indicated to occupy swamp habitat of Embarka Swamp (S.E.A. 1982), but this requires confirmation by the author. Status uncommon.

A. eardleyae. Collected from adjacent to yards at Pilalchilpna W.H., where it was found to be uncommon during the present survey, it is not otherwise known from the study area. Status uncommon.

A. sp. aff. eardleyae. Collected between Pilalchilpna and Yalcuma W.H.'s during the present survey. Status uncommon.

A. holocarpa. Pop saltbush. A. holocarpa (syn. A. holocarpum) was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). It was not collected this survey. Status rare.

A. sp. aff. holocarpa. Collected on the SW margin of Embarka Swamp during the present survey. Status uncommon.

A. incrassata. Indicated to occupy swamp habitat of Embarka Swamp (S.E.A., 1982), but this record needs confirmation by the author. Also recorded on data sheets for a dune/gibber plain interface SE of Lake Moorayepe and a floodout and clay flat south of Lake Perigundi (these records cannot be confirmed due to lack of specimens) during the present survey. Status fairly common, but possibly misidentified.

A. inflata. Included in the Cooper Basin list (E.R. & P.G., 1980), it is indicated to occupy lake habitats near Embarka Swamp (S.E.A., 1982), but this record requires confirmation by the author. Status rare if not misidentified.

A. leptocarpa. Slender-fruited saltbush. A. leptocarpa (syn A. leptocarpum) was collected just outside the study region in the area of Tinga Tingana in 1924 (Cleland et al., 1925) and in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). It was collected or observed during the present survey on a floodout near Karawinnie W.H., a floodout south of Lake Oolgoopiarie, a low white dune/lake interface on the eastern edge of Lake Toontoowaranie, clay flats, clay flat/dune interfaces and sand plain/swampy floodout interfaces near Site 25 and from floodouts north of Toolache W.H. and east of Moomba. Status patchy and common.

A. limbata. A. limbata (syn. A. limbatum) was found to be a common plant along the Cooper Creek between Innamincka and Kanowana early this century (Black, 1917). A. limbata was collected in the Clifton Hills area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It is indicated to occupy undulating dune habitat in the vicinity of Embarka

Swamp (S.E.A., 1982) and was found during the present survey to be common on a floodout 10 km south of Gidgealpa Homestead, from which it was collected Status uncommon.

Atriplex lindleyi. A. lindleyi (syn. A. halimoides) was collected," towards Cooper Creek ", last century (Tate, 1889). Two specimens were collected during the present survey, one from the dry ephemeral lake bed of Lake Oolgoopiarie and the other from a floodout west of Chillimookoo W.H (it was uncommon here). Status uncommon.

A. lobativalvis. Considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974), it appears not to have been collected in the study area prior to the present survey. The species was observed or collected on the base of a red dune 6 km east of the southern tip of Lake Moorayepe (it was locally common here), in an interdune nearMudcarnie W.H., on an interdune claypan 4.5 km south of Tooroowatchie W.H., a channel of Tirrawarra Swamp and a floodout north of Toolache W.H. Status fairly common.

A. muelleri. Annual saltbush. This species was collected from between Cordillo Downs Homestead and Innamincka in 1924 (Cleland et al., 1925). A number of specimens identified in the field as this species were identified as Atriplex sp. by the State Herbarium due to absence of fruit. The field identifications are considered to be correct. Specimens were collected on the edge of a floodout adjacent to Chillimookoo W.H., at the SE corner of Tirrawarra Swamp (Site 13), at the western edge of Embarka Swamp (Site 21) and from the south-western corner of Embarka Swamp. Status fairly common.

A. nummularia. Old man saltbush. A. nummularia was collected in the Clifton Hills area in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of river channels and floodplains (E.R. & P.G., 1980). It occupies lake habitats near Embarka Swamp (S.E.A., 1982). In the present survey, the species was collected or observed on floodout and ephemeral lake habitat most often, however it also occurred on dune/swamp interface, dune/gibber interface, gibber plain and channel edge habitat. Status very common and fairly widespread - dominant in some parts.

A. rhagodioides. River saltbush, bluebush. Collected in the Coongie area in 1975 (Jessop, 1982), it is reported to occupy lake habitats in the area of Embarka Swamp (S.E.A., 1982), but this latter record requires confirmation by the author. It was not collected this survey. Status rare.

A. spongiosa. Pop saltbush, annual saltbush. A. spongiosa (syn. A. spongiosum was found to grow abundantly after rain in the area of Innamincka in 1916 - a good stock feed (Black, 1917) and reported to grow on gibber country in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of gibber downs, river channels and floodplains (E.R. & P.G., 1980). In the vicinity of Embarka Swamp, it occupies swamp, lake and relict channel habitats (S.E.A., 1982). In the present survey, it was found to be very common and widespread in the study area in all habitats, except on dunes. Status very common.

A. velutinella. A. velutinella (syn. A. velutinellum) was said to consist of large bushes, with much new growth after rain, at Murteree (=Merty Merty) and along the Strzelecki Creek in 1916 (Black, 1917) and was found in the area of Cordillo Downs Homestead, between here and Innamincka and in the area of Tinga Tingana in 1924 (Cleland et al., 1925). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). During the present survey, it was collected or observed at 14 localities in the vicinity of 11 sites (4, 6, 7A, 8, 11, 13, 14, 17, 23, 25 & 28), on dune, floodout, channel edge and interdune claypan habitat. Where collected it was common. Status very common.

Atriplex vesicaria. Bladder saltbush. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was collected or observed during the present survey on a gibber plain, dune/gibber plain interface and gibber plain clay lens south of Lake Moorayepe, on a floodout habitat near Site 6, on the ephemeral lake bed of Lake Oolgoopiarie and on a floodout south thereof, on a dune/ floodout interface 13 km SSW of Chillimookoo W.H. and on a floodout north of Toolache W.H. Where collected it was common to very common. Status common.

Babbagia acroptera. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of river channels and floodplains (E.R. & P.G., 1980). During the present survey, it was collected or observed on a low white dune/lake margin interface on the eastern borber of Lake Toontoowaranie (Site 8), on a disturbed clayey interdune 1 km north of Yalcuma W.H. (it was uncommon here), on the ephemeral lake bed of Big Lake Moonba and on a flat SE of the dune locality of Site 29. Status fairly common.

B. dipterocarpa. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was collected during the present survey on a gibber plain south of Lake Moorayepe (Site 1) and observed on a sand dune north of Lake Hope. Where collected it was uncommon. Status uncommon.

Chenopodium auricomum. Queensland bluebush, golden goosefoot. Found growing in the dry bed of the Strzelecki Creek (to a height of 4 feet) near a soakage well in 1916 (Black, 1917), it was collected on flats in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982). The species was also collected in the Clifton Hills area in 1962 and 1975 and in the Innamincka area in 1968 (Jessop, 1982). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, it was collected or observed at 19 localities in the area of 9 sites (1, 4, 7, 7A, 8A, 13, 14, 23 & 28), in floodout, interdune and inter-dune claypan, gibber plain, dune/gibber plain interface, gibber plain clay lens, channel edge and swamp habitats. Where collected it was common. Status very common.

C. cristatum. Crested goosefoot. Collected from the study area, it appears, for the first time during the present survey, it was collected from a deep white dune SE of Boggy Lake and from moist grey clays on the edge of the Cooper Creek at a point 6 km SW of Chillimookoo W.H. Status uncommon - appear to be localised in the central Cooper Creek Floodplain.

C. nitrariaceum. Nitre goosefoot. Collected from the area of Cuttapirie Corner in 1916 and said to be,..., " a common plant, which attains a height of 8 to 10 feet on the country over-which the Cooper overflows at times" (Black, 1917), it was collected 25 miles south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It was found to occupy swamp and relict channel habitat in the area of Embarka Swamp in 1982 (S.E.A., 1982). During the present survey, it was collected or observed at 11 localities in the area of 6 sites (1, 6, 23, 25, 28 & 30), in floodout,swamp, ephemeral lake, plain and clayflat habitats. Where collected it was uncommon. Status very common with a patchy distribution - more common in the southern part of the study area.

Dissocarpus biflorus. D. biflorus (syn. Bassia biflorus) was found at Murteree (=Merty Merty) in 1916,..., " a good deal of this plant was met with near to Strzelecki Creek growing mostly on sandy country " (Black, 1917). Two varities area now known to occur in the study area, viz. D. biflorus var. biflorus and D. biflorus var. cephalocarpa.

- D. biflorus var. biflorus. Uncommon and localised on saline clay or stony scree slopes (Jessop, 1981), this variety was collected during the present survey on a gibber plain dominated by Astrebla pectinata, 3.5 km south of Lake Moorayepe, and was observed to be present in a swampy area in the same gibber plain. Where collected it was uncommon. Status uncommon - possibly restricted to the northern part of the study area.
- D. biflorus var. cephalocarpa. Included in the Cooper Basin list (E.R. & P.G., 1980), it was found to occupy swamp, river and undulating dune habitat in the area of Embarka Swamp in 1982 (S.E.A., 1982). During the present survey, it was collected on the dry surface of the ephemeral lake bed of Big Lake Moonba, SE of Moomba, where it was common. Status uncommon overall, but locally common in parts.

D. paradoxa. Cotton balls, curious saltbush. Two forms of D. paradoxa (syn. Bassia paradoxa) were reported from the Cooper Creek study region early this century (Black, 1917). It is stated by Black (1917), that D. paradoxa was very plentiful over most of the country at the time and was only eaten by camels, at least when the spiny fruitingheads were formed. The two forms, now recognised as varieties (Jessop, 1983), are D. paradoxa var. paradoxa, which was found near Lake Perigundi in 1916, and a broad-leaf form D. paradox var. latifolius (see Black, 1943-57), which was found on the Strzelecki Creek near Innamincka in the same year.

- D. paradoxa var. latifolius. This variety was collected during the present survey from a floodout 10 km south of Gidgealpa Homestead, where it was uncommon, and from a pale to yellow sand plain 6 km ESE of Scrubby Camp W.H. (Site 24). Status uncommon.
- D. paradoxa var. paradoxa. This variety is not otherwise known from the study area and was not collected during the present survey. Status uncertain - probably very rare.

Fruits were observed on a floodout west of Chillimookoo W.H. and on a floodout well to the north of Toolache W.H. These may belong to either variety, but based on collections it is more likely that they belong to D. paradoxa var. latifolius. If this is the case then the status of this variety should be considered as fairly common.

Dysphania myriocephala. Nettle-leaf goosefoot, red crumbweed. Collected in the area of Cordillo Downs Homestead in 1924 and identified under the incorrect name of D. littoralis, a species of tropical coasts (Cleland et al. 1925; Black, 1943-57; Jessop, 1981), it was considered rare with a populatior of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). D. myriocephala is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Einadia nutans. Climbing saltbush. E. nutans (syn. Rhagodia nutans) was reported from the area of Innamincka last century (Tate, 1889) and collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It was collected in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). In the present survey, E. nutans was collected or observed in open coolibah woodland in a swampy area on a gibber plain 3.5 km SE of Lake Moorayepe (it was uncommon here), on undulating dunes north of Chillimookoo W.H. in Acacia victoriae shrubland over ephemerals (it was uncommon here), in coolibah/bean tree woodland on grey silty clays near Toonman W.H. (it was rare here) and on a pale to yellow sand plain 6 km ESE of Scrubby Camp W.H. (Site 24). Status fairly common in the central and northern parts of the study area.

Enchylaena tomentosa. Ruby saltbush, currant bush. This species was found along the Strzelecki Creek last century (Tate, 1889) and was reported to be a rather common full-fruited species,whose berries provided food for birds, in the region of Lake Perigundi in 1916 (Black, 1917). It was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982). The species is included in the Cooper Basin list as an occupant of gibber downs, river channels and floodplains (E.R. & P.G., 1980). In the vicinity of Embarka Swamp it occupies lake, relict channel and river habitats (S.E.A., 1982). During the present survey, it was collected or observed at some 38 localities in the area of 16 sites (1, 4, 6, 7, 8, 8A, 13, 14, 15, 16, 18, 20, 22, 23, 25 & 28), in floodout, channel edge, dune, undulating dune, sand plain, interdune, ephemeral lake and dune/floodout interface habitats. Status very common and widespread.

Halosarcia halocnemoides. Samphire. H. halocnemoides (syn. Arthrocnemum halocnemoides) was considered depleted with a population originally widespread, but now reduced in area and needing constant monitoring in 1974 (Specht et al., 1974) and was collected in the Clifton Hills area in 1975 (Jessop, 1982) It is not otherwise known from the study area and was not collected during the present survey. Status rare.

H. indica ssp. leiostachya. Samphire. H. indica ssp. leiostachya (syn. Salicornia leiostachya) was reported from the lower Barcoo River (Qld) and the Lake Eyre Basin last century (Tate, 1889), but has not, it appears, been collected in the study area prior to the present survey. The species was considered depleted with a population originally widespread,but now reduced in area and needing constant monitoring in 1974 (Specht et al., 1974). During the present survey, it was collected or observed at 9 localities in the area of 5 sites (6, 8A, 11, 13 & 25), in floodout, clay flat, sand sheet/ swampy floodout interface and saline lake margin habitats. Where collected it was common. Status common (locally) in the central-western and south-western parts of the study area. May occur in the vicinity of salt lakes in the wider North-western Dunefields, north of the central Cooper Creek Floodplain, but this area wasn't surveyed, so its presence here cannot be verified at present.

Maireana aphylla. Cotton bush, round-leaf toadflax. This species was collected in the Clifton Hills area in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of gibber downs (E.R. & P.G., 1980). It occupies lake and undulating dune habitats in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed on a gibber plain, in gibber plain gutters, on a gibber plain clay lens and on a dune/floodout interface south of Lake Moorayepe, in a red interdune (it was rare here) and on a floodout near Site 6, on undulating dunes on the eastern border of Lake Marrakoonamooka, on a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24), on a floodout 4 km NW of Moomba and in a broad interdune 62 km north of Toolache W.H. Where collected it was generally uncommon. Status widespread, patchy and common.

M. astrotricha. Low bluebush. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of gibber downs, river channels and floodplains (E.R. & P.G., 1980). It is not otherwise known from the study area and was not collected during the present survey. Status rare.

M. ciliata. M. ciliata (syn. Kochia ciliata) was reported from along the Strzelecki Creek last century (Tate, 1889). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct along the Strzelecki Creek.

Maireana coronata. M. coronata (syn. Kochia coronata) was reported from Murteree (=Merty Merty) and along the Strzelecki Creek in 1916, but was found mostly on tablelands (Black, 1917). It was collected or observed during the present survey on a gibber plain south of Lake Moorayepe, a red dune near Site 6, an open gibber clay flat NW of Site 6 (it was common here), a floodout west of Chillimookoo W.H., a floodout 10 km east of Moomba (it was common here) and a floodout near Toolache W.H. Status widespread and common with a patchy distribution.

M. eriantha. A species of rocky plains and hills (Jessop, 1981), M. eriantha (syn. Kochia eriantha) was reported from between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889). It is not otherwise known from the study area and was not collected this survey. Status uncertain - possibly very rare if not locally extinct.

M. georgei. A species of rocky hills and loamy flats (Jessop, 1981), it was collected in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey, M. georgei was collected, 62 km north of Toolache W.H.,in coolibah/Cassia nemophila/Acacia victoriae open shrubland on a broad sand sheet adjoining a floodout. It was uncommon here. Status uncommon.

M. microcarpa. Not otherwise known from the study area, it was collected during the present survey from a red dune base 6 km east of the southern tip of Lake Moorayepe, in clays with Atriplex spp., and in swamp canegrass hummock grassland in an interdune 2 km NNW of Mudcarnie W.H. The species was locally common at both localities, Status fairly common in the northern and north-east parts of the study area.

M. pyramidata. Black bluebush, shrubby saltbush. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was collected during the present survey from the lower slope/interdune interface of a red dune 15 km WNW of Lake Oolgoopiarie (Site 6) and observed on a floodout 2.2 km north of Karawinnie W.H. Status uncommon in the central-western part of the study area.

M. sedifolia. Bluebush. M. sedifolia (syn. Kochia sedifolia) was reported from the Strzelecki Creek last century (Tate, 1889). It is not otherwise known from the study area and was not collected during this survey. Status uncertain - probably very rare if not locally extinct along the Strzelecki Creek.

Malacocera tricornis. Soft horns, soft-horned saltbush. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is not otherwise known from the study area and was not collected this survey. Status rare.

Neobassia proceriflora. Soda-bush. N. proceriflora (syn. Threlkeldia proceriflora) was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). It was not known from the study area prior to the present survey. During this survey, it was observed or collected on a gibber plain south of Lake Moorayepe, a floodout and undulating dunes north of Chillimookoo W.H., the southern end of Queerbidie W. H. (it was common here), a floodout adjacent to Toolache W.H. (Site 28) and a floodout 12 km north of Toolache W.H. (it was common here). Status common.

Rhagodia gaudichaudiana. Not otherwise known from the study area, it was collected from the channel edge of Brady's W.H. (Site 7) during the present survey. Status uncommon.

Rhagodia spinescens. Spiny saltbush. R. spinescens (syn. R. spinescens var. deltophylla) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). The species was collected in the Clifton Hills area in 1975 (Jessop, 1982) and occupies undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected from an ovoid interdune border, 2.5 km north of Brady's W.H., in Eremophila macdonnellii open shrubland. It was uncommon here. Status uncommon with a patchy distribution.

Salsola kali. Soft roly-poly, roly-poly, buckbush, prickly saltwort. Reported from between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889), it was said to be growing in great masses in sandhills near Tinga Tingana and along the Strzelecki Creek in 1916,..., " young plants are deep green, dry off to brown, detach from sand and roll about for miles "(Black, 1917). Two varieties have been reported from the study area, viz. S. kali var. kali and S. kali var. strobilifera.

- S. kali var. kali. It was collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes (E.R. & P.G., 1980). It occupies lake habitat in the area of Embarka Swamp (S.E.A., 1982).During the present survey, it was found to be very common, occurring in the vicinity of a majority of survey sites.It most frequently occupied parallel dune habitat, but was also encountered on undulating dunes, sand plains, ephemeral lake and floodout habitat. Status very common and widespread.
- S. kali var. strobilifera. Collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Schlerochlamys brachyptera. Short winged saltbush. S. brachyptera (syn. Bassia brachyptera) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey, this spreading subshrub was collected from coolibah/river red gum woodland at the southern end of Queerbidie W.H., where it was found to be common. Status uncommon overall, but locally common in parts.

Sclerolaena andersonii. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills area in 1975 and in the Innamincka area in 1924 and 1968 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, it was collected on a gibber plain 3.5 km south of Lake Moorayepe, where it was found to be common. It may also occur on Big Lake Moonba. Status uncommon overall, but locally common in parts.

S. bicornis. Goat's head burr, goat head. S. bicornis (syn. Bassia bicornis) was reported from the Cooper Creek last century (Tate, 1889) and collected in the area of Cordillo Downs Homestead and 25 miles south thereof in 1924 (Cleland et al., 1925). S. bicornis was collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of gibber downs, river channels and floodplain (E.R. & P.G., 1980). It occupies lake, relict channel, river and undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed at 17 localities in the area of 8 sites (1, 4, 6, 8A, 14, 15, 23 & 28), on gibber plain, gibber plain gutter, open gibber clay flat, dune/floodout interface, channel edge, claypan edge, interdune, ephemeral lake and floodout habitats. It occurred most frequently on floodouts. Status very common.

Sclerolaena bicuspis. S. bicuspis (syn. Bassia bicuspis) was reported from between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was considered rare in Australia by Leigh et al. (1981). It now may not occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct.

S. calcarata. Red burr. Collected in the study area for the first time during the present survey, S. calcarata was encountered in Zygochloa paradoxa hummock grassland on a red dune near Site 6, where it was uncommon, and in lignum tall shrubland adjacent to a channel in Tirrawarra Swamp, where it was common. Status uncommon overall, but locally common in parts.

S. costata. This species was collected in the study area for the first time during the present survey on a floodout 12 km north of Toolache W.H., where it was locally common. Status uncommon overall, but locally common in parts - known only from the SE part of the study area.

S. diacantha. Grey copper burr. Collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980) and occupies lake and undulating dune habitat in the vicinity of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed at 21 localities in the vicinity of 14 sites (1, 4, 6, 7, 7A, 13, 14, 16, 17, 23, 24, 25, 28 & 29), in floodout, ephemeral lake, channel edge, dune, interdune, undulating dune and sand plain habitat. Where collected it ranged in abundance from uncommon to common. Status widespread and very common.

S. divaricata. Copper burr, munyeroo. Collected in the area of Tinga Tingana in 1924 (Cleland et al., 1925), it is included in the Cooper Basin list as a species of river channels and floodplains (E.R. & P.G., 1980). It is reported to occupy lake and river habitat in the area of Embarka Swamp (S.E.A., 1982), but this requires confirmation by the author. It is not otherwise known from the study area and was not collected this survey. It is possible that the most recent record for the study area is misidentified. Status uncertain - rare if not misidentified. May not occur in the study area.

?S. holtiana. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), S. holtiana (syn. Bassia holtiana) was listed as endangered in S.A in 1977 (Jessop, 1977). In 1981, it was stated to have a maximum geographic range of less than 100 km and suspected of being threatened or rare in region 22 of S.A. (Leigh et al., 1981). The species is recorded on a data sheet as having been observed at the southern end of Queerbidie W.H., during the present survey. Status uncommon if not misidentified - Queerbidie W.H. needs to be rechecked for the presence of this species as its presence here will add significantly to the known range of the species.

S. intricata. Collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980) and occupies relict channel and river habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed at 30 localities in the area of 11 sites (1, 6, 7, 8, 8A, 13, 14, 23, 25, 28 & 29), in ephemeral lake, floodout, channel edge, dune and interdune habitat. Where collected it was common. Status very common and widespread.

Sclerolaena lanicuspis. Spinach burr, woolly spinach burr. S. lanicuspis (syn. Bassia lanicuspis) was collected near Lake Perigundi in 1916 (Black, 1917) and in the area of Cordillo Downs Homestead and between here and Innamincka in 1924,..., " grows in gibber country" (Cleland et al., 1925). It was collected in the Clifton Hills area in 1975 (Jessop, 1982). In the present survey, specimens were observed or collected on gibber plains and a dune/ floodplain interface south of Lake Moorayepe, on an open gibber clay flat NW of Site 6 and at the southern end of Queerbidie W.H. Where collected it was common. Status fairly common in the northern, north-western and eastern parts of the study area.

S. muricata var. muricata. Not known in the study area prior to the present survey, it was collected from an Eragrostis australasica hummock grassland community in an interdune 2km NNW of Mudcarnie W.H., where it was found to be common. Status uncommon overall, but locally common in the NE part of the study area.

S. parallelicuspis. Collected in the study area for the first time during the present survey, it was found in an Acacia victoriae/Grevillea striata low open woodland at a dune/floodplain interface 4.5 km south of Lake Moorayepe and observed on a red dune in the same area. Status uncommon in the northern part of the study area.

S. sp. aff. tatei. Collected at the southern end of Queerbidie W.H., where it was found to be uncommon, and given the field name of S. parallelicuspis. Status uncommon.

Sclerolaena sp. (between S. bicornis and S. tricuspis). Collected during this survey from an open gibber clay flat NW of Site 6, where it was uncommon, and from a floodout adjacent to Tirrawarra W.H. Status uncommon.

S. tricuspis. Bindyi, three-spined roly-poly. Included in the Cooper Basin list as a species of river channels and floodplains (E.R. & P.G., 1980), it is not otherwise known from the study area and was not collected this survey. Status rare.

S. uniflora. Included in the Cooper Basin list (E.R. & P.G., 1980), it may occupy river habitats in the area of Embarka Swamp (S.E.A., 1982), but this latter record requires confirmation by the author. Status rare.

S. ventricosa. Collected inthe study area for the first time during the present survey, it was encountered on the ephemeral lake bedof Big Lake Moonba and was found to be uncommon on a floodout 10 km south of Gidgealpa Homestead. Collected from the above localities it was also observed on an orange dune adjacent to Mudcarnie W.H. (Site 4). Status fairly common.

Sclerostegia tenuis. Samphire. S. tenuis (syn. Pachycornia tenuis) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills area in 1975 (Jessop, 1982). It is not otherwise known from the study area and was not collected this survey. Status rare.

CHLOANTHACEAE

Dicrastylis costelloi. Reported as good sized bushes 18 inches to 2 feet high, around Lake Perigundi in 1916 (Black, 1917:- in Black, 1943-57 as D. doranii), it appears not to have been collected in the study area again till the present survey. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in an interdune near King Lookout (Site 7). Status uncommon - may no longer occur near Lake Perigundi.

Dicrastylis lewellinii. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Innamincka area in 1975 -"a significant collection as it is a rare species previously only known from the edge of the Nullarbor" (Jessop, 1982)and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected during the present survey. Status rare.

Newcastelia cephalantha. Collected in sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982), it was collected in the Innamincka area in 1975 and the same area in 1922 (Jessop, 1982). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). It was not collected this survey. Status rare.

CLEOMACEAE

Cleome viscosa. Tick-weed. C. viscosa (syn. Polanisia viscosa) was collected near dry watercourses in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare. (in Fl. Australia, Vol. 8, Pp.224-225, this species is included in CAPPARACEAE)

CLUSIACEAE (GUTTIFERAE)

Hypericum gramineum. A specimen observed on a floodout adjacent to Toolache W.H. (Site 15) may belong to this species. It was not collected, so this cannot be confirmed. Status uncommon if not misidentified.

H. japonicum. Reported from along the Strzelecki Creek last century (Tate, 1889), it is not considered to occupy the NE (Jessop, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

CONVULVULACEAE

Bonamia media. B. media (syn. Breweria media) was reported from the Cooper Creek last century (Tate, 1889). It is no longer considered to occur in S.A. (Jessop, 1981, 1983), but occurs over the border in Qld (Dawson and Boyland, 1974) and could possibly have been introduced to the study area during floods of the Cooper. Status uncertain - probably very rare if not locally extinct.

Convulvulus erubescens. Common bindweed. Reported from the area of Innamincka last century (Tate, 1889), it was found growing in the centre of bushes in the area of the Cooper and Strzelecki Creeks in 1916,..., " otherwise it would be exterminated by stock " (Black, 1917) and was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Collected in the Innamincka area in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980) and occupies lake habitat in the area of Embarka Swamp (S.E.A, 1982). During the present survey, it was collected or observed on the channel edge of Mudcarnie W.H., in dune,floodout and open gibber clay flat habitat near Site 6, on a dune/floodout interface 13 km SSW of Chillimookoo W.H., on a deep white dune SE of Boggy Lake (Site 16), on undulating dunes on the eastern edge of Lake Marrakoonamooka, where it was found to be common, on dunes 8 km south of White Lake, where it was uncommon,and on a claypan west of Toolache W.H. Status common.

Cressa cretica. Collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982), it was not collected this survey. Status rare.

Evolvulus alsinoides. E. alsinoides (syn. E. linifolius) was reported from the Cooper Creek last century (Tate, 1889). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it is not otherwise known from the study area apart from collections during the present survey of 2 specimens of E. alsinoides var. villosicalyx from NW of Innamincka. Status uncommon.

Ipomaea muelleri. Reported from north of Cooper's Creek (Black, 1943-57), it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

I. racemigera. Collected in the Innamincka area north of Cooper's Creek in 1924 (Black, 1943-57; Jessop, 1982), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Polymeria angustata sensu Tate (1889). Reported from along the Cooper Creek last century (Tate, 1889). Unsure of present identity. Status uncertain.

P. longifolia. Naturalised: Lesser bindweed. Reported from the Cooper Creek last century (Tate, 1889), but P. longifolia (syn. Convulvulus arvensis) may not have occurred in this State (Black, 1943-57). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

CRASSULACEAE

Crassula sieberiana. C. sieberiana ssp. sieberiana (syn. Tillaea verticillaris) was reported from the area of Innamincka last century (Tate, 1889). This subspecies now only occurs in the southern Lofty region of S.A. (Jessop, 1983). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct.

CUCURBITACEAE

Cucumis melo ssp. agrestis. Ulcardo melon. C. melo ssp. agrestis (syn. C. trigonus) was collected from a waterhole 25 miles south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). During the present survey, it was encountered on a gibber plain south of Lake Moorayepe and in a channel leading into the NE corner of Lake Apachirie, near Coongie. It was collected at the latter site. Status uncommon.

Mukia maderaspatana. M. maderaspatana (syn. Melothria maderaspatana) was collected along creek beds in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982). It is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, it was collected or observed on parallel dunes 18 km NNW of Coongie (Site 8A), on a dune/floodout interface 13 km SSW of Chillimookoo W.H., on undulating dunes 1 km north of Chillimookoo W.H. and on a red parallel dune 1 km SW of Lake Perigundi. At the latter locality, it was found to be locally common entwined on hummocks of Zygochloa paradoxa. Status fairly common - associated with dunes.

CYPERACEAE

Bulbostylis turbinata. B. turbinata (syn. B. capillaris) was collected in a watercourse in the area of Cordillo Downs Homestead in 1924 (Cleland et al 1925; Jessop, 1982). It may no longer occur in the NE (Jessop, 1981, 1983). Status uncertain - probably very rare.

Cyperus cunninghamii. Collected from the study area for the first time during the present survey from adjacent to the bank of Mudcarnie W.H. The species was previously only known from W.A. and N.T. and it was uncertain whether it occurred in the NW of S.A. in Central Australia (Jessop, 1981). Status uncommon.

C. sp. aff. cunninghamii. Collected from the study area for the first time during the present survey from the channel edge of Brady's W.H.(Site 7). It was previously considered to occur only in the NW of S.A. in Central Australia (Jessop, 1982). Status uncommon.

C. dactylotes. C. dactylotes (syn. C. clelandii) is known in the study area from only one collection, which was made in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). Status uncertain - probably very rare.

C. difformis. Variable flat-sedge. The species was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

C. eragrostis sensu Tate (1889). Considered to be present along the Strzelecki Creek in 1885 (Tate, 1889), it is uncertain whether Tate was referring to the naturalised drain flat-sedge or umbrella sedge C. eragrostis Lam., as this species is considered to occupy only the southern Lofty and South-east regions of S.A. (Jessop, 1983). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

C. exaltatus. Tall flat-sedge. Not previously recorded from the study area, it was collected during the present survey from lignum tall shrubland bordering a channel in Tirrawarra Swamp (it was locally common here) and may also occur in the vicinity of Scrubby Camp W.H. (Site 20). Status uncommon overall, but locally common in parts.

C. gilesii. Collected in the area of Innamincka last century (Tate, 1889) and in the same area in 1960 (Jessop, 1982), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected during the present survey. Status rare - there may be a localised population(s) in the area of Innamincka which persists or propagules may be periodically carried into the study area during floods of the Cooper.

C. gymnocaulos. Spiny flat-sedge. Collected in the Coongie area in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980). In the present survey, it was collected or observed on a low white dune/ lake margin interface at the eastern edge of Lake Toontoowaranie (Site 8), on the channel edge of Kudriemitchie W.H., on the edge of a channel in Tirrawarra Swamp, on a claypan in a floodout south of Lake Perigundi, where it was locally common, and on a salty lake/floodout interface 8 km south of White Lake, where it was also locally common. It may also occur at the southern end of Queerbidie W.H., near Innamincka. Status fairly common - locally common in parts.

C. iria.Collected in the area of Innamincka last century (Tate, 1889) and from watercourses in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925; Jessop, 1982), it was also collected in the Innamincka area in 1968 and in the Clifton Hills area " no date " (Jessop, 1982). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and was not collected during the present survey. Status rare.

Cyperus pygmaeus. Flat-sedge. This species was collected in the area of Tooroowatchie (=Toorawatchy) W.H. and from 40 miles north of Innamincka in 1924 (Cleland et al., 1925; Jessop, 1982). Jessop (1982), also includes a collection from the Clifton Hills area "no date". The species was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected this survey. Status uncertain - probably very rare (the last dated collection was in 1924).

C. rotundus ssp. retzii. Balsam grass, nut grass. C. rotundus ssp. retzii (as C. rotundus) was collected in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Clelandet al., 1925). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

C. squarrosus. Bearded flat-sedge. Collected in the Clifton Hills area previously " no date " (Jessop, 1982), it is not otherwise known from the study area and was not collected this survey. The species was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). Status uncertain - probably rare or very rare.

C. vaginatus. Flat-sedge. C. vaginatus (as C. vaginatus var. densiflorus) was collected from the Akalana Crossing along the Strzelecki Creek in 1924 (Cleland et al., 1925). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare; closely related to C. gymnocaulos (Jessop, 1981).

Eleocharis acuta. Common spike-rush. Collected in the Clifton Hills area in 1975 (Jessop, 1982) it was collected from the SE corner of Tirrawarra Swamp (Site 13) during the present survey. Contrary to its common name, which indicates that it is common, this appears to be erroneous at least for the study area. It appears to be uncommon(if not rare)in comparison to E. pallens (see below). Status uncommon.

E. pallens. Pale spike-rush. E. pallens (syn. Heleocharis acuta) was generally found growing close to watercourses or springs along the Strzelecki Creek in 1916 (Black, 1917; Jessop, 1982) and in watercourses in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982). It was also collected in the Innamincka area in 1968 (Jessop, 1982). Comsidered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it is included in the Cooper Basin list (E.R. & P.G., 1980) and occupies swamp habitat of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected from the western edge of Embarka Swamp (Site 21) and from in the swamp at its south-western margin (in water). It was observed in a swamp canegrass dominated interdune 2 km NW of Mudcarnie W.H. Status fairly common - it may no longer occur along the Strzelecki Creek.

Fimbristylis dichotoma. Eight day grass, common fringe-rush. F. dichotoma (syn. F. diphylla) was collected from a water-course in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982). The species was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Isolepis austaliensis. Club-rush. I. australiensis (syn. Scirpus australiensis) was collected in the area of Innaminacka last century (Tate, 1889), in the Clifton Hills area in 1934 and 1939 and the Innamincka area in 1968 (Jessop, 1982). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it is included in the Cooper Basin list (E,R, & P.G., 1980). It was not collected during the present survey. Status rare.

I. marginata. I. marginata (syn. Scirpus cartilaginous) was reported from the area of Innamincka last century (Tate, 1889). It is not otherwise known from the study area and was not collected this survey. The species is now not considered to occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

Schoenoplectus litoralis. S. litoralis (syn. Scirpus litoralis) was collected in the Clifton Hills area in 1975 (Jessop, 1982). It was not collected from the study area during the present survey. Status rare.

Scirpus maritimus. Sea club-rush. S. maritimus (now separated in the genus Bulboschoenus, Jessop, 1983) was collected in the Clifton Hills area in 1975 (Jessop, 1982). Itwas not collected during the present survey. Status rare.

EHRETIACEAE

Halgania cyanea. Rough halgania. H. cyanea was recorded from the area of Innamincka last century (Tate, 1889) and was collected in the same area in 1975 (Jessop, 1982). It apparently persists in this area. The species was not collected during the present survey. Status rare.

ELATINACEAE

Bergia ammannioides. B. ammannioides was reported from the area of Innamincka last century (Tate, 1889) and the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982). The species may not occur in the NE (Jessop, 1983). It was not collected during the present survey. Status uncertain - probably very rare, but possibly misidentified.

B. trimera. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974),it was collected in the Clifton Hills area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected this survey. Status rare.

EUPHORBIACEAE

Adriana hookeri. Waterbush, mallee bitter-bush. A. hookeri (syn. A. glabrata) was collected in sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). The species was collected in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list(E.R. & P.G., 1980). It was collected during the present survey from an orange dune east of Mudcarnie W.H. (Site 4) and an orange-brown dune near King Lookout (Site 7). Status uncommon - may only occur in the NE and east of the study area.

Euphorbia australis. Not previously collected in the study area, it was collected during thie survey on a gibber plain 3.5 km south of Lake Moorayepe, where it was common, and observed on a gibber plain 8 km south of the lake. Status uncommon overall, but locally common in parts - may only occur in the northern part of the study area.

E. boophthana. Gascoyne spurge, bottle-tree caustic. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is not considered to occur in S.A.

(Jessop, 1983), but it occurs in all areas around the perimeter of S.A. in Central Australia (Jessop, 1981), so can reasonably be expected to occur here. Status rare.

E. drummondii. Caustic weed, milk weed, mat spurge, buffalo bush, Currawinya clover. Reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), it was said to be a poisonous plant growing flat on the ground and in quantities on tablelands, in the area of the Cooper and Strzelecki Creeks, in 1916 (Black, 1917). It was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982). Included in the Cooper Basin list (E.R. & P.G., 1980), it occupies swamp and dune habitat in the area of Embarka Swamp (S.E.A., 1982). In the present survey, it was collected from a low orange dune adjacent to Bookabourdie W.H. (Site 17). Status uncommon.

E. parvicaruncula. Not otherwise known from the study area it may have been observed in the vicinity of gibber plain gutters and on a dune/floodout interface south of Lake Moorayepe and on a claypan edge near Mudcarnie W.H. It was collected from a floodout 10 km east of Moomba (and given the field name of E. stevenii), where it was uncommon. Status uncommon - if the observations are correct it should be considered fairly common.

E. stevenii. Bottle-tree caustic. Included in the Cooper Basin list (E.R. & P.G., 1980), it is not otherwise known from the study area and was not collected this survey. Status rare, but possibly misidentified.

E. tannensis ssp. eremophila var. eremophila. Caustic bush, flooded-ground caustic, desert spurge. E. tannensis ssp. eremophila var. eremophila (syn. E. eremophila) was reported from the area of Innamincka last century (Tate, 1889) and collected on a sandhill 20 miles south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). During the present survey, it was collected or observed at 14 localities in the area of 11 sites (1, 6, 7, 7A, 11, 16, 20, 21, 23, 24 & 28), on dune/gibber interface, dune, interdune, undulating dune, sand plain, floodout and open gibber clay flat habitat. It was common at at least one locality from which it was collected. Status very common.

E. wheeleri. A species usually of crests and upper slopes of sandhills (Jessop, 1981), it was reported from the area of Innamincka and between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889). It was collected on sandhills in the area of Cordillo Downs Homestead and 25 miles south of here in 1924 (Cleland et al., 1925) and was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). It was observed during the present survey on an open gibber clay flat NW of Site 6, but was not collected. Status uncommon.

Phyllanthus fuernrohrii. Sand spurge. Collected in the area of Tinga Tingana in 1924 (Cleland et al., 1925) and in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, the species was observed or collected on red dunes near Site 6, near the Appanburra Channel, on a pale sand dune just west of Coongie Lake, on dunes at three localities near Site 25 and on undulating dunes north of Chillimookoo W.H. and east of Lake Marrakoonamooka. Where collected the species was common. Status common.

P. lacunarius. Lagoon spurge, Caraweena clover. Collected along the upper Strzelecki Creek and in the area of Tinga Tingana in 1924 (Cleland et al., 1925), it was collected in the Clifton Hills and Coongie areas in 1975

(Jessop, 1982). In the present survey, it was collected or observed at 10 localities in the area of 8 sites (6, 8, 13, 14, 16, 25, 28 & 29), in dune, dune/floodout interface, low white dune/ephemeral lake margin interface, floodout and claypan habitat. Status common.

Phyllanthus sp. aff. lacunarius. Collected during the present survey on a sand sheet/floodout (swampy) interface near Pilalchilpna W.H., where it was locally common, and observed on a pale dune of recent deposition immediately bordering the western edge of Coongie Lake. Status fairly common.

P. maderaspatensis var. angustifolius. Known from a collection in the Innamincka area in 1968 (Jessop, 1982), it was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected this survey. Status rare.

Sauropus trachyspermus. S. trachyspermus (syn. Phyllanthus rhytidospermus) was collected in the area of Cordillo Downs Homestead and south of here in 1924 (Cleland et al., 1925). S. trachyspermus (syn. Glochidion rhytidospermum) was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). During the present survey, a specimen was collected from a claypan/floodout area on the edge of a dry salty lake 8 km south of White Lake. It was common here. Status uncommon overall, but locally common in parts.

FRANKENIACEAE

Frankenia angustipetala. Listed as endangered in S.A. in 1977 (Jessop, 1977), the species was collected during this survey from a broad interdune 62 km north of Toolache turnoff on the Innamincka road (it was uncommon here) and from NW of Innamincka. Status uncommon.

F. cinerea. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was listed as endangered in S.A. in 1977 (Jessop, 1977). In 1981, it was listed as rare with a maximum geographic range of over 100 km and was thought to occur in S.A. north of the Nullarbor region only (region 23) (Leigh et al., 1981). During the present survey, F. cinerea was collected from a disturbed clayey run-on area in an interdune 1 km north of Yalcuma W.H., where it was uncommon. Status uncommon in the western part of the study area. Due to the above collection,a revision of Leigh et al. (1981), will show the following modification, viz.
Frankenia cinerea 3R/W,S/8, 9, 23 -- 3R/W,S/8, 9, 23, 25 (Dr. J.D.Briggs, pers. comm.).

F. cordata. This species is reported to occupy lake habitats in the area of Embarka Swamp (S.E.A., 1982), but this record requires confirmation by the author. Status rare, but possibly misidentified.

F. cupularis. Collected in the Clifton Hills area in 1960 (Jessop, 1982), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and was listed as endangered in S. A. by Jessop (1977). It was not collected this survey. In Jessop (1983), it is considered that the species only occurs in the Eastern region of S.A. Status rare.

F. foliosa. This species is reported to occupy lake habitat in the area of Embarka Swamp (S.E.A., 1982), but this record requires confirmation by the author. Status rare, but possibly misidentified.

Frankenia gracilis. Collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982), it is not otherwise known from the study area and was not collected this survey. Status rare.

F. pseudo-flabellata. This species was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht *et al*., 1974). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and listed as endangered in S.A. by Jessop (1977). During the present survey, it was collected from the bed of Lake Apachirie, near Coongie (and given the field name of *F. foliosa*), where it was common. Status uncommon overall, but locally common in parts.

F. serpyllifolia. Collected from Murteree (=Merty Merty) and the area of Innamincka and said to be"often met with"in the area of the Cooper and Strzelecki Creeks in 1916 (Black, 1917), it was collected in the area of Cordillo Downs Homestead in 1914 (Cleland *et al*., 1925). In 1975, it was collected in the Clifton Hills area (Jessop, 1982) and in the present survey it was collected from a gibber plain 8 km south of Lake Moorayepe, where it was uncommon. Other records for *F. serpyllifolia* on data sheets, but not collected, are considered doubtful. Status uncommon.

F. uncinata. Not otherwise known from the study area it was collected during the present survey from moist clays adjacent to a bore overflow near Mudcarnie Well and from a claypan edge 3 km north of Mudcarnie W.H. It was common at both localities. Status fairly common in the NE part of the study area.

GENTIANACEAE

Centaurium spicatum. Australian centaury. *C. spicatum* (syn. *Erythraea australis*) was reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889). The species was collected in the Clifton Hills area in 1975 (Jessop, 1982) and is reported to occupy swamp habitat of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected from an Eragrostis australasica ephemeral swamp NW of Mudcarnie W.H. and an interdune claypan 3.0 km south of Tooroowatchie W.H. (Site 7A). Status uncommon - may no longer occur along the Strzelecki Creek or in the area of Innamincka.

GERANIACEAE

Erodium aureum. Naturalised species. This species was collected during the present survey from the area of a dry salty lake south of White Lake, where it was rare. Status uncommon.

E. crinitum. Native crowfoot, blue crowfoot. This species was collected from the western edge of Embarka Swamp (Site 21) during the present survey. Status uncommon.

E. cygnorum ssp. cygnorum. Reported to occur in river habitat in the area of Embarka Swamp (S.E.A., 1982), but this record requires confirmation by the author. Status rare, but possibly misidentified.

E. cygnorum ssp. glandulosum. Collected in the Innamincka area in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980). It was collected during the present survey from the SE corner of Tirrawarra Swamp (Site 13) and from a floodout 0.7 km west of Toolache W.H. It was common at the latter locality. The species may also occur on Big Lake Moonba, but no collection was made so this can't be confirmed. Status fairly common, locally common in parts.

GOODENIACEAE

<u>Goodenia cycloptera</u>. <u>G. cycloptera</u> was said to be fairly common in the area of Tinga Tingana, but seen only once higher in the Strzelecki Creek in 1916 (Black, 1917). <u>G. cycloptera</u> (includes the synonym <u>G. mitchellii</u>) was collected in the Clifton Hills area in 1960 and 1975 and in the Innamincka area in 1960 and 1968 (Jessop, 1982) and is included in the Cooper Basin list (E. R. & P.G., 1980). It was not collected this survey. Status rare.

<u>G. fascicularis</u>. Cowslip. <u>G. fascicularis</u> (syn. <u>G. glauca var. sericea</u>) was collected in a creek bed in the area of Cordillo Downs Homestead in 1924 (Cleland <u>et al</u>., 1925). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

<u>G. glauca</u>. Reported from along the Strzelecki Creek last century (Tate,1889), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht <u>et al</u>., 1974). During the present survey, the species was collected from moist grey clays adjacent to a channel on the western side of Coongie Lake, where it was locally common, and from the channel edge of Kudriemitchie W.H. Status fairly common, locally common in parts.

<u>G. sp. aff. havilandii</u>. This species was collected on a floodout 10 km south of Gidgealpa Homestead, where it was found to be uncommon. Status uncommon.

<u>G. heterochila</u>. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht <u>et al</u>., 1974), it was collected in the Clifton Hills area in 1975 (Jessop, 1982). It was not collected this survey. Status rare.

<u>G. lobata</u>.Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht <u>et al</u>., 1974), it was considered vulnerable with a maximum geographic range of less that 100km and to occur only in region 22 of S.A. in 1981 (Leigh <u>et al</u>., 1981). During the present survey, a specimen was collected from a floodout adjacent to Toolache W.H., where it was common, and the species observed to be present on a floodout 12 km north of Toolache W.H. and on the ephemeral lake bed of Lake Marrakoonamooka (these latter identifications cannot be confirmed due to lack of specimens). Status uncommon overall, but locally common at one locality. Due to the above collection, a revision of Leigh <u>et al</u>. (1981) will show the following modification, <u>viz</u>.
<u>Goodenia lobata</u> 2V/S/22 -- 3V/S/22, 25 (Dr. J.D. Briggs, pers. comm.).

<u>G. lunata</u>. Considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht <u>et al</u>., 1974), the species was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It wasn't collected during this survey. Status rare.

<u>Lechenaultia divaricata</u>. Reported from along the Cooper Creek last century (Tate, 1889), it was found growing in colonies in sandy soil in the area of Cordillo Downs Homestead and along the upper Strzelecki Creek in 1924 (Cleland <u>et al</u>., 1925). The species was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht <u>et al</u>., 1974) and was collected in the Clifton Hills and Coongie areas in 1975 and said to be,...," not rare in the far NE " (Jessop, 1982). It occupies river and undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, the species was collected or observed on red dunes south of Lake Moorayepe and near Site 6, on a stable orange dune crest (Site 10), on

undulating dunes north of Chillimookoo W.H. and east of Lake Marrakoonamooka, on a floodout 4 km NW of Moomba (it was locally common here) and growing in a Zygochloa paradoxa hummock on a red dune 1 km north of Yalcuma W.H. (it was uncommon here). Status common..

Scaevola aemula. S. aemula (syn. S. humilis) was reported from between Innamincka and Kanowana and considered to be a common plant along the Strzelecki Creek in 1916 (Black, 1917). The species was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list(E.R. & P.G., 1980). It occupies lake habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected from an orange dune 15 km WSW of Innamincka. In Jessop (1983), it is not considered to occupy the NE. Status uncommon.

S. collaris. In 1916 a large 2 foot high bush of this species was reported from the area of Lake Perigundi (Black, 1917). This is the only record and locality for the species in the study area. Status uncertain - probably very rare.

S. depauperata. Reported from the Cooper Creek last century (Tate, 1889), it was collected from sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974)the species was collected in the Clifton Hills and Innamincka areas in 1975 and also in the Clifton Hills area in 1956 and the Innamincka area in 1960 (Jessop, 1982). During the present survey, it was collected from an orange dune east of Mudcarnie W.H. (Site 4) and an orange-brown dune near King Lookout (Site 7). Status uncommon.

S. ovalifolia. Reported from the Strzelecki and Cooper Creeks last century (Tate, 1889), it was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills area in 1975 (Jessop, 1982). It occupies river and undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982). S. ovalifolia was collected or observed during the present survey on red dunes south of Lake Moorayepe and near Site 6, on an orange-brown dune near King Lookout (Site 7) and orange dunes 18 km NNW of Coongie. Where collected it was common. Status fairly common.(It is not considered to occupy the NE by Jessop (1983)).

S. spinescens. Prickly fanflower. This species was collected in the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889) and in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes (E.R. & P.G., 1980). It was not collected this survey. Status rare.

GYROSTEMONACEAE

Codonocarpus continifolius. Desert poplar, native poplar, western bell fruit. Considered depleted with a population originally widespread, but now reduced in area and needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected during this survey. Status rare.

Gyrostemon ramulosus. Said to occur on sandhills and to be found on Cordillo Downs Station in 1924 (Cleland et al., 1925), the species was considered depleted with a population originally widespread, but now reduced in area and needing constant monitoring in 1974 (Specht et al., 1974). It is not otherwise known from the study area and was not collected during the present survey. The species is not now considered to occupy the NE (Jessop, 1981, 1983), but occurs in adjacent areas in Qld (Dawson and Boyland, 1974). It may occupy the Triodia sand plains of the NE part of the study area, a preferred habitat of the species (Jessop, 1981), which were not studied during this survey.

HALORAGACEAE

Haloragis aspera. H. aspera (syn. H. heterophylla var. aspera) was reported from Murteree (=Merty Merty) along the Strzelecki Creek and between Innamincka and Kanowana in 1916,..., " often met with along the Cooper " ,..., " 6 to 10 inches tall" (Black, 1917). It was collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). The species occupies swamp habitat of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed at 15 localities in the area of 10 sites (4, 6, 7, 13, 14, 22, 23, 24, 28 & 29), in dune, interdune, undulating dune, sand plain, open gibber clay flat, channel, channel edge, swamp and floodout habitat. Where collected it was common. Status common.

H. glauca. Grey raspweed. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). it was collected in the Clifton Hills area in 1934 (Jessop, 1982). H. glauca forma sclopetifera was collected in the study area from the SE corner of Tirrawarra Swamp (Site 13) during the present survey. Status uncommon.

H. gossei. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected this survey. Status rare.

Myriophyllum muelleri. Collected in a waterhole in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it is not otherwise known from the study area and was not collected this survey. It is not considered to occupy the NE by Jessop (1983). Status uncertain - probably very rare, but possibly misidentified.

M. verrucosum. Collected from a waterhole in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

JUNCACEAE

Juncus planifolius. Broad-leaf rush. Reported from along the Strzelecki Creek last century (Tate, 1889), it is not otherwise known from the study area and was not collected during the present survey. It is not considered to occupy the NE by Jessop (1981, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

JUNCAGINACEAE

Triglochin calcitrapum. Spurred arrow-grass. T. calcitrapum (syn. T. calcitrapa) was found on damp soil in a watercourse in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

LAMIACEAE (LABIATAE)

Mentha australis. River mint. Collected from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), it was found growing in and near water in the area of Murteree (=Merty Merty) in 1916 (Black, 1917) and in watercourses in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925). The species was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is indicated to occupy river habitat in the area of Embarka Swamp (S.E.A., 1982), but this record requires confirmation by the author. A specimen collected from a channel edge adjacent to Chillimookoo W.H., was identified as this species - probably. It was common at this locality at the time of collection during the present survey. Status uncommon, but locally common in parts.

Prostanthera striatiflora. Reported from " towards Cooper Creek last century (Tate, 1889),there are no other records relating to the study area. Status uncertain - probably very rare if not locally extinct.

Teucrium racemosum. Grey germander. Reported from the Cooper Creek last century (Tate, 1889), two varieties are known from the study area, viz. T. racemosum var. racemosum and T. racemosum var. tripartitum.

- T. racemosum var. racemosum. Collected from Murteree (=Merty Merty) on the Strzelecki Creek and Cuttapirie Corner on the Cooper Creek in 1916 (Black, 1917), it was collected in the area of Cordillo Downs Homestead and south of here in 1924 (Cleland et al., 1925). This variety was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is reported to occupy swamp and river habitat in the area of Embarka Swamp (S.E.A., 1982). In the present survey, it was collected or observed on a gibber plain, in gibber plain gutters and on a dune/floodplain interface south of Lake Moorayepe, in an interdune of parallel dunes, on a claypan edge and in Eremophila macdonnellii dominated and Hakea eyreana fringed ovoid interdunes near Mudcarnie W.H., on a grey-brown dune base 4.5 km south of Tooroowatchie W.H. (Site 7A), adjacent to Scrubby Camp W.H. (Site 20), at the southern end of Queerbidie W.H., on a floodout 10 km south of Gidgealpa Homestead, on a sand plain 6 km ESE of Scrubby Camp W.H. and on a floodout 62 km north of Innamincka. Where collected it was common. Status very common.
- T. racemosum var. tripartitum. Collected in the area of Tinga Tingana in 1916 - only at one site along the Strzelecki Creek (Black, 1917, 1943-57), it was collected during the present survey from a pale to yellow sand plain, 6 km ESE of Scrubby Camp W.H. (Site 24). Status uncommon.

LILIACEAE

Bulbine alata. A native leek. B. alata (syn. B. semibarbata) was reported from the area of Innamincka last century (Tate, 1889). B. alata (syn. Bulbostylis semibarbata) was collected in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, it was observed or collected on a deep white dune SE of Boggy Lake (Site 16), on undulating dunes east of Lake Marrakoonamooka, on a floodout near Toonman W.H., adjacent to and 12 and 62 km north of Toolache W.H. on floodouts, on a floodout 10 km east of Moomba and on a clayflat near Site 29. Where collected it was common. Status common;appears to be restricted to the southern half of the study area.

Thysanotus exiliflorus. Reported from the area of Innamincka last century (Tate, 1889), the species was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). There are no other records relating to the study area. It was recently omitted from a list for the NE (Jessop, 1981), but its range is now thought to include the region (Jessop, 1983). Status uncertain - probably very rare if not locally extinct.

Tricoryne elatior. Yellow autumn-lily, yellow rush-lily. Reported from the Cooper Creek last century (Tate, 1889), it is not otherwise known from the study area and was not collected this survey. It is not considered to occupy the NE by Jessop (1981, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

LORANTHACEAE

Amyema maidenii. Mistletoe. A. maidenii (syn. Loranthus mitchellii) was collected from red mulga Acacia cyperophylla in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). It was not collected this survey. Status rare.

A. preissii. Mistletoe. A. preissii (syn. Loranthus linifolius) was reported from the Cooper Creek last century (Tate, 1889) and collected in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey, it was collected or observed on a Cassia phyllodinea bush on a gibber plain south of Lake Moorayepe, on a Santalum lanceolatum shrub in an ephemeral creek line 1 km north of Mudcarnie W.H., on a coolibah tree,Acacia victoriae shrub and A. stenophylla tree on floodout, undulating dune and channel edge habitat, respectively, in the vicinity of Chillimookoo W.H., on a floodout near a channel at Site 18, on a coolibah tree at Scrubby Camp W.H. (Site 20), on an Acacia victoriae shrub on a sand plain NW of Scrubby Camp W.H.& on an Acacia salicina tree on a floodout 1 km SE of Lake Perigundi. Where collected it generally was locally common. Status common.

A. quandang. Mistletoe. A. quandang (syn. Loranthus quandang) was reported from the Cooper Creek last century (Tate, 1889). There are no other records relating to the study area. Status uncertain - probably very rare if not locally extinct.

Diplatia grandibractea. Mistletoe. D. grandibractea (syn. Loranthus grandibractea) was reported from the Cooper Creek last century (Tate, 1889). Considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974), it was collected in the Clifton Hills area in 1960 and in the Clifton Hills and Coongie areas in 1975 - considered significant collections as the species was not otherwise known from the far NE at that time (Jessop, 1982). During the present survey, it was collected or observed, always on coolibah, on a floodout near a channel at Site 18, at the southern end of Queerbidie W.H., on a floodout near Toolache W.H. (Site 28), on a channel edge near Site 25, on the edge of a dry W.H. 1.2 km NE of Yalcuma W.H., on a floodout 3.0 km NE of Yalcuma W.H. and on a floodout 1.4 km SSW of Pilalchilpna W.H. Status common - appears to be restricted to the southern half of the study area and to be host specific to coolibah Eucalyptus microtheca in this region.

Lysiana exocarpi ssp. exocarpi. Mistletoe. L. exocarpi ssp. exocarpi (syn. Loranthus exocarpi) was reported from the Cooper Creek last century (Tate, 1889). In 1924, two forms of L. exocarpi ssp. exocarpi (syn. Loranthus exocarpi) were recognised by Cleland et al. (1925), viz. a yellow form collected in the area of Cordillo Downs Homestead from Acacia farnesiana and a red form collected between Cordillo Downs Homestead and Innamincka from Atalaya hemiglauca, in the area of Innamincka from Eremophila freelingii and E. dalyana and in the area of Tinga Tingana from Hakea leucoptera and Atalaya hemiglauca. The species was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop,1982) and is included in the Cooper Basin list as a species of the south-western dunes (E.R. & P.G., 1980). During the present survey, it was collected or observed on an ephemeral stream margin 3.0 km north of Mudcarnie W.H. from Santalum lanceolatum, on the channel edge of Brady's W.H. from Atalaya hemiglauca, Owenia acidula and Eucalyptus microtheca, on a sand dune 18 km NNW of Coongie from Acacia ligulata, on the SE corner of Tirrawarra Swamp (Site 13) from Acacia stenophylla, on undulating dunes north of Chillimookoo W.H. from Pittosporum phylliraeoides var. microcarpa, on grey-red dunes near Brolga #2 well site from Acacia victoriae, on a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24 - possibly parasitising Hakea leucoptera) and on a floodout near Site 25 from Muehlenbeckia cunninghamii. Where collected it ranged in abundance from uncommon to locally common. Status very common.

Lysiana linearifolia. Mistletoe. L. linearifolia (syn. Loranthus linearifolia was collected from Acacia tetragonaphylla in the area of Cordillo Downs Homestead in 1924,..., " probably " this species (Cleland et al., 1925). It is not otherwise known from the study area and is not now considered to occupy the NE or S.A. (Jessop, 1983), but it occurs in adjacent areas of Central Australia in Qld (Dawson and Boyland, 1974; Jessop, 1981). Status uncertain - probably very rare.

LYTHRACEAE

Ammania multiflora. A. multiflora (syn. A. baccifera) was reported from the Cooper Creek last century (Tate, 1889). It was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

Lythrum hyssopifolia. Lesser loosestrife. This species is reported to occupy swamp habitat of Embarka Swamp (S.E.A., 1982), but this record requires confirmation by the author. It is not otherwise reported from the study area and there are no specimens from the area in the State Herbarium. Status rare, but possibly misidentified.

MALVACEAE

Abutilon fraseri. Dwarf lantern flower, flannel-weed. Reported as"bushes to 3 feet"..., in,..," many places on high ground along creeks ", in the area of the Cooper and Strzelecki Creeks, in 1916 (Black, 1917), a variety, A. fraseri var. parviflorum, was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). A fraseri was collected in the Clifton Hills area in 1975 (Jessop, 1982). During th present survey, the species was probably encountered on a red dune south of Lake Moorayepe, on a red dune north of Karawinnie W.H. (adjacent to Site 6), on undulating dunes north of Chillimookoo W.H. and east of Lake Marrakoonamooka and on a deep white sand dune SE of Boggy Lake (Site 16). Only one specimen was collected, but the mericarps were destroyed by insects prior to examination so positive identification could not be made. Status fairly common.

A. halophilum. Reported from the area of Innamincka last century (Tate,1889), it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably veryrare if not locally extinct.

A. leucopetalum. Lantern bush. This species was reported from the Cooper

Creek last century (Tate, 1889). A. leucopetalum (syn. A. mitchellii) was encountered by Capt. S.A. White in the area of the Cooper and Strzelecki Creeks in 1916 (Black, 1917). A. leucopetalum was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). There are no other records for the species relating to the study area. Status uncertain - probably very rare.

Abutilon otocarpum. Desert chinese lantern, flannel weed. This species was collected in the Coongie and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, it was observed or collected on a red dune slope 1 km north of Kernacoopina W.H., on a dune/floodout interface 13 km SSW of Chillimookoo W.H., on a pale sand dune adjacent to Coongie Lake and a red dune 10 km west of the lake, on a dune near Bookabourdie W.H. (Site 17), on sand plains 14 km NW and 6 km ESE of Scrubby Camp W.H. (Sites 20 & 24), on undulating dunes east of Lake Marrakoonamooka and on orange dunes on the western edge of Embarka Swamp (Site 21). It was common at at least one locality from which it was collected. Status common.

A. theophrasti. Naturalised species. A. theophrasti (syn. A. avicennae) was reported from the Cooper Creek last century (Tate, 1889). It is not otherwise known from the study area and is not now considered to occupy the NE (Jessop, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

Alyogyne pinoniana. A. pinoniana (syn. Hibiscus pinonianus) is included in the Cooper Basin list (E.R. & P.G., 1980). It is not otherwise known from the study area and is considered by Jessop (1981, 1983) to occur only in the NW of the State. Status rare, but possibly misidentified.

Hibiscus krichauffianus. This species was recorded from the Cooper Creek last century (Tate, 1889). Collected from the Innamincka area in 1975 (Jessop, 1982) it is included in the Cooper Basin list (E.R. & P.G., 1980). In this survey, the species was collected or observed on a red dune slope 4 km south of Lake Moorayepe, on an orange dune east of Mudcarnie W.H. (Site 4) and on an orange-brown dune near King Lookout (Site 7). It was common at at least one of these loclities. Status fairly common in the northern and NE parts of the study area.

H. trionum var. vesicarius. Bladder ketmia. H. trionum var. vesicarius (syn. H. trinum) was reported from the Cooper Creek last century (Tate, 1889; Jessop, 1981). There are no other records relating to the study area and it may not now occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct.

Lavatera plebeia. Australian hollyhock, native hollyhock, marsh-mallow. Reported from the Strzelecki Creek last century (Tate, 1889), it was collected near Murteree (=Merty Merty) and said to grow luxuriantly (to a height of 5-6 feet) on swampy ground near waterholes in the area of the Cooper and Strzelecki Creeks in 1916 (Black, 1917). White (1917b) said the species was as common as lignum in the big swamp (Embarka Swamp) in 1916. L. plebeia was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Coongie and Clifton Hills areas in 1975 (Jessop,1982). Included in the Cooper Basin list (E.R. & P.G., 1980), it occupies swamp and river habitat in the area of Embarka Swamp (S.E.A., 1982). In the present survey, the species was collected or observed on the channel edge of Mudcarnie W.H., near a channel in Tirrawarra Swamp and in swamp and dune habitat in the SE corner of the swamp (Site 13), on the channel edge of Chillimookoo W.H. and on floodout adjacent to the W.H., on floodout near Site 18, on the wetsern edge of Embarka W.H., on the channel edge near Straw Bridge (=Nowrie Crossing) 19 km NNW of Embarka W.H., on floodout adjacent to Toolache W. H. and on floodout adjacent to Scrubby Camp W.H. It was common near Straw Bridge and uncommon near Embarka W.H. Status common - no longer grows in abundance in Embarka Swamp.

Lawrencia glomerata. L. glomerata (syn. Plagianthus glomeratus) was collected at one locality in the area of Lake Perigundi in 1916, where it grew to 12-15 inches high (Black, 1917). There are no other records relating to the study area. Status uncertain - probably very rare.

Malvastrum americanum. Naturalised: Spiked malvastrum. Reported from along the Strzelecki Creek last century (Tate, 1889), it was often met with along water courses,in the area of the Cooper and Strzelecki Creeks,by Capt. S.A. White in 1916 (Black, 1917). The species was collected in the area of Cordillo Downs Homestead and 25 miles south of here in 1924 (Cleland et al., 1925) and in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982). Included in the Cooper Basin list (E.R. & P.G., 1980), it was not collected in the present survey. Status rare.

Sida ammophila. Not previously recorded from the study area, it was collected or observed during the present survey on red dunes 4 km south of Lake Moorayepe, 3 km north of Mudcarnie W.H. and near Site 6, on an orange-brown dune near King Lookout (Site 7), on a deep white dune SE of Boggy Lake (Site 16), on a red dune slope 1 km north of Kernacoopina W.H., on a floodout 10 km south of Gidgealpa Homestead, on a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24) and on an orange dune 15 km WSW of Innamincka (Site 22). Status common.

S. corrugata. Corrugated sida. Reported from the area of Innamincka last century (Tate, 1889), it was collected in the area of Murteree (=Merty Merty) in 1916 (Black, 1917) and in the Coongie area in 1975 (Jessop, 1982). One specimen was recorded on a data sheet during the present survey as having been observed on a dune/floodout interface 13 km SSW of Chillimookoo W.H. It was not collected so its identity cannot be confirmed. Status uncommon or rare.

S. cunninghamii. Collected in the Innamincka area in 1916 and 1924 (Jessop, 1982), this species was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al, 1974). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1982). It is indicated to occupy undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982), but this record requires confirmation by the author. One specimen was recorded on a data sheet during the present survey froma red dune 10 km west of Coongie Lake, but not collected, so its identity cannot be confirmed. Status uncommon or rare.

S. fibulifera. Silver sida. This species was collected in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). A specimen was probably collected during the present survey from undulating dunes north of Chillimookoo W.H., however the quality of the specimen due to insect damage,precluded positive identification. It was uncommon at the above locality. Status uncommon or rare.

S. intricata. This species was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills area in 1975 (Jessop, 1982). It was not collected this survey. Status rare.

Sida sp. D (Fl. C. Aust. Pp. 218). S. sp. D (syn. S. virgata) was collected along watercourses in the area of Cordillo Downs Homestead in 1924 (Cleland e al., 1925). During the present survey, it was collected from a floodout 10 km south of Gidgealpa Homestead in association with S. ammophila. It was uncommon at this locality. Status uncommon.

Sida trichopoda. High sida. S. trichopoda (syn. S. corrugata var.trichopoda) was collected from between Innamincka and Kanowana and said to consist of bushes,18 inches to 2 feet high, growing on flooded ground in 1916 (Black,1917). It was collected from south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). During the present survey, the species was collected from a gibber plain 3.5 km south of Lake Moorayepe, where it was common. Status uncommon, but locally common in the northern part of the study area.

MARSILEACEAE

Marsilea drummondii. Common nardoo, nardoo. M. drummondii (syn. M. quadrifida was reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889). The species was collected from between Innamincka and Kanowana and said to be very plentiful along the Cooper and Strzelecki Creeks in 1916, where,..., " in some instances the leaves and fruit were very large" (Black, 1917). It was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). It is reported to occupy swamp and river habitat in the are of Embarka Swamp (S.E.A., 1982). The species was collected or observed during this survey, on a gibber plain, in gibber plain gutters and on a gibber plain clay lens south of Lake Moorayepe, in an interdune near Mudcarnie W.H., on an interdune claypan near King Lookout and in the same habitat 4.5 km south of Tooroowatchie W.H., near the Appanburra Channel, on the channel edge of Kudriemitchie W.H., in the SE corner of Tirrawarra Swamp (Site 13), on a channel edge 6 km SW of Chillimookoo W.H. and a floodout to the west of the W.H., on the western edge of Embarka Swamp (Site 21), at the southern end of Embarka Swamp, in the swamp itself and at its margin (Site 23) and at the southern end of Queerbidie W.H. Where collected it was common. Status very common - much more common in the past, but now reduced to small locally common patches and may no longer occur along the Strzelecki Creek.

M. hirsuta. Short-fruit nardoo. Collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it was considered endangered with only small colonies remaining under adverse conditons in 1974 (Specht et al., 1974). Ther are no other records relating to the study area. Status uncertain - probably very rare.

M. mutica. Nardoo. M. mutica (syn. M. brownii) was collected on " Cooper's Creek at Innamincka " in 1924 (Cleland et al., 1925). There are no other records relating to the study area and the species is now not considered to occupy the NE (Jessop, 1983). It may be a misidentified form of M. drummondii (see Black, 1943-57),due possibly to a larger than normal size under very favourable conditions at the locality from which it was collected. Status uncertain - probably very rare, but possibly misidentified.

MELIACEAE

Owenia acidula. Emu apple, sour apple, gruie, colare, gooya. This species was collected in sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Coongie and Innamincka areas in 1975 and in the Innamincka area in 1962 (Jessop, 1982). The species was collected or observed in this survey, on an orange dune and an ovoid interdune border (it was rare here) near Mudcarnie W.H., on an orange-red dune near King Lookout (Site 7), on a floodout adjacent to Chillimookoo W.H. (one tree only), on red dunes 1 km north of Kernacoopina W.H. (a grove of trees), on a floodout adjacent to Scrubby Camp W.H. (locally common as a grove of trees), on a channel edge near Straw Bridge (=Nowrie Crossing) 19 km NNW of Embarka W.H., on a floodout near Toonman W.H. (it was rare here) and on a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24). Status common - often as groves.

MENYANTHACEAE

Nymphoides crenata. Wavy marshwort. N. crenata (syn. Limnanthemum crenatum) was collected from mud near a waterhole in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Considered depleted with a population originally widespread, but now reduced in area and needing constant monitoring in 1974 (Specht et al., 1974), there are no other records relating to the study area. Status uncertain - probably very rare.

MIMOSACEAE

Acacia aneura. Mulga. Reported to be the most common species encountered in a survey of the Cooper and Strzelecki Creeks in 1916, the species was badly affected by stock, to such an extent that it was killed off in some localities, at this time (Black, 1917). It is included in the Cooper Basin list as a species of the south-western dunes, river channels and floodplains (E.R. & P.G., 1980), but there are no other records relating to the study area. Status uncertain-probably very rare.

A. brachystachya. Umbrella mulga, turpentine mulga. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of the south-western and Strzelecki dunes (E.R. & P.G., 1980), but there are no other records relating to the study area. Status rare.

A. cambagei. Gidgee, gidgea, gidya, stinking wattle. Collected from near watercourses in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it is included in the Cooper Basin list as a species of gibber downs (E.R. & P.G., 1980). The species is reported to occupy swamp and river habitat in the area of Embarka Swamp (S.E.A., 1982), but these records require confirmation by the author as they are considered doubtful. There are no other records relating to the study area. Status uncertain - probably very rare.

A. cyperophylla. Red mulga, mineritchie, minniritchi. Reported from the Cooper Creek last century (Tate, 1889) and from 20 miles north of Innamincka to the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982). It is included in the Cooper Basin list as a species of gibber downs (E.R. & P.G., 1980). During the present survey, no specimens were collected although the species was observed in ephemeral creek lines in the North-eastern Dunefield and Floodplain Environmental Subassociation; often as the subdominant in shrubland communities. Status uncommon overall, but more common in areas of the north-eastern and eastern parts of the study area.

A. dictyophleba. Collected in sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). It was also collected in the Clifton Hills area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, the species was encountered on an orange parallel dune 800 m east of Mudcarnie W.H. (Site 4), from which site it was collected. Status uncommon .

Acacia farnesiana. Mimosa bush, sweet acacia, cassie. Reported from along the Cooper Creek last century (Tate, 1889), it was collected from,..., " on the flats ",..., in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). The species was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974). During the present survey, the species was found to be locally commonon on the edge of a ephemeral creek line 1 km north of Mudcarnie W.H. It formed the subdominant. component of a tall open shrubland community with Acacia victoriae (probably ssp. victoriae) at this locality. Status uncommon, but locally common in the NE part of the study area.

A. ligulata.Dune wattle, sandhill wattle, umbrella bush, pitchuri willow, small cooba. A. ligulata (syn. A. varians - also recognised around this time as a variety of A. salicina) was widespread in the area of the Cooper and Strzelecki Creeks in 1916; "always a shrub (from 2-4 m high), which propogated from suckers " (Black, 1917) The species was collected in the area of Cordillo Downs Homestead and Tinga Tingana in 1924 (Cleland et al., 1925). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes (E.R. & P.G., 1980). In the area of Embarka Swamp, A. ligulata occupies dune and undulating dune habitat (S.E.A., 1982). During the present survey, the species was collected or observed at 39 localities in the area of 21 sites (1, 4, 6, 7, 7A, 8, 8A, 9, 10, 11, 14, 16, 19, 21, 22, 23, 24, 25, 28, 29 & 30), on parallel dunes most frequently, but also on undulating dune, uncoordinated dune and sand plain habitat. Status very common and widespread.

A. murrayana. Murray's wattle, colony wattle. Reported from the Cooper Creek last century (Tate, 1889), it was collected from sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Collected also in the Clifton Hills area in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes (E.R. & P.G., 1980). It occupies dune habitat in the area of Embarka Swamp (S.E.A., 1982). The species was collected or observed at 17 localities in the area of 13 sites (1, 4, 6, 7, 8, 10, 11, 16, 17, 20, 25, 29 & 30), in the present survey, in parallel dune and sand plain habitats. Where collected it was generally common. Status very common.

A. oswaldii. Umbrella wattle, umbrella bush, nelia, miljee. Reported from the Cooper Creek last century (Tate, 1889), it was collected in the area of Murteree (=Merty Merty), Cuttapirie Corner and Lake Perigundi in 1916,...,"a low shrub, which was often on the banks of dry watercourses and weeping in habit "(Black, 1917),and in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). In 1975, the species was collected in the Coongie area (Jessop, 1982) and it is included in the Cooper Basin list (E.R. & P.G., 1980). This species was collected or observed at 12 localities in the area of 10 sites(1, 7A, 8, 14, 17, 23, 24, 25, 28 & 29), in the present survey, on dune, undulating dune, sand plain, channel edge and floodout habitat. The species was uncommon where collected. Status widespread, common.

A. ramulosa. Horse mulga. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills area in 1975 (Jessop, 1982). Since it has been recognied that A. ramulosa and A. linophylla are possibly synonymous (Whibley, 1977), A. ramulosa is probably not as rare as was thought in 1974 by Specht et al. The species was not collected in the study area during this survey. Status rare.

A. salicina. Native willow, Broughton willow, doolan, cooba, willow wattle.

Collected in the area of Lake Perigundi in 1916,..., " a large tree 6-12 m high inhabiting moist situations especially the flats along running creeks and rivers " (Black, 1917), it was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of river channels and floodplains (E.R. & P.G., 1980). A. salicina was collected or observed during this survey on the channel edge of Kudriemitchie W.H., on a floodout near Chillimookoo W.H. and adjacent to the channel edge of the W.H., on a floodout between Darby's W.H. and Cuttapirie Corner W.H. (Site 18 - it was very common here), on channel edges 1.8 km SW and 2 km south of Pilalchilpna W.H. and near Site 25 and a floodout near Yalcuma W.H. Where collected it ranged in abundance from common to very common. Status common.

Acacia stenophylla. River cooba, coobah, bulgroo, belalie, eumong. Reported from along the Cooper Creek last century (Tate, 1889), it was collected in the area of Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925). The species was considered to be of geographical importance with a disjunct or isolated distribution in 1974 (Specht et al., 1974). Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of river channels and floodplains (E.R. & P.G., 1980). In this survey, it was collected or observed at 26 localities in the area of 12 sites (4, 8, 11, 13, 14, 15, 18, 20, 23, 25 & 28), on floodout, channel edge, swamp and less commonly interdune and ephemeral lake margin habitat. Status common near Site 25, Chillimookoo W.H. and Tirrawarra Swamp and tending to be locally common in other parts.

A. tetragonaphylla. Dead-finish, kurara. Collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it was collected in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes (E.R. & P.G., 1980). It occupies dune habitat near Embarka Swamp (S.E.A., 1982). A. tetragonaphylla was collected or observed during this survey on a red dune and in an interdune north of Karawinnie W.H. (Site 6), on a red dune 1 km north of Kernacoopina W.H., on an orange dune on the western edge of Embarka Swamp (Site 21), on undulating dunes on the eastern edge of Lake Marrakoonamooka, on a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24), in a pale interdune near Toolache W.H. and in dune habitat of Site 29. Where collected it was uncommon. Status common.

A. victoriae. Elegant wattle, bramble wattle, prickly acacia, gunda-bluey. Two subspecies occur in the study area, viz. A. victoriae ssp. arida and A. victoriae ssp. victoriae.

- A. victoriae ssp. arida. A low form of the species, it was collected or observed during the present survey on a gibber plain/sand dune base interface and a gibber plain/floodout/interdune interface south of Lake Moorayepe and on a plain near Toolache W.H. It was locally common at at least one of these localities. Status fairly common.
- A. victoriae ssp. victoriae. Elegant wattle. A fast growing species, which recovers quickly from disturbance (Jessup, 1951), A. victoriae ssp. victoriae (syn. A. sentis) was reported from the Strzelecki Creek last century (Tate, 1889) and was collected in the area of Cordillo Downs Homestead, Tinga Tingana and along the upper Strzelecki Creek in 1924 (Cleland et al. 1925). Collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of the south-western dunes, river channels and floodplains (E.R. & P.G., 1980). It occupies dune and undulating dune habitat adjacent to Embarka Swamp (S.E. A., 1982) and was collected or observed at 23 localities in the area of 12 sites (1, 4, 8A, 13, 14, 20, 21, 22, 23, 24, 25 & 28) during the present survey. The species was found to occupy parallel dune, interdune, interdune pan, undulating dune, sand plain, floodout, dune/floodout interface, sand sheet/swampy floodout interface, ephemeral channel and channel

edge habitat. Where collected it was common. Status very common, but uncommon to absent in some parts.

Acacia sp. An undescribed endemic species of Acacia, which is known from only one locality in the Clifton Hills area from which it has been twice collected (Jessop, 1982), is not otherwise known from the study area. Status rare.

Neptunia dimorphantha. N. dimorphantha (syn. N. monosperma) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974), there are no other records relating to the study area. Status uncertain - probably very rare.

MYOPORACEAE

Eremophila bignoniiflora. Gooranurra. E. bignoniiflora (syn. E. bignoniflora) was reported from along the Strzelecki Creek last century (Tate, 1889) and from the area of " Cordillo West " on Cordillo Downs Station in 1924 (Cleland et al., 1925; Jessop, 1982). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills and Coongie areas in 1975 and previously in the Clifton Hills area in 1930, 1934, 1939 and 1971 (Jessop, 1982). It is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, it was collected or observed at 15 localities in the area of 10 sites (4, 7, 8, 13, 14, 18, 20, 23, 25 & 28), on channel edge, floodout, ephemeral lake margin, interdune and dune/claypan interface habitat. Where collected it was common. Status very common.

E. clarkei. E. clarkei (syn. E. goodwinii) was reported from between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889). There are no other records relating to the study area and it is not now considered to occur in the NE (Jessop, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

E. dalyana. Reported from between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889), it was collected from amongst rocks on Innamincka Station in 1924 (Cleland et al., 1925). The species was collected in the Innamincka area in 1962 (Jessop, 1982) and was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). It was not collected this survey. Status rare.

E. duttonii. Reported from the Cooper Creek last century (Tate, 1889). There are no other records relating to the study area. Status uncertain - probably very rare if not locally extinct.

E. freelingii. Limestone fuchsia bush. Reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), bushes of this species were found to be much broken down by stock in the area of the Cooper and Strzelecki Creeks in 1916 (Black, 1917). The species was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected this survey. Status rare.

E. glabra. Black fuchsia, tar bush. E. glabra (syn. E. brownii) was reported from the area of Innamincka last century (Tate, 1889). There are no other records relating to the study area. Status uncertain - probably very rare if not locally extinct.

E. latrobei. Native fuchsia. Reported from the Cooper Creek last century

(Tate, 1889), it was collected in the Clifton Hills area in 1975 (Jessop, 1982). It was not collected this survey. Status rare.

Eremophila longifolia. Emu bush, native plum-tree, long-leaved Eremophila, berrigan. This species was collected in the area of Murteree (=Merty Merty) in 1916,..., " many of the shrubs were growing along the Strzelecki Creek, but were much broken down by stock "(Black, 1917), and in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes (E.R. & P.G., 1980) and occupies dune habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, the species was observed or collected on a gibber plain gutter south of Lake Moorayepe, on a red dune crest near Mudcarnie W.H., on an orange-red dune near King Lookout (Site 7), on a red dune 10 km west of Coongie Lake, on a floodout near Chillimookoo W.H., on a sand plain 14 km NW of Scrubby Camp W.H., on an orange dune 15 km WSW of Innamincka (Site 22) and in dunes 5 km north or Toolache W.H. Where collected it was common. Status common.

E. macdonnellii. Wakimba. Reported from along the Strzelecki Creek last century (Tate, 1889), it was collected on Kanowana in 1916,..., " one of the smallest species" ,..., " not common " ,..., " height of a few feet " (Black, 1917). The species was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). During the present survey, it was collected from an ovoid interdune border 2.5 km north of Brady's W.H., where it formed the dominant component of an open shrubland community, and from a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24). Status fairly common.

E. macgillivrayi.Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills area in 1975 and the Innamincka area in 1924, 1960 and 1970 (Jessop, 1982). In this survey, it was collected from a sandy-clay ovoid interdune 2.5 km north of Brady's W.H., where it was found to be very common. Status uncommon, but very common in the NE part of the study area.

E. maculata. Fuchsia bush, native fuchsia. Reported from along the Strzelecki Creek and the area of Innamincka last century (Tate, 1889), it was collected from the Strzelecki Creek SW of Innamincka and the area of Murteree (=Merty Merty) in 1916,..., " relished by stock " ,..., " bushes laden with ripe fruit " (Black, 1917). It was collected from a flat a few miles south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980). E. maculata was collected or observed during the present survey on an orange dune east of Mudcarnie W.H. (Site 4), in a red interdune 2.5 km north of Brady's W.H., on an open gibber clay flat NW of Karawinnie W.H., on a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24) and a floodout 62 km north of Toolache W.H. Where collected it was generally locally common. Status common.

E. obovata. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is not otherwise known from the study area and was not collected this survey. Status rare.

Myoporum acuminatum. Boobialla, water bush, native myrtle. M. acuminatum (syn. M. cunninghamii) was reported from along the Strzelecki Creek last century (Tate, 1889). There are no other records relating to the study area. Status uncertain - probably very rare if not locally extinct.

MYRTACEAE

Eucalyptus camaldulensis var. obtusa. Northern river red gum. E. camaldulensis var. obtusa (syn. E. rostrata) was reported from flooded watercourses generally in the Lake Eyre basin last century (Tate, 1889) and was collected in the area of Cordillo Downs Homestead and Innamincka in 1924,..., " none between Innamincka and 7 miles below Tinga(Tingana), but found from here to the end of the Strzelecki Creek " (Cleland et al., 1925). The species was collected in the Coongie and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of river channels and floodplains (E.R. & P.G., 1980). During the present survey, the species was observed or collected on the channel edge of Kudrimitchie W.H., on a channel edge in Tirrawarra Swamp, on the channel edge of Chillimookoo W.H. and on a floodout adjacent to the W.H., on a floodout bordering Tirrawarra W.H. (Site 15), adjacent to Scrubby Camp W.H. (Site 20), on an island in Minkie W.H. (Site 22) and at the southern end of Queerbidie W.H. Where collected it was uncommon. The species is found at Cuttapirie Corner W.H. on the Cooper (Dr. S.A. Parker, pers. comm.). Status common - occurs along the Cooper to Cuttapirie Corner on the main channel and to Coongie on the NW Branch.

E. microtheca. Coolibah, coolebah, swamp box. Reported from the Cooper Creek last century (Tate, 1889), it was encountered at Cuttapirie Corner and along the Cooper Creek in 1916,..., " lining all creeks and growing on flooded ground " (Black, 1917) and was found to occur between Cordillo Downs Homestead and Murnpeowie in 1924 (Cleland et al., 1925). The species was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of river channels and floodplain (E.R. & P.G., 1980). It occupies relict channel and river habitats in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was observed or collected at well over 50 localities in the area of 18 sites (1, 4, 6, 7, 7A, 8, 8A, 9, 13, 14, 15, 17, 18, 20, 22, 23, 25 & 28), in floodout, channel edge and swamp habitat. Status very common and widespread.

E. terminalis. Bloodwood, long-fruited bloodwood. E. terminalis (syn. E. pyrophora) was collected from the area of Cordillo Downs Homestead and further east in 1924 (Cleland et al., 1925). Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of the Strzelecki Desert dunes (E.R. & P.G., 1980). This latter recor may be considered doubtful. During the present survey, the species was observed or collected at the base of an orange dune east of Mudcarnie W.H. (Site 4), on the channel edge of Mudcarnie W.H. and in a Hakea eyreana fringed ovoid interdune 3 km NW of Mudcarnie W.H. The only specimen collected had immature fruits. Status fairly common.

Melaleuca glomerata. M. glomerata (syn. M. hakeoides) was reported from the Cooper Creek last century (Tate, 1889), however Carrick and Chorney (1979), indicate that the species does not occur in the study area. If indeed it did occur here last century, which is quite possible,its status should be considered uncertain - probably very rare if not locally extinct. It may though be misidentified.

M. leariifolia var. trichostachya. A paper-bark tea-tree. M. leariifolia var. trichostachya (syn. M. trichostachya) was reported from the Cooper Creek last century (Tate, 1889) and collected in the bed of the Cooper in the area of Innamincka in 1924,..., " probably ",..., this species (Cleland et al., 1925 - a record confirmed by Jessop, 1982). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it is included in the Cooper Basin list (E.R. & P.G., 1980) and may occu in the study region between Innamincka and Ooranie Creek (see distribution map in Carrick and Chorney, 1979). Status uncertain - appears to be rare, but propagules may be carried into the study area from time to time in flows of the Cooper - if this does occur the species has not been able to become established further west possibly due to grazing on seedlings by stock, rabbits and other feral herbivores.

NYCTAGINACEAE

Boerhavia diffusa. Tar-vine. Collected along the lower Strzelecki in 1924 (Cleland et al., 1925), it was considered to be a species of geographical importance with a disjunct or isolated distribution in 1974 (Specht et al., 1974). There are no other records relating to the study area. Status uncertai - probably very rare.

Commicarpus chinensis. C. chinensis (syn. Boerhavia repanda) was collected in the area of Cordillo Downs Homestead and Innamincka in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

ONAGRACEAE

Ludwigia peploides ssp. montevidensis. Naturalised: Water primrose. Collected in the Coongie area in 1975 (Jessop, 1982), it was collected or observed in the present survey in a channel in the NE corner of Lake Apachirie, on the channel edge of Kudriemitchie W.H. and NW of Innamincka. In Kudriemitchie W.H. it formed thick mats at the channel edge. Status fairly common - locally common in parts in moist or recently moist situations.

ORCHIDACEAE

Caladenia deformis. Bluebeard caladenia. Reported from along the Strzelecki Creek last century (Tate, 1889), it is not otherwise known from the study area and is now not considered to occupy the NE (Jessop, 1983). Status uncert ain - probably very rare if not locally extinct.

Cymbidium canaliculatum sensu Tate (1889). Reported from along the Cooper Creek last century (Tate, 1889; Jessop, 1981), but Jessop (1981), considers this record to be,..., " almost certainly an error " . The presence of Caladenia deformis along the Strzelecki Creek though makes the record of another orchid quite possible. What the present taxonomic identity of C. canaliculatum sensu Tate (1889) is, is not known. Status uncertain as is not otherwise known from the study area - probably very rare if not locally extinct.

PAPILIONACEAE

Aeschynomene indica. Budda pea. Collected from along watercourses in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925), it was collected during the present survey from a floodout adjacent to Kudriemitchie W.H. and from a sand dune bordering the SE corner of Tirrawarra Swamp (Site 13). It was uncommon. Status uncommon.

Clianthus formosus. Sturt pea. A species of sandy situations, which quickly disappears under the influence of grazing (Jessop, 1981), it was said to occur on Cordillo Downs Station in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

Crotalaria cunninghamii. Green birdflower, birdflower, Stuart's pea, rattle-pod, parrot plant, parrot-pea, Hack's pea. C. cunninghamii (syn. C. cunninghami) was reported from along the Strzelecki Creek last century (Tate, 1889).

C. cunninghamii (syn. C. cunninghamii var.trifoliolata) was said to be presen in small patches, but not in great quantities along the Strzelecki Creek in 1916 (Black, 1917). In 1924, the species was encountered in sand from Akalana Crossing on the Strzelecki Creek to Cordillo Downs Homestead (Cleland et al., 1925). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basinlist as a species of the Strzelecki Desert dunes (E.R. & P.G., 1980). In the present survey, C. cunninghamii was observed or collected on a red dune south of Lake Moorayepe, on an orange dune east of Mudcarnie W.H. (Site 4), on red dunes north of Karawinnie W.H. (near Site 6), on a yellow/white dune north of Coongie and another NNW of Coongie, on a pale sand dune on the western margin of Coongie Lake and a red dune 10 km west of the lake, on an orange dune 15 km WSW of Innamincka (Site 22) and pale dunes 6 km SW of Daralingie Well (dominated by Cynanchum floribundum). Where collected it was common. Status common;in the central area of the study region.

C. eramaea ssp. eremaea. Kahlo. C. eremaea ssp. eremaea (syn. C. dissitiflora was said to have a very general distribution in the Lake Eyre basin last century (Tate, 1889) and in 1924, it was encountered in sand from Lakes Crossing to the area of Cordillo Downs Homestead (Cleland et al., 1925). C. eremaea was collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It occupies dune and undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982). It was found at all but one locality (pale dunes 6 km south of Daralingie Well) at which C. cunninghamii, above, was encountered in this survey. In addition, C. eremaea ssp. eremaea was collected or observed on an orange-red dune near King Lookout (Site 7), on a stable orange dune crest NW of Karawinnie W.H. (Site 10),on asand dune overlooking the SE corner of Tirrawarra Swamp (Site 13), on a dune/floodout interface 13 km SSW of Chillimookoo W.H., on a deep white dune SE of Boggy Lake (Site 16) and on an orange dune on the western edge of Embarka Swamp (Site 19). Where collected it was common. Status very common in the central-northern parts of the study area - may no longer occur in the more southerly part.

C. smithiana. C. smithiana (syn. C. mitchellii) was recorded from along the Strzelecki Creek last century (Tate, 1889) and was collected in the Innamincka area in 1926 (Jessop, 1982). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, the species was collected from within an ephemeral creek line 3 km north of Mudcarnie W.H., where it was locally common, and from a small ephemeral channel near King Lookout (Site 7). Status fairly common in the central-NE part of the study area.

Glycine canescens. Silky glycine. G. canescens (syn. G. sericea) was reported from the area of Innamincka and from between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889). It was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982). It occupies swampand lake habitat in the area of Embarka Swamp (S.E.A., 1982) and during the present survey, was collected from a red sand dune slope,dominated by Atalaya hemiglauca low open woodland, 4 km south of Lake Moorayepe,where it was uncommon. Status uncommon.

G. falcata. A species of depressions in clay soil plains, which may possibly increase in abundance after fire (Jessop, 1981), it was reported to be present along the Cooper Creek last century by Tate (1889). The species was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974). There are no other records of G. falcata relating to the study area and the species may no longer occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct.

Glycine tomentosa. Reported from along the Cooper Creek last century (Tate, 1889; Black, 1943-57), it was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974). The species is not now considered to occupy the NE of S.A. in central Australia (Jessop, 1981) and may not now occur in S.A. (Jessop, 1983). There are no other records relating to the study area. Status uncertain - probably very rare if not locally extinct.

Indigofera brevidens. Reported from along the Cooper Creek last century (Tate, 1889), it was collected in the Clifton Hills area in 1975 (Jessop, 1982). It is not otherwise known from the study area and it was not collected this survey. Status rare.

I. colutea. Sticky indigo. I. colutea (syn. I. viscosa) was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974). It was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected this survey. Status rare.

I. linnaei. I. linnaei (syn. I. enneaphylla) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925).There are no other records relating to the study area. Status uncertain - probably very rare.

Isotropis wheeleri. A species of Triodiasand plains (Jessop, 1981), it was reported from between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889). Considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974), it was collected in the Clifton Hills and Innamincka areas in 1975 and previously in the Clifton Hills area in 1960 and the Innamincka area in 1971 (Jessop, 1982). It is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected this survey. Status rare.

Lotus cruentus. Red-flower lotus, poison pea. A species of moist situations, which is apparently salt tolerant (Jessop, 1981), L. crentus (syn. L. australis) was reported from the area of Innamincka last century (Tate, 1889). L. cruentus (syn. L. australis var. parviflorus) was found at Lake Blanche south of the study area and was said to be fairly plentiful on the lower Strzelecki Creek,..., " growing in other bushes for protection from stock ", ..., in 1916 (Black, 1917). It was collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). During this survey, the species was collected from a claypan, dominated by umbrella canegrass Leptochloa digitata, in an ovoid interdune 3.0 km south of Tooroowatchie W.H. Status uncommon.

?Medicago polymorpha. Naturalised: Burr medic. Not otherwise known from the study area, one specimen of a probable small-leaved form of this species was collected from the SE corner of Tirrawarra Swamp (Site 13) during the present survey. Status uncommon.

Psoralea australasica (see below)

P. cinerea. Annual verbine. Collected from 25 miles south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it was collected in this survey from a gibber plain 3.5 km south of Lake Moorayepe (near Site 1) and observed on a red dune north of Karawinnie W.H. Where collected it was uncommon. Status uncommon.

Psoralea eriantha - P. patens (complex). A recent revision of this complex has resulted in a division of the two formerly recognised and distinct species (see Jessop, 1983), so that some formerly recognised specimens of P. eriantha are now considered to be P. patens (partly) and some formerly recognised specimens of P. patens are now considered to be P. australasica (partly) and P. pallida (partly). P. eriantha is now reduced to a synonym. As it is not possible to determine the identity of species referred to in reports and papers in the past, in the absence of the particular specimens referred to in these publications, the records for P. eriantha and P. patens will be dealt with(as published) and then the probable present status of the species P. australasica and P. pallida, as presently recognised, will be assessed - P. patens,as now recognised,does not occur in the study area.

- P. eriantha sensu Black (1943-57). Bullamon lucerne. Reported as 2 foot high bushes in sandhills between Innamincka and Kanowana in 1916 (Black, 1917), it was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). P. eriantha was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It occupies lake habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, specimens from a pale sand dune on the western edge of Coongie Lake, a red dune 10 km west of the lake and a floodout 10 km south of Gidgealpa Homestead, were identified in the field as P. eriantha, but were not collected. Status uncommon.
- P. patens. Native verbene. Collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it was collected also in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). During the present survey, specimens from a red dune south of Lake Moorayepe, an orange dune east of Mudcarnie W.H. (Site 4) and a red dune crest north of Karawinnie W.H. were identified in the field as P. patens, but were not collected. Status uncommon.

Species collected during this survey are:

P. australasica. During the present survey, this species was collected or observed on the channel edge of Mudcarnie W.H., in a small ephemeral channel near King Lookout (Site 7), on a red dune 10 km west of Coongie Lake, at the southern end of Queerbidie W.H. and on a floodout 62 km north of Toolache W.H. It was common at two localities from which it was collected and uncommon at another. Status fairly common.

P. pallida. This species was collected from orange dunes on the western edge of Embarka Swamp (Site 19 & 21). Status uncommon - known only from this part of the study area.

Rhynchosia minima. Considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974), it was collected from gutters in a gibber plain 3.5 km SE of Lake Moorayepe during the present survey.There are no other records relating to the study area and it was recently not considered to occur in the NE (Jessop, 1983). Status uncommon.

Sesbania cannabina . Yellow pea, Sesbania pea. S. cannabina (syn. S. aculeata) was reported from the Cooper Creek last century (Tate, 1889). S. cannabina was collected in the Clifton Hills area in 1924 and 1927 (Jessop, 1982) and was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). There are no other records relating to the study area. Status uncertain - probably rare or very rare.

Swainsona campylantha. Reported as a species of crabholes and from the Cooper Creek last century (Tate, 1889), it was found as plants from a few inches to five feet in height (height varied with soil nutrient status) along the Strzelecki Creek near Innamincka in 1916 (Black, 1917). There are no other records relating to the study area. Status uncertain - probably very rare.

Swainsona flavicarinata. Reported from along the Strzelecki Creek (Black, 1943-57), it is not otherwise known from the study area and was not collected this survey. Status rare.

S. lessertiifolia. Collected in the Innamincka area in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980). It is not otherwise known from the study area and is not considered to occupy the NE by Jessop (1983). Status rare.

S. microphylla. Small-leaf Swainsona. This species was said to be uncommon with plants being encountered at only a few places in sandhills near Tinga Tingana along the Strzelecki Creek in 1916 (Black, 1917). It is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

S. oligophylla. Reported from along the Cooper Creek last century (Tate, 1889), it was encountered as small clumps along the Strzelecki Creek SW of Innamincka in 1916 (Black, 1917). It is included in the Cooper Basin list (E.R. & P.G., 1980), but there are no other records relating to the study area. Status uncertain - probably very rare and may no longer occur along the Strzelecki Creek.

S. oroboides. Kneed Swainsona. Reported from the Cooper Creek last century (Tate, 1889), it was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). S. oroboides was collected or observed in the present survey in an interdune 3.0 km north of Mudcarnie W.H., on the channel edge of Kudriemitchie W.H., on a floodout 10 km south of Gidgealpa Homestead (it was common here) and on a claypan NW of Toolache W.H. Status fairly common.

S. phacoides. Dwarf Swainsona. Reported from the area of Innamincka last century (Tate, 1889), it was collected from between Innamincka and Kanowana in 1916 (Black, 1917) and in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982). Included in the Cooper Basin list (E.R. & P.G., 1980), it occupies lake habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed on undulating dunes north of Chillimookoo W.H. and on the eastern border of Lake Marrakoonamooka, on a floodout 10 km south of Gidgealpa Homestead and in the same habitat 4 km NW of Moomba, and on a hard claypan 6 km ESE of Scrubby Camp W.H. (Site 24). It was common where collected in undulating dune habitat. Status fairly common in parts.

S. rigida. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills and Coongie areas in 1975 and in the Innamincka area in 1971 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). The species was collected from a red dune south of Lake Moorayepe (it was locally common here), a pale sand dune on the western margin of Coongie Lake (it was uncommon here) and an orange dune on the western edge of Embarka Swamp (Sites 19 & 21), during the present survey. Status fairly common.

S. stipularis. S. stipularis (syn. S. phacifolia) was reported from along the Strzelecki Creek last century (Tate, 1889). There are no other records that relate to the study area. Status uncertain - probably very rare if not locally extinct.

?Templetonia egena. Desert broombush, broombush. A specimen collected from the area of the Appanburra Channel (Site 8A), resembled this species, however consisted of only a small amount of material. Status uncertain - if identity correct is probably uncommon.

Tephrosia sphaerospora. *T. sphaerospora* was collected from between Cordillo Downs Homestead and Innamincka in 1924 (Cleland *et al*., 1925) and was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht *et al*., 1974). Collected in the Coongie area in 1975 (Jessop, 1982), it was collected or observed during the present survey on a yellow/white dune 28.75 km north of Kudriemitchie W.H. and a low white dune bordering the eastern margin of Lake Toontoowaranie (Site 8), on a pale sand dune on the western margin of Coongie Lake, on a deep white dune SE of Boggy Lake (Site 16), on a dune 1.5 km north of Yalcuma W.H., on a dune/claypan interface 1 km SW of Pilalchilpna W.H., on a claypan NW of Toolache W.H. and on the dune of Site 29. Where collected it was common. Status common.

Trigonella suavissima. Cooper's clover, Cooper clover. Reported from the Strzelecki Creek last century (Tate, 1889), it was collected in the area of Murteree (=Merty Merty) and between Innamincka and Kanowana in 1916,..., " found growing in damp localities along the Creek and near waterholes " (Black, 1917). The species was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, the species was collected or observed on Lake Apachirie near Coongie, in the SE corner of Tirrawarra Swamp (Site 13), on the western edge of Embarka Swamp (Site 21), at the southern end of Queerbidie W.H. and at the southern edge of Embarka Swamp (Site 23). Status fairly common - now appears to be restricted to the more regularly inundated parts of the Cooper and may no longer occur along the Strzelecki Creek.

Vigna lanceolata. Yam. This species was collected along a watercourse in the area of Cordillo Downs Homestead in 1924 (Cleland *et al*., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

PITTOSPORACEAE

Pittosporum phylliraeoides var. microcarpa. Weeping pittosporum, butterbush, meemeei, cattle bush. *P. phylliraeoides var. microcarpa* (syn. *P. phillyroides*) was reported from the Lake Eyre basin last century (Tate, 1889). *P. phylliraeoides var. microcarpa* (syn. *P. phillyraeoides*) was reported to consist of small clumps to 20 feet high on tablelands east of Mungeranie in 1916 (Black, 1917). *P. phylliraeoides var. microcarpa* (syn. *P. phillyreoides*) was collected in the area of Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland *et al*., 1925). In the present survey, the species was collected from adjacent to Chillimookoo W.H., where it was uncommon, and from undulating dunes 2 km north of Chillimookoo W.H., where it was locally common in association with *Grevillea striata*. It was also observed to be present adjacent to Scrubby Camp W.H. (Site 20). Status fairly common.

PLANTAGINACEAE

Plantago turrifera. This species is reported to occupy swamp, lake and undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982), but these records require confirmation by the author. Not otherwise reported from the study area, the species is considered to occupy the NE (Jessop, 1981, 1983), but there are no records in the State Herbarium to support this. Status uncertain - if not misidentified, it is rare.

P. varia. Variable plantain. Reported from the area of Innamincka last century (Tate, 1889), it is included in the Cooper Basin list (E.R. & P.G., 1980). It was omitted from a list for the NE of S.A. in Central Australia in 1981 (Jessop, 1981), but is now considered to occupy the region (Jessop, 1983). During the present survey, the species was observed or collected on a gibber plain south of Lake Moorayepe (Site 1) and on floodouts near Chillimookoo W.H., 4 km NW of Moomba, 10 km south of Gidgealpa Homestead (at which locality it was collected), 10 km east of Moomba, 30 km north of Toolache W. H. and 0.8 km west of Toolache W.H. (Site 28). Field determinations were as P. turrifera, based on Fl. C. Aust. Pp. 349. It was locally common near Toolache W.H. Status common.

POACEAE (GRAMINEAE)

Agrostis avenacea. Blown grass. A. avenacea (?syn. Calamagrostis aemula) was collected from along the Strzelecki Creek in 1916, where it was often seen growing in mass around claypans, which had recently held water - it was eaten by stock (Black, 1917). Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was collected during the present survey from the ephemeral lake bed of Lake Apachirie, near Coongie, from lignum tall shrubland adjacent to a channel in Tirrawarra Swamp and from coolibah/northern river red gum woodland at the southern end of Queerbidie W.H. It was common at all three localities. Status fairly common - may no longer occur along the Strzelecki Creek.

Alopecurus geniculatus. Naturalised: Marsh fox-tail. This species was collected along the Strzelecki Creek in 1916, where it was growing sparsely in very poor country to a height of 6-8 inches (Black, 1917). There are no other records relating to the study area. Status uncertain - probably very rare.

Aristida anthoxanoides. Yellow threeawn. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was collected from a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24) and a floodout 62 km north of Toolache W.H. during this survey. It was common at the latter locality. Status fairly common.

A. browniana. Erect kerosene grass, white grass. A. browniana (syn. A. stipoides) was reported from along the Strzelecki Creek last century (Tate, 1889) and from amongst gibber stones between Innamincka and Kanowana in 1916 (Black, 1917). A. browniana (syn. A. stipoides) was collected in sandhills 25 miles south of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). In the present survey, A. browniana was collected or observed at 11 localities in the area of 9 sites (6, 7, 7A, 8, 10, 11, 16, 23 & 24), in dune habita and in one instance on the ephemeral lake bed of Lake Marrakoonamooka. Where collected it was common. Status common in areas of the central part of the study region. Status overall very common.

A. contorta. Mulga grass, fly spear grass, kerosene grass, sand wire-grass, sand spear-grass, bunched kerosene grass, wind grass. A. contorta (syn. A. arenaria) was collected in the area of Cordillo Downs Homestead, Tooroowatchi (=Toorawatchy) W.H. and Innamincka in 1924 (Cleland et al., 1925) and in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey, A. contorta was collected or observed on a red dune south of Lake Moorayepe, on an orange dune east of Mudcarnie W.H. (Site 4), on a red dune crest and in an interdune north of Karawinnie W.H. (Site 6), on undulating dunes north of Chillimookoo W.H. and east of Lake Marrakoonamooka, on a floodout 10 km south of Gidgealpa Homestead and on a floodout 12.3 km north of Toolache W.H. It was common at most localities from which it was collected. Status common and widespread.

A. ramosa. Collected near watercourses in the area of Cordillo Downs Homestead and 25 miles south of here in 1924 (Cleland et al., 1925), it is not otherwise known from the study area and was not collected this survey. The species is now not considered to occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare, but possibly misidentified.

?A. strigosa. Rough threeawn. ?A. strigosa (syn. A. calycina) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

Astrebla lappacea. Curly mitchell grass, curly mitchell, wheat mitchell. This species was collected in the study area for the first time during the present survey from a floodout 12 km north of Toolache W.H., where it was locally common. Status uncommon, but locally common in the SE part of the study area.

A. pectinata. Mitchell grass, barley mitchell, barley mitchell grass. Collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it was collected in the Clifton Hills area in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of gibber downs, river channels and floodplains (E.R & P.G., 1980). The species was collected or observed during the present survey on gibber plains, in gibber plain gutters and on gibber plain clay lenses south of Lake Moorayepe (Site 1), in ovoid interdunes 3.5 km NW of Mudcarnie W.H. and 2.5 km north of Brady's W.H., on an open gibber clay flat and an adjacent dune NW of Karawinnie W.H. and in gibber areas and on interfaces with gibber in the North-eastern Dunefield and Floodplain Environmental Subassociation (8.4.4.6). Where collected it was common. Status common to very common in gibber or associated areas in the northern parts of the study area.

Bothriochloa bladhii. (Mountain or Forest) Blue-grass. B. bladhii (syn. Andropogon intermedius) was collected in the area of Tooroowatchie (=Toora-watchy) W.H. in 1924 (Cleland et al., 1925). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al. 1974), it is not otherwise known from the study area and was not collected this survey. It is not considered to occupy the NE by Jessop (1983). Status uncertain - probably very rare,but possibly misidentified.

Brachiaria notochthona. Naked armgrass. B. notochthona (syn. Panicum notochthona) was collected from the garden of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

Brachyachne ciliaris. Hairy native couch. B. ciliaris (syn. Cynodon ciliaris) was collected on gibber plains in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Jessop, 1982). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Chloris pectinata. Comb chloris. C. pectinata (syn. C. divaricata var. minor) was collected from near watercourses in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925).There are no other records relating to the study area. Status uncertain - probably very rare.

C. scariosa. Large-flower chloris, winged chloris. Collected from watercourse in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and is not otherwise known from the study area. It was not collected this survey. Status uncertain - probably very rare.

Chrysopogon fallax. Golden-beard grass. C. fallax (syn. Andropogon gryllus) was collected from a watercourse in the area of Cordillo Downs Homestead in 1924, where it attained a height of 4-5 feet (Cleland et al., 1925). It was also collected in the Clifton Hills area in 1924 and 1935 (Jessop, 1982) and was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). There are no other records relating to the study area. Status uncertain - probably rare or very rare.

Cymbopogon sp. Collected in the Innamincka area in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980). In both records it is under the identity of Cymbopogon exaltatus, but the only two S.A. species of Cymbopogon are C. ambiguus and C. obtectus. There are no other records for either of these species that relate to the study area. Status rare.

Cynodon dactylon. Naturalised: Couch-grass, couch. C. dactylon was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and in the Coongie area in 1975 (Jessop, 1982). During the present survey, this species was collected from moist clays in coolibah/northern river red gum woodland adjacent to Scrubby Camp W.H. (Site 20), where it was relatively common. It was also observed in similar habitat at the southern end of Queerbidie W.H. Status fairly common.

Dactyloctenium radulans. Button grass, finger grass. D. radulans (syn. D. aegypticum) was collected in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925). D. radulans, was observed or collected during the present survey on gibber plains 3.5 and 8.0 km south of Lake Moorayepe and gutters in gibber plains in the same area; also on a channeledge 6 km SW of Chillimookoo W.H. It was common in the gibber areas, but uncommon SW of Chillimookoo W.H. Status fairly common, but locally common on gibber plains in the extreme north of the study area.

Dichanthium affine. Dwarf bluegrass. D. affine (syn. Andropogon annulatus) was collected in watercourses in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) . D. affine was collected in the area of Cordillo Downs in 1960 (Jessop, 1982) and was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). Jessop (1982), considered it to be,..., " quite rare ". It was not collected this survey. Status rare.

Digitaria ammophila. Spider grass, silky umbrella-grass. This species is reported to occupy undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982), but this record requires confirmation by the author. There are no other records relating to the study area. Status rare, but possibly misidentified.

D. brownii. Cotton grass, cotton panic grass, silver spike grass. D. brownii (syn. Panicum leucophroeum) was reported from the Cooper Creek last century (Tate, 1889). D. brownii (syn. Panicum leucophraeum) was found growing amongst stones on tablelands in the area of Innamincka in 1916 (Black, 1917) and D. brownii (syn. Panicum brownii) was collected in a watercourse in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). The species is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Diplachne fusca. Brown beetle-grass, water grass. Collected from the study area for the first time during the present survey on the channel edge of Mudcarnie W.H. and the ephemeral lake bed of Lake Apachirie, near Coongie. It was common at both localities. Status fairly common.

Echinochloa crus-galli. Naturalised: Cockspur grass, barnyard grass, sorghum. E. crus-galli (syn. Panicum crus-galli) was collected in creeks in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925). There are no other records relating to the study area Status uncertain - probably very rare. (?May be E. inundata, see Below).

E. inundata. Channel millet. E. inundata (syn. E. turnerana) was collected on " Cordillo Downs " in 1924 (Jessop, 1982). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). E. inundata has a maximum geographic range of over 100 km and was suspected of being either threatened or rare in 1981 (Leigh _et al._, 1981) During the present survey, it was collected from adjacent to and on the channel edge of Mudcarnie W.H., near a channel in Tirrawarra Swamp (it was common here) and on a sand dune overlooking the SE corner of Tirrawarra Swamp (Site 13). Status fairly common.

Enneapogon avenaceus. Bottle-washers, ridge grass. _E. avenaceus_ (syn. _Pappophorum avenaceum_) was collected in the area of Innamincka and on the Strzelecki Creek SW of Innamincka in 1916,..., " met in many localities - seems to be of dwarf nature " (Black, 1917) and in the area of Cordillo Downs Homestead in 1924 (Cleland _et al._, 1925). The species was collected in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey, the species was collected or observed on a gibber plain and in gibber plain gutters south of Lake Moorayepe, on undulating dunes east of Lake Marrakoonamooka, at the western edge of Embarka W.H. and on floodouts 10 km south of Gidgealpa Homestead, 12 km north of Toolache W.H. and 0.8 km west of Toolache W.H. (Site 28). Where collected it was common. Status common.

E. cylindricus. Jointed nineawn. Collected during the present survey for the first time from undulating dune habitat on the eastern edge of Lake Marrakoonamooka, where it was relatively common. Status uncommon.

E. nigricans. Niggerheads. _E. nigricans_ (syn. _Pappophorum nigricans_) was collected in the area of Cordillo Downs Homestead and Innamincka in 1924 (Cleland _et al._, 1925). There are no other records relating to the study area Status uncertain - probably very rare.

E. polyphyllus. Leafy nineawn. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was collected during the present survey from a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24). Status uncommon.

Enteropogon acicularis. Curly windmill grass, spider grass, umbrella grass. _E. acicularis_ (syn. _Chloris acicularis_) was found growing around crab-holes in the area of Innamincka in 1916 (Black, 1917) and was collected in watercourses in the area of Cordillo Downs Homestead in 1924 (Cleland _et al._, 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

Eragrostis australasica. Swamp cane grass, cane-grass, bamboo grass. _E. australasica_ (_syn. Glyceria ramigera_) was collected in the area of Cuttapirie Corner along the Cooper Creek in 1916 (Black, 1917) and on flats south of Cordillo Downs Homestead in 1924 (Cleland _et al._, 1925). _E. australasica_ is included in the Cooper Basin list as a species of river channels and floodplains (E.R. & P.G., 1980) and occupies swamp and lake habitat in the area of Embarka Swamp (S.E.A., 1982). In this survey, the species was observed or collected on a gibber plain clay lens south of Lake Moorayepe, in an interdune near Mudcarnie W.H., on an ovoid interdune claypan 4.5 km south of Tooroowatchie W.H. (Site 7A), near the Appanburra Channel (Site 8A), on Lake Marrakoonamooka and on a plain 16 km NNW of Toolache W.H. At several localities it formed the dominant component of a grassland community. Status common, but very common in some parts.

E. basedowii. _E. basedowii_ (syn. _E. concinna_) was collected in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland _et al._, 1925). Collected in the Innamincka area in 1968 (Jessop, 1982), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht _et al._, 1974) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, the species was collected from the channel edge of Mudcarnie W.H. Status uncommon.

Eragrostis confertifolia. Spike love grass. E. confertifolia (syn. E. interrupta var. densiflora) was collected in the area of Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925; Jessop, 1982). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it is not otherwise known from the study area and was not collected this survey. The 1924 collection may be the only state record (Jessop, 1982). Status uncertain - probably very rare.

E. dielsii. Mulka grass, mallee love grass. Collected in the area of Cordillo Downs Homestead and south of here in 1924 (Cleland et al., 1925), it was collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). The species occupies swamp, lake and undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed on a gibber plain 5 km SSW of Lake Moorayepe, on the channel edge of Mudcarni W.H. and on an interdune border nearby, on a channel edge in an interdune and on an interdune claypan near King Lookout (Site 7), on a deep white dune SE of Boggy Lake (Site 16), on an orange dune 15 km WSW of Innamincka (Site 22) and on an undulating dune on the eastern edge of Lake Marrakoonamooka. Where collected it was common. Status common.

E. eriopoda. Naked woollybutt , woollybutt grass. Collected from the study area for the first time during the present survey, it was encountered on a gibber plain 5 km SSW of Lake Moorayepe (Site 1), on undulating dunes north of Chillimookoo W.H., on a sand plain 6 km ESE of Srubby Camp W.H. (Site 24) and on the ephemeral lake bed of Big Lake Moonba. Where collected it was common. Status fairly common.

E. falcata. Sickle lovegrass. Collected in the area of Murteree (=Merty Merty and along the Strzelecki Creek in 1916, where it was found growing on flooded ground and,..., " did not seem to be relished by stock "(Black, 1917), it is not otherwise known from the study area and was not collected in this survey. Status uncertain - probably very rare.

E. japonica. Delicate lovegrass. E. japonica (syn. E. interrupta var. tenuissima) was collected from creeks in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

E. leptocarpa. Drooping lovegrass. Collected along creeks in the area of Cordillo Downs Homestead and south of here in 1924 (Cleland et al., 1925), it was collected in the Clifton Hills area in 1975 (Jessop, 1982) and occupies swamp and river habitat in the area of Embarka Swamp (S.E.A., 1982). It was collected during the present survey on a floodout 62 km north of Toolache, where it was locally common. The species may have been observed in the area of a channel in Tirrawarra Swamp, but no specimen was collected so this cannot be confirmed. Status uncommon, but locally common in parts.

E. parviflora. Weeping lovegrass. E. parviflora (syn. E. pilosa) was collected in the area of Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertai - probably very rare.

E. setifolia. Narrow-leaf neverfail, bristly lovegrass. This species was collected from the Strzelecki Creek SW of Innamincka in 1916 and was said to be a common grass growing around claypans, waterholes and in the valleys between sandhills (Black, 1917). It was encountered in watercourses in the area of Cordillo Downs Homestead, Tooroowatchie (=Toorawatchy) W.H. and Innamincka in 1924 (Cleland et al., 1925). Collected in the Clifton Hills area in 1975 (Jessop, 1982), it was collected or observed during the present survey on gibber plains and in gibber plain gutters south of Lake Moorayepe (Site 1), on an open gibber clay flat and adjacent dunes, a floodout and a red interdune (Site 6) north of Karawinnie W.H., on a floodout west of Cartoonganie W.H., near the Appanburra Channel (Site 8A), on a sand plain 14 km NW of Scrubby Camp W.H. (Site 20) and a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24), on a floodout 10 km south of Gidgealpa Homestead and on a floodout 0.8 km west of Toolache W.H. (Site 28). It was common at some localities from which it was collected. Status very common.

Eragrostis speciosa. Handsome lovegrass. Considered rare with a population of adequate size, but needingconstant monitoring in 1974 (Specht et al., 1974), it was collected in the study area for the first time during the present survey from adjacent to the bank of Mudcarnie W.H. Status uncommon.

E. xerophila. Knotty-butt neverfail, knotty-butt neverfail grass. Collected in the Innamincka area in 1916 and 1924 (Jessop, 1982), it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and is included in the Cooper Basin list (E.R. & P.G., 1980). There are no other records relating to the study area. Status uncertain - probably very rare.

Eriachne aristidea. Three-awned wanderrie. Collected in sandhills in the area of Cordillo Downs Homestead and south of here in 1924 (Cleland et al., 1925), it is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, it was collected on a gibber plain 3.4 km south of Lake Moorayepe (near Site 1), in an interdune 2 km NW of Mudcarnie W.H. and on an orange dune east of the W.H. (Site 4), on a sand dune 18 km NNW of Coongie and on an orange dune 15 km WSW of Innamincka (Site 22). Where collected it was generally common. Status common.

E. ovata. Swamp wanderrie. E. ovata (syn. E. ovata var. pallida) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

Eriochloa pseudo-acrotricha. Perennial cupgrass, early spring grass. E. pseudo-acrotricha (syn. E. punctata/E. annulata var. acrotricha) was collected from between Innamincka and Kanowana in 1916, where it was found around the margins of lakes, on flooded ground and in the dry sandy beds of creeks,..., " in some instances growing very luxuriantly " (Black, 1917). E. pseudo-acrotricha (syn. E. punctata var. acrotricha) was collected in a watercourse in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). During the present survey, the species was encountered growing on moist grey clays on a river edge, where water had receded, 6 km SW of Chillimookoo W.H. It was common here. Status uncommon, but common in parts.

Eulalia fulva. Sugar grass, silky brown top . E. fulva (syn. Pollinia fulva) was collected in a watercourse in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925), in the Innamincka area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected this survey. Status rare.

Iseilema membranaceum. Small Flinders-grass. I. membranaceum (syn. I. membranacea) was collected in watercourses in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

Leptochloa digitata. Umbrella cane-grass. This species was collected in the area of Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925; Jessop, 1982). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, the species was collected on the channel edge of Mudcarnie W.H., on the channel edge of Brady's W.H. (Site 7) and in an interdune claypan 3.0 km south of Tooroowatchie W.H. (Site 7A). It was common where collected and dominated the interdune claypan south of Tooroowatchie W.H. Status fairly common in areas of the NE part of the study area.

?Panicum austaliense. Bunch panic. ?P. australiense (syn. P. mitchellii) was reported from the Cooper Creek last century (Tate, 1889). P. australiense was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). There are no other records relating to the study area. It was recently notconsidered to occupy the NE (Jessop, 1981), but has since been listed for the region (Jessop, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

Panicum decompositum. Native millet, windmill grass, wild millet, pepper grass, popper grass. Reported from the Cooper Creek last century (Tate, 1889) it was collected from along watercourses in the area of Cordillo Downs Homestead and Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925). It was collected in the Clifton Hills area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, the species was collected from a channel in the NE corner of Lake Apachirie and from the ephemeral bed of the lake. It was common at both localities. Status fairly common.

P. whitei. Pepper grass, pigeon grass. Collected from the Strzelecki Creek SW of Innamincka and the Cooper Creek at Cuttapirie Corner in 1916 and was apparently common,..., " seen in many localities growing on ground lately flooded by heavy rains; forms good sized clumps and stools out all around; stock seem to relish it; also forms a feed for seed eating birds " (Black, 1917). Collected in the Clifton Hills area in 1960, it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). During the present survey, a specimen was collected from a dune/floodout interface 13 km SSW of Chillimookoo W.H. Status uncommon - was more common in the past.

Paractaenum novae-hollandiae. Reflexed panic, reverse grass, reverse panic grass. Encountered in the study area for the first time in this survey, it was collected from an orange dune 15 km WSW of Innamincka (Site 22). It may also have been collected or observed in the area of a channel in Tirrawarra Swamp, on a sand plain 14 km NW of Scrubby Camp W.H. and at Scrubby Camp W.H. (Site 20). The latter three collection/observations all relate to a single collection for which insufficient material was available for positive identification. Status uncommon, but possibly fairly common if all listed records are correct.

Paspalidium gracile. P. gracile (syn. Panicum gracile) was met with at one locality only in the area of Innamincka in 1916 (Black, 1917). The species was also collected in the area of Tooroowatchie (=Toorawatchy) W.H. in 1924 (Cleland et al., 1925). There are no other records relating to the study area and it is not now considered to occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare, but possibly misidentified.

Perotis rara. Comet grass. This species was reported to occur"towards Cooper Creek " last century (Tate, 1889). There are no other records that relate to the study area and it is now considered to occur only in the NW of the State (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

Plagiosetum refractum. Brittle-brush grass. P.refractum (syn. Pennisetum refractum) was reported from the Cooper Creek last century (Tate, 1889). P. refractum was collected 15 miles west of Innamincka in 1916,..., " this grass was met with in sandhill country to the south of the Cooper; stock eat it; only seen once or twice " (Black, 1917) and was found in the sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It has not been encountered in the study area again till the present survey, in which it was collected from a deep red dune crest 3.5 km NW of Mudcarnie W.H an orange stable dune crest NW of Karawinnie W.H. (Site 10) and a red dune area 10 km west of Coongie Lake. At the latter locality, it varied in abundance from uncommon to locally common in different sections of the dunes. Status fairly common in the central part of the study area, but locally common in some localities.

Sporobolus actinocladus. Ray grass, katoora. This species was collected on gibber plains in the area of Cordillo Downs Homestead in 1924 (Cleland et al 1925). It was collected in the study area during the present survey from gibber plain habitat south of Lake Moorayepe (Site 1), where it was common. Status uncommon, but fairly common on gibber plains in the northern part of the study area.

S. caroli. Fairy grass, yakka grass. S. caroli (syn. S. lindleyi) was collected in a watercourse in the area of Cordillo Downs Homestead in 1924 (Clelan et al., 1925) and was considered rare with a population of adequate size, bu needing constant monitoring in 1974 (Specht et al., 1974). There are no othe records that relate to the study area. Status uncertain - probably very rare

S. mitchellii. Rat's tail couch, lake grass, swamp or short rat-tail grass. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Coongie area in 1975 (Jessop, 1982). During the present survey, S. mitchellii was collected or observed on a floodout 2.2 km north of Karawinnie W.H., on the ephemeral lake bed of Lake Apachirie (it was common here), on a channel edge 2 km SW of Pilachilpna W.H. (it was uncommon here), on a claypan/floodout ar on the edge of a dry salty lake 8.0 km south of White Lake (it was uncommon here) and on a floodout adjacent to Toolache W.H. Status fairly common.

S. virginicus. Salt couch. Reported to occupy swamp habitat in the area of Embarka Swamp (S.E.A., 1982), however this record requires confirmation by the author. There are no other records that relate to the study area. Statu uncertain - probably rare if not misidentified.

Stipa semibarbata. Fibrous spear-grass, barbed spear-grass. Reported from the Innamincka area last century (Tate, 1889), it is not otherwise known fro the study area and was not collected this survey. It is not now considered to occupy the NE (Jessop, 1983), but this was recently not the case (Jessop, 1981). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

Themeda australis. Kangaroo grass. T. australis (syn. T.triandra) was collected in a watercourse in the area of Cordillo Downs Homestead in 1924 (CLeland et al., 1925). There are no other records that relate to the study area. Status uncertain - probably very rare.

Tragus australianus. Burr grass, small burr-grass. T. australianus (syn. T. racemosus) was collected on gibber plains in the area of Cordillo Downs Home stead in 1924 (Cleland et al., 1925). During the present survey, the species was collected from a deep white dune SE of Boggy Lake (Site 16), an orange dune on the western edge of Embarka Swamp (Site 21) and an orange dune 15 km WSW of Innamincka (Site 22). Status fairly common.

Triodia basedowii. Porcupine grass, lobed spinifex, hard spinifex, spinifex. T. basedowii (syn. T. pungens) was collected in the area of Lake Perigundi in 1916 and said to be not in any quantity (Black, 1917). T. basedowii (syn. T. pungens - said to be probably T. pungens by the authors) was collected in sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, it was observed or collected at 15 localities in the area of 8 sites (1, 4, 6, 7, 7A, 8A, 11 & 25), in dune areas. Where collected it was common. The species also appears to be common on the sand plains in the NE part of the study area Status very common in areas of the northern half of the study area, but has a patchy distribution.

Tripogon loliiformis. Five-minute grass, rye beetle-grass, eight-day grass. T. loliiformis (syn. Diplachne loliiformis) was collected between Innamincka and Kanowana in 1916 as dwarf specimens of 6-10 cm in height (Black, 1917). The species was also collected in the Innamincka area in 1961 and 1968 (Jessop, 1982) and was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). It was not collected this survey. Status rare.

Triraphis mollis. Purple heads, purple-plume grass, needle grass. T. mollis (syn. T. mollis var. humilis) was found on flooded ground in the area of Innamincka in 1916 (Black, 1917). T. mollis was collected in the Coongie area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). The species was collected or observed in this survey on a red dune north of Karawinnie W.H., on a low white dune/ ephemeral lake interface on the eastern margin of Lake Toontoowaranie (Site 8), on orange dunes on the western edge of Embarka Swamp (Site 21) and 15 km WSW of Innamincka (Site 22) on undulating dunes on the eastern edge of Lake Marrakoonamooka and on a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24). Where collected it was relatively common. Status common.

Zygochloa paradoxa. Sand-dune cane-grass, sandhill(s) canegrass. Z. paradoxa (syn. Spinifex paradoxus) was reported from the Lake Eyre basin last century (Tate, 1889) and stated to be,..., " a great sand-binder covering hundreds of miles of sandhill country, and where it is not eaten by stock keeps the sand from drifting; grows in large bushes to 5 feet high " ,..., in the results of a survey of the Cooper and Strzelecki Creeks in 1916 (Black, 1917). Z. paradoxa (syn. Spinifex paradoxus) was collected,..., " in the sandhills " ,..., in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes (E.R. & P.G., 1980) and occupies dune and undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed at over 30 localities in the area of 22 sites (1, 4, 6, 7, 7A, 8, 8A, 9, 10, 11, 14, 16, 17, 19, 20, 21, 22, 23, 24, 25, 29 & 30), in dune, undulating dune, uncoordinated dune and sand plain habitat. Where absent, Cynanchum floribundum (? an increaser species) may occupy its niche. Status very common or dominant in dune and sand plain areas not heavily grazed by herbivores.

POLYGONACEAE

Muehlenbeckia coccoloboides. Sandhills lignum. Collected in the region of the lower Strzelecki Creek in 1924 (Cleland et al., 1925), it was collected in the Innamincka area in 1960, 1968 and 1971 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974). It was not collected this survey. Status rare.

Muehlenbeckia cunninghamii. Lignum. Reported from the area of Innamincka last century (Tate, 1889), it was collected on flats in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). The species was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of river channels and floodplains (E.R. & P.G., 1980). It occupies swamp and river habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, the species was encountered at over 35 localities in the area of 16 sites (1, 6, 7, 7A, 8, 8A, 11, 13, 14, 18, 20, 21, 22, 23, 25 & 28), in floodout, swamp, channel edge, lake margin, interdune, interdune claypan and gibber plain gutter habitat. Status very common in parts - probably replaced by Atriplex nummularia and swamp canegrass in least frequently inundated parts of floodplains.

Polygonum attenuatum. Reported from the area of Innamincka last century (Tate 1889; Black, 1943-57), it was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974). There are no other records that relate to the study area and the species may now not occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct.

P. plebeium. P. plebeium (syn. P. plebejum) was reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889) and was collected in the Clifton Hills area in 1975 (Jessop, 1982), but was recently considered as not being present in the NE (Jessop, 1981, 1983). Two specimens were collected in this survey from adjacent to Mudcarnie W.H., wher the species was common in moist clays where water had receded. Status fairly common - may no longer occur near Innamincka or along the Strzelecki Creek.

Rumex crystallinus. Shiny dock. Reported from along the Strzelecki Creek and in the area of Innamincka last century (Tate, 1889), it was collected in the Clifton Hills area in 1975 (Jessop, 1982). During the present survey, it was observed or collected on a floodout west of Cartoonganie W.H., on the channel edge of Brady's W.H. (Site 7), in a channel in the NE corner of Lake Apachir-ie, near a channel in Tirrawarra Swamp, at the southern end of Queerbidie W. H. (Site 22), at the western edge of Embarka W.H. and on a floodout 18 km south of Gidgealpa Homestead. Where collected it was generally common. Status common.

PORTULACACEAE

Calandrinia balonensis. Parakilia, broad-leaf parakeelya. C. balonensis (syn. C. balonnensis) was reported from the area of Innamincka and along the Strze-lecki Creek last century (Tate, 1889) and was collected in the Kanowana area in 1916,at which time it was said,..., " this 'parakilia' was not nearly so plentiful as one would imagine it would be in that sandy country; no doubt due to rabbits, overstocking and the drought " (Black, 1917). C. balonensis was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). There are no other records that relate to the study area. Status uncertain - probably very rare.

C. eremaea. Collected in the Innamincka area in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected this survey. Status rare.

Calandrinia polyandra. Parakeelya. Collected in the Clifton Hills area in 1975 (Jessop, 1982), it is not otherwise known from the study area and was not collected this survey. Status rare.

C. ptychosperma. Considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht _et al_., 1974), it was collected in the Clifton Hills area in 1934, 1960 and 1975 and in the Innamincka area in 1968 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It was not collected this survey. Status rare.

C. remota. Round-leaved parakeelya. Collected in the study region from the area of King Lookout (Site 7) for the first time during the present survey. Status uncommon.

Portulaca intraterranea. Munyeroo. Collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982), it was collected or observed during the present survey at 26 localities in the area of 14 sites (1, 4, 6, 8, 8A, 11, 13, 14, 16, 21, 22, 23, 25 & 28), in dune, undulating dune, swamp, channel edge, dune/clay flat and dune/ephemeral lake margin habitat. Where collected it was generally common. Status very common and widespread generally, but uncommon or absent in some parts.

P. oleracea. Collected in the area of Cordillo Downs Homestead, from between Cordillo Downs Homestead and Innamincka and along the lower Strzelecki Creek in 1924 (Cleland _et al_., 1925).There are no other records that relate to the study area. Status uncertain - probably very rare, but possibly misidentified may in fact be _P. intraterranea_).

PROTEACEAE

Grevillea pterosperma. Reported from the Cooper Creek last century (Tate, 1889). There are no other records relating to the study area. It is not now considered to occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

G. stenobotrya. Rattlepod. Collected in the area of Lake Perigundi and said to be,..., " found in sandhill country, 15-20 feet high, flowers (Sept. - Oct.) with much honey, ground under bushes covered with a thick mass of fallen leaves ",..., in the results of a survey of the Cooper and Strzelecki Creeks in 1916 (Black, 1917), it was collected in the area of Cordillo west on Cordillo Downs Station in 1924 (Cleland _et al_., 1925) and was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht _et al_., 1974). It is included in the Cooper Basin list as a species of the Strzelecki Desert dunes (E.R. & P.G., 1980). During the present survey, _G. stenobotrya_ was collected or observed on a red dune 7 km south of Lake Moorayepe, on an orange dune east of Mudcarnie W.H. (Site 4) and a red dune 3 km north of the W.H. and on an orange-red dune near King Lookout (Site 7). Status fairly common in the northern and NE parts of the study area.

G. striata. Beefwood. Reported from the Cooper Creek last century (Tate, 1889) and from Cordillo west on Cordillo Downs Station (in any soil to 40 feet high - eaten by stock in times of drought), the upper Strzelecki Creek and Tinga Tingana on the lower Strzelecki Creek in 1924 (Cleland _et al_., 1925) , the species was collected in the Innamincka area in 1975 - a significant collection as it was the first record for the State Herbarium from the far NE (Jessop, 1982). It is included in the Cooper Basin list as a species of river channels and floodplains (E.R. & P.G., 1980). This species was collected or observed during the present survey on a dune/floodplain interface 4.5 km south of Lake Moorayepe (where it was a common component of an

Acacia victoriae-Grevillea striata low open woodland community),on an orange dune east of Mudcarnie W.H. (Site 4) and a red dune crest 3.5 km NW of the W.H., adjacent to Chillimookoo W.H. (where it was common),on undulating dunes north of Chillimookoo W.H., on a floodout adjacent to Scrubby Camp W.H. (Site 20) and on a sand plain 14 km NW of Scrubby Camp W.H. Status common.

Hakea eyreana. collected in the Clifton Hills area in 1975 (Jessop, 1982), H. eyreana (syn. H. divaricata) is included in the Cooper Basin list as a species of the Strzelecki Desert dunes (E.R. & P.G., 1980) and occupies dune and undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982). The species was collected or observed during the present survey, on a dune/floodplain interface 7.0 km south of Lake Moorayepe, where it was common, in an ovoid interdune 3.5 km NW of Mudcarnie W.H., where it formed a fringing community, and on a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24), where it was a component of a mixed Acacia spp.-Hakea spp. community. Status fairly common.

H. ivoryi. Corkwood. Collected in the area of Cordillo west on Cordillo Downs Station in 1924, where it grew in sandy soil and was said to be eaten by camels (Cleland et al., 1925), it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare

H. leucoptera. Needle-bush,needlewood. Reported from along the Strzelecki and Cooper Creeks last century (Tate, 1889), it was said to be,..., " sparsely distributed all over the sandhill country " ,..., in the area of the Cooper and Strzelecki Creeks in 1916 and of it the following was noted,..., " 15-20 feet high; many ' needle-bushes ' in full flower (Sept.-Oct.) detected at some distance by sweet odour " ,..., " doubt if anything will eat this bush except as a last resource from starvation " (Black, 1917). It was encountered in the area of Cordillo Downs Homestead on stony downs and also in sand along the banks of the Strzelecki Creek in 1924 (Cleland et al., 1925). The species was collected in the Clifton Hills area in 1975 (Jessop, 1982). H. leucoptera was collected or observed in this survey at 12 localities in the area of 11 sites (4, 6, 7A, 8A, 11, 14, 20, 22, 23, 24 & 25), in dune, interdune, undulating dune and sand plain habitat. Where collected it tended to be relatively common in some parts on the western slopes of dunes. It was often encountered as solitary low trees. Status common and reasonably widespread - may no longer occur along the Strzelecki Creek.

RUBIACEAE

Asperula gemella. Although recently considered to occupy the NE (Jessop, 1981), there was some uncertainty about this in 1983 (Jessop, 1983). The two specimens and one observation of this species from the study area during the present survey, confirm its presence in the NE. These collections and an observation are the first for the study area. It was encountered in a twining habit adjacent to a channel in Tirrawarra Swamp, on the margin of Tirrawarra W.H. (Site 15) and at the southern end of Queerbidie W.H. It was uncommon where collected. Status fairly common.

Dentella pulvinata var. pulvinata. Dry moss. D. pulvinata var. pulvinata (syn Dentella repens) was reported from between Stokes Range (Qld) and Cooper Creek last century (Tate, 1889). It was said to form,..., " patches of dense green carpet in the dry bed of the Strzelecki(Creek) between Innamincka and Tinga (Tingana) and at Tinga (Tingana) in 1924 (Cleland et al., 1925), at which time it was collected (Jessop, 1982). Considered rare with a populatior of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was also collected in the Clifton Hills area in 1975 and the Innamincka area in 1960, 1968 and 1971 (Jessop, 1982). It is included in the Cooper Basin list (E.R. & P.G., 1980) and was collected during the present survey from a gibber plain 3.5 km south of Lake Moorayepe, undulating dunes

2.0 km north of Chillimookoo W.H., a clay flat SW of Lake Perigundi and from NW of Innamincka. It was locally common at the first two localities from which it was collected and uncommon at the third. Status fairly common, but may not now be so common along the Strzelecki Creek.

Synaptantha tillaeacea. S. tillaeacea (syn. Oldenlandia tillaeacea) was reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889). Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R & P.G., 1980). It was not collected in this survey. Status rare.

SANTALACEAE

Santalum lanceolatum Plumbush, plum, cherry, plumwood. Reported from the Lake Eyre basin last century (Tate, 1889), it was collected in the area of Cordillo Downs Homestead and south of here in 1924 (Cleland et al., 1925). The species was collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). It occupies undulating dune habitat in the area of Embarka Swamp (S.E.A., 1982). During the present survey, it was collected or observed in the area of a gibber plain gutter south of Lake Moorayepe, near an ephemeral creek line 1 km north of Mudcarnie W.H., at the edge of Coorambalapinna W.H. (26°53'25"S, 140°31'55"E) near Site 4, at the channel edge of Brady's W.H. (Site 7), at the channel edge of Chillimookoo W.H. and in undulating dunes 2 km north of the W.H.,and NW of Innamincka. It was uncommon where collected although at some localities it consisted of groups of pendulous trees to 3.0 m in height. Status common.

SAPINDACEAE

Atalaya hemiglauca. Whitewood. Reported from the Strzelecki Creek last century (Tate, 1889), it was encountered on flats in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and was collected in the Clifton Hills and Coongie areas in 1975, and previously in the Clifton Hills area in 1958 and in the Innamincka area in 1964, 1968 and 1971 (Jessop, 1982). The species is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes (E.R. & P.G., 1980). During the present survey, it was collected or observed at 23 localities in the area of 12 sites (1, 4, 6, 7, 7A, 14, 15, 20, 22, 23, 24 & 28), in dune, undulating dune, sand plain, gibber plain gutter, channel edge and floodout habitat. Where collected it was generally common in the form of groves of trees to 3-4 m in height. Status very common and generally widespread - occurs as groves of trees at anumber of localities

Dodonaea angustissima. Hopbush. D. angustissima (syn. D. attenuata - said to probably be this species by the authors) was collected in sand in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Collected in the Clifton Hills area in 1975 (Jessop, 1982), D. angustissima (syn. D. attenuata is included in the Cooper Basin list as a species of the Strzelecki Desert dunes (E.R. & P.G., 1980). This species was collected or observed during the present survey on a claypan edge, in an interdune and on the edge of an ephemeral creek line north of Mudcarnie W.H., on an orange-brown dune near King Lookout (Site 7), on a brown-grey dune base 4.5 km south of Tooroowatchi W.H. (Site 7A), on undulating dunes 2 km north of Chillimookoo W.H., on an orange dune 15 km WSW of Innamincka (Site 22) and on a sand plain 6.0 km ESE of Scrubby Camp W.H. (Site 24). It was common north of Mudcarnie W.H. and uncommon north of Chillimookoo W.H. One specimen had broader than average leaves. Status common.

Dodonaea microzyga. Hopbush. Reported from the Strzelecki Creek last century (Tate, 1889), it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct.

D. viscosa. Hopbush. Reported from the Strzelecki Creek last century (Tate, 1889) and the area of Innamincka in 1916 (Black, 1917), it was collected during the present survey from the base of an orange dune 800 m east of Mudcarnie W.H. (Site 4), where it was relatively common. Status uncommon.

Heterodendrum oleaefolium. Bullock bush, rosewood, boonaree. H. oleaefolium (syn. Heterodendron oleifolium) was reported from the Cooper Creek last century (Tate, 1889) and was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

SCROPHULARIACEAE

Glossostigma diandrum. G. diandrum (syn. G. spathulatum) was collected in a damp drying watercourse in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925; Black, 1943-57). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al. 1974). The species is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare.

Mimulus gracilis. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collected in the Clifton Hills area in 1975 and previously in the same area in 1930 and 1934 (Jessop, 1982). There are no other records that relate to the study area. Status rare.

M. prostratus. Reported from the Strzelecki Creek last century (Tate, 1889), its distribution includes the,..., " country near Strzelecki and Cooper's Creek " (Black, 1943-57). It was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and was collected during the present survey from NW of Innamincka. Status uncommon.

Morgania floribunda. Bluerod. M. floribunda was collected in the area of Cordillo Downs Homestead and 25 miles south of here in 1924 (Cleland et al., 1925). During the present survey, it was collected or observed on a low white dune/ephemeral lake margin interface on the eastern margin of Lake Toontoowaranie (Site 8), on a channel edge of Kudriemitchie W.H., on a red dune 1 km SW of Lake Perigundi and on a clayey interdune 1 km north of Yalcuma W.H. Where collected it was uncommon. Status fairly common.

M. glabra. Bluerod, bluetop, blueflower. M. glabra was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). Collected in the Clifton Hills, Coongie and Innamincka areas in 1975 (Jessop, 1982) it is included in the Cooper Basin list as a species of river channels and floodplain (E.R. & P.G., 1980). In the present survey, this species was encountered on a gibber plain 8.0 km south of Lake Moorayepe, at the border of a swamp canegrass interdune 2.0 km NNW of Mudcarnie W.H., where it was common, and at the southern end of Queerbidie W.H. Status fairly common.

Peplidium sp. D. (Fl. C. Aust. Pp. 331). Collected in the study area during the present survey for the first time from a gibber plain 3.5 km south of Lake Moorayepe, where it was common. Status uncommon.

SOLANACEAE

Nicotiana excelsior. Native tobacco, giant tobacco. N. excelsior (syn. N. suaveolens) was collected in the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889) and was encountered as specimens, which were ,..., " 6-10 cm high in many localities on flooded ground near creeks; a very stunted form " ,..., in a survey of the Cooper and Strzelecki Creeks in 1916 (Black, 1917). It was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925) and was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). There are no other records that relate to the study area and the species may not now occupy the NE (Jessop, 1983). Status uncertain - probably very rare, but possibly misidentified (may be N. velutina).

N. velutina. This species was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). During the present survey, it was collected or observed at 18 localities in the area of 13 sites (4, 6, 8, 8A, 11, 13, 14, 16, 18, 21, 22, 23 & 25), in floodout, channel edge, swamp, dune, interdune claypan and sand sheet/swampy floodout habitat. Where collected it was common. Status very common.

Solanum chenopodium. Reported from the Cooper Creek last century (Tate, 1889) it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). There are no other records relating to the study area. Status uncertain - probably very rare if not locally extinct.

S. ellipticum. Potato-bush, wild gooseberry. Reported from the area of Innamincka last century (Tate, 1889), it was collected in sandhills in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of the Strzelecki Desert dunes (E.R. & P.G., 1980). The species was not collected this survey. Status rare.

S. esuriale. Tomato bush, tomato plant, quena. This species was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

S. oligacanthum. Collected in the area of Kanowana and Cuttapirie Corner in 1916, it consisted of,..., " many leaves with a single prickle on upper face; not in any quantity till well down the Cooper "(Black, 1917). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). Prior to the 1975 collections it was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). During the present survey, the species was collected or observed on floodouts near Site 6, Kudriemitchie W.H. and in the Fly Lake area, and at five localities near Site 25, it occupied floodout, clay flat or channel edge habitat. Status common - appears to be more common in the SW part of the study area near Site 25.

S. sturtianum. Reported from the area of Innamincka last century (Tate, 1889) it is not otherwise known from the study area and was not collected this survey. Status uncertain - probably very rare if not locally extinct.

STERCULIACEAE

Keraudrinia integrifolia. Considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974), it was collect ed in the Innamincka area in 1975 - considered a significant collection as this was the second S.A. record for the State Herbarium (Jessop, 1982). It is included in the Cooper Basin list (E.R. & P.G., 1980), but was not collected this survey. Status rare.

Melhania oblongifolia. M. oblongifolia (syn. M. incana) was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974) and was collected in the Clifton Hills area in 1975 (Jessop, 1982). There are no other records that relate to the study area. Status rare.

Rulingia loxophylla. Collected in the Innamincka area in 1975 (Jessop, 1982), it is included in the Cooper Basin list (E.R. & P.G., 1980). It is not otherwise known from the study area and was not collected this survey. Status rare

TETRAGONIACEAE

Tetragonia tetragonioides. New Zealand spinach, Warrigal cabbage. T. tetragonioides (syn. T. expansa) was reported from the area of Innamincka last century (Tate, 1889) and from the area of Cordillo Downs Homestead (said to be a young plant, which was probably this species by the authors) in 1924 (Cleland et al., 1925). Collected in the Coongie area in 1975 (Jessop, 1982), it is included in the Cooper Basin list as a species of the south-western dunes, river channels and floodplains (E.R. & P.G., 1980). The species was collected or observed in the present survey at 18 localities in the area of 7 sites (4, 13, 14, 15, 22, 23 & 28), in floodout (most frequently), channel and channel edge, dune, interdune and undulating dune habitat. Where collected or observed it ranged in abundance from uncommon to locally common, being apparently more prevalent along the Strzelecki Creek particularly near Toolache W.H. Status very common.

THYMELAEACEAE

Pimelea microcephala. Reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), it was collected in the area of Tinga (Tingana) in 1924 (Cleland et al., 1925). There are no other records relating to the study area. Status uncertain - probably very rare.

P. simplex ssp. continua. P. simplex ssp. continua (syn. P. continua) was considered endangered with only small colonies remaining under adverse conditions in 1974 (Specht et al., 1974). A 1975 collection well to the west of the study area and listed in the far NE N.C.S.S.A. Survey report was considered significant as the species was,..., " possibly not previously known from further north than Leigh Creek " (Jessop, 1982). The one collection during the present survey from an open gibber-clay flat NNW of Site 6 (where the species was uncommon) and an observation of the species on a gibbe plain 3.5 km south of Lake Moorayepe (which must be considered tentative due to the lack of a specimen), therefore add significantly to the known range of the species. Status uncommon in the northern half of the study area - possibly associated with gibber areas.

P. simplex ssp. simplex. Collected on tableland country in a survey of the Cooper and Strzelecki Creeks in 1916 (Black, 1917), it is included in the Cooper Basin list (E.R. & P.G., 1980). There are no other records that relate to the study area. Status uncertain - probably very rare.

P. trichostachya. Spiked riceflower, poverty bush, broom bush. Reported from the area of Innamincka last century (Tate, 1889), it was collected in the Clifton Hills area in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E.R. & P.G., 1980). During the present survey, it was collected from near Coongie (Site 8) and from a sand plain 6 km ESE of Scrubby Camp W.H. (Site 24). Status uncommon.

VERBENACEAE

Verbena bonariensis. Naturalised: Purpletop. Collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982), it is not otherwise known from the study area and was not collected this survey. Jessop (1983), considers it to only occupy the Southern Lofty region of S.A. Status uncertain - probably rare, but may be misidentified.

V. macrostachya sensu Tate (1889). ?Naturalised. Reported from the area of Innamincka and along the Strzelecki Creek last century (Tate, 1889), its synonomy is uncertain. Status uncertain.

V. officinalis. Naturalised: Common verbena. Collected from south of Cordillo Downs Homestead and in the area of Innamincka in 1924 (Cleland et al., 1925), it is included in the Cooper Basin list (E.R. & P.G., 1980). It was collected during the present survey from clayey soil around a borrow pit 2.0 km west of Cartoonganie W.H., where it was locally common, from a channel in Tirrawarra Swamp, where it was uncommon, and from a floodout bordering Tirrawarra W.H. (Site 15). Status fairly common.

VIOLACEAE

Hybanthus monopetalus. H. monopetalus (syn. H. tatei) was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al., 1925). It was considered depleted with a population originally widespread, but now reduced in area and needing constant monitoring in 1974 (Specht et al., 1974). The species was recently considered to occupy the NE (Jessop, 1981), but has more recently been omitted from a list for the area (Jessop, 1983). There are no other records that relate to the study area. Status uncertain - probably very rare.

ZYGOPHYLLACEAE

Nitraria billardieri. Nitre-bush. N. billardieri (syn. N. schoberi) was collected in the Clifton Hills area in 1975 (Jessop, 1982). It was not collected this survey and is not otherwise known from the study area. Status rare.

Tribulus hystrix. Caltrop, bull head, cat head. Reported from the area of Innamincka last century (Tate, 1889), it was found as a bush 8-10 inches high and 2 feet across in sand at Tinga Tingana in 1916 (Black, 1917). It was collected in the area of Cordillo Downs Homestead in 1924 (Cleland et al. 1925) and was considered rare with a population of adequate size, but needing constant monitoring in 1974 (Specht et al., 1974). The species was collected in the Clifton Hills area in 1962 and 1975 and in the Innamincka area in 1972 and 1975 (Jessop, 1982) and is included in the Cooper Basin list as a species of the south-western and Strzelecki Desert dunes (E.R. & P.G., 1980). During the present survey, T. hystrix was collected from a dune/floodout interface 13 km SSW of Chillimookoo W.H., where it was locally common. Status uncommon, but locally common in parts.

T. occidentalis. Perennial caltrop. During the present survey, T. occidentalis was collected or observed on a red dune slope 4.0 km south of Lake Moorayepe, where it was common, on an orange dune east of Mudcarnie W.H. (Site 4), on a low white dune/lake margin interface on the eastern margin of Lake Toontoowaranie (site 8), on a deep white dune SE of Boggy Lake (Site 16), on an orange dune on the eastern edge of Embarka Swamp (Site 21) and on a red dune 1.5 km north of Yalcuma W.H., where it was common. Status common.

Tribulus terrestris. Naturalised: Caltrop. Collected on stony tablelands in the area of the Cooper and Strzelecki Creeks in 1916 (Black, 1917), a specime (probably this species - insufficient material to be positive) was collected on undulating dunes on the eastern edge of Lake Marrakoonamooka during this survey. It was common at this locality. Status uncommon overall, but locally common in parts.

Zygophyllum ammophilum. Sand twinleaf. Reported from the area of Innamincka last century (Tate, 1889), it was collected in the Clifton Hills and Innamincka areas in 1975 (Jessop, 1982) and is included in the Cooper Basin list (E. R. & P.G., 1980). It was collected or observed during the present survey on a red dune 10 km west of Coongie Lake, on the channel edge of Chillimookoo W.H. and a floodout adjacent to the W.H., on a dune/floodout interface 13 km SSW of Chillimookoo W.H., on a floodout bordering Tirrawarra W.H. (Site 15), at the southern end of Queerbidie W.H., on a floodout adjacent to Toolache W.H. and on a red dune 5.0 km north of the W.H. and on a pale dune 6.0 km SW of Daralingie Well. It was common at one locality from which it was collected and uncommon at another. Status common.

Z. aurantiacum. Shrubby twinleaf. Z. aurantiacum (syn. Z. fruticulosum) was reported from the area of Innamincka last century (Tate, 1889) and in the area of Lake Perigundi, it,..., " formed large bushes on the shores of some salt lakes ",..., in 1916 (Black, 1917). It was collected in the Clifton Hills area in 1975 (Jessop, 1982), but was not collected this survey. Status rare.

Z. billardieri. Reported from the area of Innamincka last century (Tate, 1889), it is not otherwise known from the study area and was not collected this survey. It is now notconsidered to occupy the NE (Jessop, 1981, 1983). Status uncertain - probably very rare if not locally extinct, but possibly misidentified.

Z. crenatum. Z. crenatum (syn. Z. glaucescens) was reported from the Strzelecki Creek last century (Tate, 1889). There are no other records that relate to the study area. Status uncertian - probably very rare if not locally extinct.

Z. howittii. Z. howittii was found growing in the dry sandy bed of the Strzelecki Creek in 1916 (Black, 1917). It was collected in the Clifton Hills and Coongie areas in 1975 (Jessop, 1982). During this survey, it was collecte or observed on a deep white dune SE of Boggy Lake (Site 16), on an orange dune on the western edge of Embarka Swamp (Site 21), on undulating dunes on the eastern edge of Lake Marrakoonamooka, on a sand dune north of Lake Hope and on a floodout 12.3 km north of Toolache W.H. It was uncommon where it was collected. Status fairly common.

Z. iodocarpum. Z. iodocarpum was found to be,..., " common over the whole country " ,..., in a survey of the Cooper and Strzelecki Creeks in 1916 (Black, 1917). In this survey, it was collected on a floodout west of Toolache W.H., where it was common. Status uncommon, but common in parts.

ADDENDUM: Rhagodia hastata and R. parabolica both included in E.R. & P.G. (1981) - see page 12 - and not included in their appendix on plants (Appendix 1) are considered doubtful, i.e. possibly misidentified.

Appendix S

APPENDIX S - ANNOTATED LIST OF SPECIES OF BIRD ENCOUNTERED IN THE COOPER CREEK ENVIRONMENTAL ASSOCIATION 8.4.4 PREVIOUSLY OR DURING THE PRESENT SURVEY, WITH AN INDICATION OF STATUS IN THE STUDY AREA.

- Those species which are inadequately conserved in South Australia are indicated.
- Doubtful records are indicated by (?).

STRUTHIFORMES

DROMAIIDAE

Emu *Dromaius novaehollandiae*. Generally uncommon to moderately common in 8.4.4 in all habitats although less common in dunefields away from water. E.R. & P.G. (1980) indicate a preference for grassy or chenopodioid plains in the Cooper Basin. Occasionally large concentrations have been recorded in adjacent regions to 8.4.4 in the North-East (e.g. Reese, 1935a), presumably attracted to water in dry seasons or due to a build up in numbers in good seasons.

PODICIPEDIFORMES

PODICIPEDIDAE

Great Crested Grebe *Podiceps cristatus*. Rare non-breeding visitor with a few records only in 8.4.4 from along the Cooper north to Coongie (e.g. May, 1980 - Mr L. Joseph, pers. comm.).

Inadequately conserved (Reid and Vincent, 1979).

Hoary-headed Grebe *Poliocephalus poliocephalus*. Generally uncommon to rare in 8.4.4, except after good flows along the Cooper when large concentrations can occur at Coongie (e.g. August, 1979 - Reid, unpubl. data), and Embarka Swamp where it was breeding in 1983 (this survey) - the northern extension of its breeding range (Parker *et al.*, 1979). The species also occurs on lakes and dams away from the Cooper.

Australasian Grebe *Tachybaptus novaehollandiae*. Less common than the preceding species in the study area, although as widespread, being found on bore drains, casual waters and the Cooper. There is a northern breeding record in 8.4.4 (R.A. O.U. ATLAS).

PELICANIFORMES

PELICANIDAE

Australian Pelican *Pelecanus conspicillatus*. Generally uncommon to moderately common in 8.4.4, although large breeding populations build up occasionally; the population must crash to virtually zero in times of drought coincident with the Cooper drying almost completely. It is mainly found along the Cooper, but also Strzelecki Creek and casual waters - there are breeding records from Lake Goyder and Coongie. The North-East is one of six "main centres of distribution" of the species in South Australia when conditions are appropriate (Parker *et al.*, 1979).

ANHINGIDAE

Darter *Anhinga melanogaster*. Uncommon in 8.4.4. An irregular and apparently non-breeding visitor, although moderately common in some years e.g. 1975 (Cox, 1982), and 100+ at Coongie in August, 1979 (Reid, unpubl. data). The species is confined to the Cooper and was not recorded this survey.

Inadequately conserved.

PHALACROCORACIDAE

Great Cormorant Phalacrocorax carbo. Generally uncommon in 8.4.4, although large concentrations may occur along the Cooper in favourable seasons. Breeding at Coongie in 1973-75 (Rix, 1974; Cox, 1982), there are few records away from the Cooper.

Reid and Vincent (1979) are uncertain whether P. carbo is adequately conserved.

Pied Cormorant P. varius. Generally uncommon to absent in 8.4.4, although occasionally larger numbers occur. The species is largely confined to the Cooper and was breeding at Coongie between 1973-75 (Rix, 1974; Cox, 1982). P. varius is primarily a coastal species.

Little Black Cormorant P. sulcirostris. Generally uncommon in 8.4.4, although occasionally large concentrations occur. The species is confined to the Cooper including breeding at Coongie in September, 1973 (Rix, 1974).

Little Pied Cormorant P. melanoleucos. Uncommon in 8.4.4. Only recorded on the Cooper including breeding at Coongie in September, 1973 (Rix, 1974).

ARDEIFORMES

ARDEIDAE

Pacific Heron Ardea pacifica. Generally uncommon, although widespread in 8.4.4. Occurs on small and casual sources of water as well as the Cooper and Strzelecki and breeds occasionally as at Coongie (e.g. McGilp, 1931a). This species was moderately common in the recent wet period, 1973-80, but numbers crashed over the subsequent dry period; only a few records this survey.

Uncommon and declining in South Australia (Parker et al., 1979). Inadequately conserved (Reid and Vincent, 1979).

White-faced Heron A. novaehollandiae. Generally uncommon to moderately common in 8.4.4. Widespread in a variety of wetland habitats. Occurs throughout the study area when conditions are favourable, but is most common along the Cooper; one breeding record (R.A.O.U. ATLAS) - northern (Parker et al., 1979).

Great Egret Egretta alba. Uncommon to absent in 8.4.4. Generally confined to the Upper Cooper, but there are also records from the Lower Cooper (e.g. Badman, 1979)

Little Egret E. garzetta. Rare; single birds at Coongie in August, 1979 (Reid, unpubl. data).

Intermediate Egret E. intermedia. Rare; at Coongie in August, 1979 (Reid, unpubl. data) and Innamincka in May, 1980 (Mrs J.B. Paton, pers. comm.).

Rufous Night Heron Nycticorax caledonicus. Generally uncommon to absent in 8.4.4. Largely restricted to the Cooper in the study area and reputed to breed here (R.A.O.U. ATLAS).

Reid and Vincent (1979) are uncertain whether it is adequately conserved.

PLATALEIDAE

Glossy Ibis Plegadis falcinellus. Uncommon to rare in 8.4.4. Often absent, but in some years a few large concentrations occur on the Cooper e.g. 1973 (Rix, 1974), 1979 and 1982 (Pedler, unpubl. data); not recorded in 1974, 1975, 1976 and 1980 when bird observers were in the region. This species must be highly nomadic, although Badman (1979) regards it as the commonest of the three Ibis species in the (greater) Lake Eyre region. Bred NW of 8.4.4 in 1930 (Reese, 1930b).

Inadequately conserved (contra Reid and Vincent, 1979).

Sacred Ibis Threskiornis aethiopica. Uncommon. No early records, but regularly recorded along the Cooper since 1973 when Rix (1974) found it to be "common" at Coongie. Subsequent records are of low numbers, and the species was not seen during this survey possibly due to the drier nature of the study area since 1980.

Reid and Vincent (1979) are uncertain whether it is adequately conserved.

Straw-necked Ibis T. spinicollis. Uncommon. Irregular visitor after heavy rains and flood events (Parker et al., 1979), often in large numbers. Embarka and Tirrawarra Swamps should provide suitable nesting habitat after flooding of the Cooper. Frequents bore drains and casual waters as well as the major watercourses; not recorded in this survey of 8.4.4, but recorded previously on the Cooper Creek floodplain at Coongie and in the south-western dunefields.

Inadequately conserved (Reid and Vincent, 1979).

Royal Spoonbill Platalea regia. Generally uncommon in the study area, although in some seasons common and widespread along the Cooper as in 1975 (Cox and Pedler, 1977).

Doubtfully adequately conserved (contra Reid and Vincent, 1979).

Yellow-billed Spoonbill P. flavipes. Uncommon to moderately common; generally more common and widespread than the previous species (although the situation is occasionally reversed as in 1975); found on bore drains and casual waters as well as the major watercourses. Previously has bred in the study area (R.A.O.U. ATLAS) and was breeding at Embarka Swamp in 1983 (this survey).

Inadequately conserved (Reid and Vincent, 1979).

ANSERIFORMES

ANATIDAE

Magpie Goose Anseranas semipalmata. Virtually extinct in South Australia. Records along the North-West Branch of the Cooper Creek in the 1920's and reported to have always been present at Coongie by Reese (1924). This species has suffered a drastic decline in Australia since European settlement (Frith, 1977). Once a breeding resident throughout south-eastern Australia, it is now almost entirely restricted to the northern sub-coastal plain. Extinct in the North-East, although vagrants will occasionally turn-up.

(?) Wandering Whistling-Duck Dendrocygna arcuata. Status uncertain. Condon (1969) refers to a specimen from Cooper Creek (in South Australia), and there are sight records from Innamincka (Rix, 1974) and Coongie (Bird Talk 1:5). However, its presence is regarded as questionable, owing to possible confusion with the following species. D. arcuata is most unlikely to occur in South Australia, being confined to the far north of Australia (Frith, 1977).

Plumed Whistling-Duck D. eytoni. Generally uncommon and often absent from the study area, D. eytoni is occasionally common after flood events along Cooper

Creek. Records are from along the Cooper and large numbers were recorded along the Strzelecki in 1976 (Cupper, 1983). A few breeding records e.g. Lake Hope in October, 1863 (Parker, 1980b) and more recently (Cupper, 1983). Recorded at Coongie and Embarka Swamp during the present survey.

Inadequately conserved.

Black Swan Cygnus atratus. Generally uncommon in the study area. Found along the length of the Cooper when in flood; breeding reported occasionally as at Coongie in 1930 (McGilp, 1931a).

Freckled Duck Stictonetta naevosa. Uncommon in 8.4.4 with only a handfull of records of small numbers including a few from along the Cooper. The records are from Lake Goyder (Reese, 1927b), Lakes Hope and Appadare (Badman, 1979), Coongie (August, 1979 and in 1982 - Pedler, unpubl. data) and near Moomba (in January, 1983 - R.A.O.U. Newsletter No. 56). It is known to breed along Cooper Creek in South Australia (Mr S.A. Parker, pers. comm.). Despite the paucity of records, current opinion (Parker and Braithwaite, in prep.; Martindale, 1983 - R.A.O.U. Newsletter No. 56) holds that the Cooper system in South Australia may form part of the breeding stronghold of the species.

Threatened and requiring further protection.

Australian Shelduck Tadorna tadornoides. Uncommon to absent in 8.4.4 with occasionally large concentrations along the Cooper e.g. ca 600 at Coongie in August, 1975 (Cox and Pedler, 1977). Confined to the Cooper in 8.4.4.

Pacific Black Duck Anas superciliosa. Widely distributed, generally moderately common and occasionally abundant in the study area. Regularly breeds here when conditions are favourable (e.g. Rix, 1974). Most abundant along the Cooper, but frequents casual waters as well. Surprisingly uncommon in the study area during the present survey; in some years numbers are low e.g. not recorded along the Strzelecki and Cooper in October, 1916 (White, 1917a).

Grey Teal A. gibberifrons. Moderately common to abundant in the study area. Frequents most waters; many birds on Lake Goyder and lakes to the south in 1983, however, waterbirds were absent from nearby Lake Apanburra (Mr L.W. Best, pers. comm.) possibly due to adverse conditions related to salinity (see Section 2.4). A. gibberifrons regularly breeds here when conditions are favourable. Size of the population fluctuates greatly according to the season - a highly nomadic species.

Chestnut Teal A. castanea. Rare vagrant in the study area, which was recorded at Coongie in August, 1979 (Reid, unpubl. data) and there were unconfirmed reports from the North-West Branch in 1983 (this survey).

Reid and Vincent (1979) are uncertain whether it is adequately conserved.

Australian Shoveler A. rhynchotis. Generally absent with occasionally small numbers along the Cooper, further north adjacent to the study region (Reese, 1925 - Minnie Downs) and Cordillo Downs (Mrs J.B. Paton, pers. comm.). "Common" at Coongie in August, 1979 (Reid, unpubl. data).

Threatened, inadequately conserved and deserving total protection (Reid and Vincent, 1979).

Northern Shoveler A. clypeata. An extremely rare vagrant in South Australia. The sole South Australian record is from Coongie in August, 1979 (Close and Jaensch, 1981).

Pink-eared Duck Malacorhynchus membranaceus. Generally moderately common to abundant, while occasionally uncommon. Highly nomadic, the species frequents all waters and regularly breeds along the length of the Cooper after flood events e.g. at Innamincka, Embarka Swamp and Coongie.

Inadequately conserved and requiring further protection (Reid and Vincent, 1979).

Hardhead *Athya australis*. Generally uncommon and thinly scattered on the Cooper in 8.4.4, where it has been occasionally reported as common e.g. at Lakes Hope and Appadare (Badman, 1979). It has been recorded breeding at Coongie (Rix, 1974) and was breeding at Embarka Swamp in 1983 (this survey), and is also recorded infrequently on dams and waterholes away from the Cooper.

Inadequately conserved and threatened (Reid and Vincent, 1979).

Maned Duck *Chenonetta jubata*. Moderately common to very common. Most abundant along the Upper Cooper e.g. 3000 on Lake Oolgoopiarie and 2000 at Coongie in August, 1979 (Cox and Pedler, 1977); found in small numbers on dams and casual waters as well as the major watercourses. Breeding recorded along the Cooper and possibly the Strzelecki (R.A.O.U. ATLAS).

Blue-billed Duck *Oxyura australis*. Rare visitor. Within 8.4.4 there are three records from along the length of the Cooper (e.g. Badman, 1979). There is also an unconfirmed record from Embarka Swamp in 1983 (this survey). Prefers deeper waters.

Inadequately conserved (Reid and Vincent, 1979).

Musk Duck *Biziura lobata*. Generally uncommon and sometimes absent in the study area. Almost totally confined to the deeper pools of the Cooper Creek; no breeding records.

ACCIPITRIFORMES

ACCIPITRIDAE

Black-shouldered Kite *Elanus notatus*. Generally absent in the study area, although moderately common in 1974 (Cox and Pedler, 1977), perhaps in response to a mouse plague following the widespread rains in 1973 and 1974. No records north of Moomba and Innamincka in 8.4.4 (Cox and Pedler, 1977; R.A.O.U. ATLAS).

Letter-winged Kite *Elanus scriptus*. Irregular breeding visitor to 8.4.4, often in large numbers (Parker, 1980a), and its occurrence is geared to periodic population explosions of *Rattus villosissimus*. Reported to be breeding and common along the Cooper (e.g. Lake Hope) in 1863 by Samuel White (Parker, 1980b); another invasion occurred in 1924 (Reese, 1924), and there appears to have been three since 1950 (Baker-Gabb and Pettigrew, 1982), while no doubt others have occurred prior to 1950. Large concentrations reported from 8.4.4 include *ca* 50 at Patchawarra Bore in October, 1974 (Cox and Pedler, 1977), and Mr T. Fraser (this survey) found more than 100 nests in a disused colony at Lake Oolgoopiarie. After the most recent invasion in 1974-75, stragglers remained until at least 1980 (Baker-Gabb and Pettigrew, 1982). *E. scriptus* appears to be expanding its foraging niche as it was recently reported (Baker-Gabb and Pettigrew, 1982) as preying on plaguing *Mus musculus*. If breeding colonies can be sustained on a diet of *Mus*, perhaps appearances of this species will become more frequent. The species favours tree lined watercourses in which to roost and breed, and breeds only in the Lake Eyre Drainage in South Australia.

Inadequately conserved.

Black Kite *Milvus migrans*. Generally common, particularly around waterholes and centres of human activity (e.g. dwellings, camps and towns), although numbers fluctuate widely. During dry spells, numbers are considerably reduced (Reese, 1928a, 1935a - adjacent to 8.4.4; observations this survey), while in good seasons flocks of 500 and 2000 have been reported (Cox and Pedler, 1977).

(?) Square-tailed Kite Lophoictinia isura. Status uncertain. One unconfirmed report from woodland habitat in the study area (this survey). No other records in 8.4.4 or the wider North-East.

Black-breasted Buzzard Hamirostra melanosternon. Uncommon breeding resident of tree-lined watercourses in 8.4.4. Probably most common along the Upper Cooper in areas of northern river red gum woodland e.g. three pairs were seen by Cox (1982) at Coongie, although assuredly breeds along the lengths of the Cooper and Strzelecki (e.g. Condon, 1969; Dr D.J. Baker-Gabb in litt.; observations this survey by L.P. Pedler and Mr T. Fraser). Regularly only occurs in the the Lake Eyre Drainage in South Australia.

Inadequately conserved (Reid and Vincent, 1979).

Whistling Kite Haliastur sphenurus. Moderately common and widespread in 8.4.4, although fairly restricted to watered areas. It breeds along the watercourses (Reid, unpubl. data).

Brown Goshawk Accipiter fasciatus. Uncommon in 8.4.4 and perhaps a non-breeding visitor in the main, although breeding adjacent to the study area in August, 1979 (Reid, unpubl. data). It has only been reported from the Cooper Creek floodplain within 8.4.4, where it is restricted to better wooded waterholes and watercourses.

Collared Sparrowhawk A. cirrhocephalus. Indeterminate status, although possibly uncommon in 8.4.4. Probably not a resident judging by the paucity of records (12 in the entire North-East). There are several records from Kudriemitchie to Coongie; one breeding report prior to 1950 (R.A.O.U. ATLAS).

Wedge-tailed Eagle Aquila audax. Moderately common to common in the study area. Recorded throughout. A breeding resident; breeding is probably largely restricted to tree-lined watercourses.

Little Eagle Hieraaetus morphnoides. Moderately common in the study area. Occurs along the Cooper where it favours riparian woodland habitat. Also recorded along the Strzelecki and present on minor watercourses in the study area. e.g. breeding at Mudcarnie W.H. in 1983 (this survey).

Spotted Harrier Circus assimilis. Generally uncommon in 8.4.4, although occasionally widespread and common (Cox and Pedler, 1977; Cox, 1982). Forages over all habitats and breeding is not confined to timbered watercourses e.g. 39 km south of Moomba (Reid, unpubl. data).

Marsh Harrier C. aeruginosus. Generally uncommon in 8.4.4, although may be encountered on bore drains, swamps and lakes in some years (Cox, 1982; Mrs J.B. Paton, pers. comm.) - confined to such habitats. Old breeding records from Lake Hope in 1863 (Parker, 1980b). A large population build-up occurred in 8.4.4 between 1975 and 1980, when the Cooper and its lakes often contained large amounts of water. Few birds though were seen in 1982 (Pedler, unpubl. data) and 1983 (this survey).

Reid and Vincent (1979) are uncertain whether it is adequately conserved.

FALCONIDAE

Black Falcon Falco subniger. This highly nomadic species varies from uncommon to common in 8.4.4 and breeds along watercourses (Cox, 1982), but forages in a wide range of habitats. Particularly common in 1974 and 1975 (Cox and Pedler, 1977) and 1979 (Reid, unpubl. data). Widespread when common.

Peregrine Falcon Falco peregrinus. Uncommon vagrant in the study area. Reported at Coongie (R.A.O.U. ATLAS) and a breeding record adjacent to 8.4.4 (Nappa Merrie, Qld - Chenery, 1921).

Inadequately conserved (Reid and Vincent, 1979).

Australian Hobby F. longipennis. Uncommon generally in the study area. Confined to the Cooper where it is regularly encountered in wooded habitat. The species is moderately common along the North-West Branch and was breeding at Tirrawarra W.H. in August, 1982 (Pedler, unpubl. data). A winter influx of this species may occur.

Inadequately conserved in South Australia (Reid and Vincent, 1979).

Grey Falcon F. hypoleucos. Rare in the study area. A handfull of records along the Strzelecki and Cooper in 8.4.4, including (indications of) breeding along both creeks. Rare and nomadic throughout its central Australian range and rare overall in Australia (Slater, 1980).

Inadequately conserved in South Australia (Reid and Vincent, 1979).

Brown Falcon F. berigora. Generally uncommon and widespread in the study area, where it breeds regularly (e.g. Parker, 1980b). Numbers vary.

Australian Kestrel F. cenchroides. Generally uncommon and widespread in all habitats in 8.4.4.

GALLIFORMES

PHASIANIDAE

Stubble Quail Coturnix novaezelandiae. Uncommon (?)visitor, with scattered records in 8.4.4. Favours grassland and other well grassed habitats, as are found after heavy rains or floods. It has been reported to breed (Reese, 1936) and to be in large numbers in some years (Reese, 1933a) in the vicinity of 8.4.4.

GRUIFORMES

TURNICIDAE

Little Button-quail Turnix velox. Same notes as for Stubble Quail.

BALLIDAE

Baillon's Crake Porzana pusilla. Rare. The sole record for 8.4.4 is of one at Coongie in August, 1975 (Cox, 1982).

Inadequately conserved (Reid and Vincent, 1979).

Australian Crake P. fluminea. Probably a regular and moderately common visitor to lignum swamps along the Cooper in 8.4.4 after flooding; known from Coongie and Embarka Swamp, where common at both localities in 1979 (Reid, unpubl. data) and 1983 (this survey), respectively.

Spotless Crake P.tabuensis. Rare. Only recorded at Coongie in 8.4.4 (August, 1979 - Reid, unpubl. data).

Inadequately conserved in South Australia (Reid and Vincent, 1979).

Black-tailed Native-hen Gallinula ventralis. At least moderately common in 8.4.4, where favourable habitat is most often found along the Cooper. Huge numbers have been reported here after floods e.g. "thousands" at Coongie in late 1930 (McGilp, 1931a), 5 000 at Coongie and 10 000 at Lake Oolgoopiarie in August, 1975 (Cox, 1982). The study area forms part of the breeding stronghold of the species in Australia, and as the Cooper dries following flood events, massive declines in the local population occur resulting in Australia wide irruptions (Parker, 1980a)

Inadequately conserved (Reid and Vincent, 1979).

Dusky Moorhen G. tenebrosa. Rare visitor in small numbers to the study area. First recorded in 8.4.4 at Coongie in August, 1975 (Cox, 1982 - also the first record for the North-East). And, recorded at Embarka Swamp in 1983 (this survey). The species may be expanding its range northwards.

Purple Swamphen Porphyrio porphyrio. Generally uncommon in 8.4.4. There are several records from the Coongie district (e.g. Cox, 1982) and Embarka Swamp (this survey). It has been reported as moderately common at both localities, but not breeding.

Eurasian Coot Fulica atra. Generally uncommon and sometimes absent in the study area, favouring open water of lakes, swamps and waterholes; all records are from the Cooper. Occasionally large concentrations occur along the Cooper e.g. in the Coongie district in August, 1979 (Reid, unpubl. data), and "thousands" on the Lower Cooper in 1977 (Badman, 1979). The species was breeding at Coongie in September, 1973 (Rix, 1974).

GRUIDAE

Brolga Grus rubicundus. Generally uncommon and relatively widespread in the study area. It has been recorded from the entire length of the Cooper and also the districts to the north in 8.4.4, where it frequents bore drains, lakes, swamps, waterholes and their surrounds. 109 birds were observed on Lake Goyder in February, 1924 (Reese, 1924) and breeding records in the vicinity of 8.4.4 were made in April, 1936 (Reese, 1936) and June, 1963. Observations this survey include Lake Marrakoonamooka.

Inadequately conserved (Reid and Vincent, 1979).

OTIDAE

Australian Bustard Ardeotis australis. Uncommon to rare in the study area. Records are widespread and it is known to breed here (R.A.O.U. ATLAS). Favours well grassed flats. Not recorded in this survey of 8.4.4. In the North-East generally it becomes moderately common and widespread in good seasons after heavy rains and/or big floods (Reese, 1925, 1930b, 1931b) as was the case in 1974 and 1980, however, it was not recorded in 1982-83 (Pedler, unpubl. data; this survey) so in average seasons it is uncommon to rare. The species has declined in the North-East this century (contra E.R. & P.G., 1980) - the "hundreds" that used to occur (Reese, 1930b) are no longer reported.

Declining (extinct in parts of southern South Australia) and inadequately conserved.

CHARADRIIFORMES

BURHINIDAE

Bush Thick-knee Burhinus magnirostris. Declining this century to be rare (Badman and May, 1983), although uncommon at times along the Cooper in 8.4.4. Recorded twice by White (1917a), once by Reese (1925), several times by Messrs Parker and

May (in Badman and May, 1983), and there is at least one other record (R.A.O.U. ATLAS) - mostly from the Cooper. Apparently a rare visitor, favouring riparian woodland and nearby grassy flats.

Rare and declining in mainland South Australia; urgently requiring study (Reid and Vincent, 1979).

CHARADRIIDAE

Masked Lapwing Vanellus miles. Common and relatively widespread in 8.4.4, with a preference for bore drains, swamps, lakes and occasionally waterholes. The two subspecies V. m. miles and V. m. novaehollandiae are regularly encountered. Breeds regularly (Badman and May, 1983).

Banded Lapwing V. tricolor. Uncommon but widespread in the study area, with occasional irruptions (Badman and May, 1983). Recorded fairly regularly along the Cooper and Strzelecki including brreding. Favours open flats and short grasslands near water.

Lesser Golden Plover Pluvialis dominica. Vagrant - one at Lake Goyder in August, 1982 (Badman and May, 1983). Uncommon arctic breeding migrant to South Australia.

Inadequately conserved (Reid and Vincent, 1979).

Red-kneed Dotterel Erythrogonys cinctus. An uncommon to locally common nomadic. It is only known from the Cooper Creek floodplain in 8.4.4, where it regularly frequents ephemeral swamps and less frequently other wetland habitats - also breeds regularly (e.g. Badman and May, 1983).

Inadequately conserved (Reid and Vincent, 1979).

Red-capped Plover Charadrius ruficapillus. Common. Recorded on fresh and salt lakes, less-so other water bodies and occasionally on gibber - large concentrations can occur at times e.g. 2000 at Lake Goyder and large numbers at Coongie, Lakes Toontoowaranie, Hope and Appadare (Badman and May, 1983). Generally infrequently seen by other observers in 8.4.4 - along the Cooper,and once on the Strzelecki (Rix, 1974), although White (1917a) regarded it as widespread in Oct., 1916. Found breeding at Embarka Swamp in 1983 (this survey).

Black-fronted Plover C. melanops. Widespread and moderately common to common near water in 8.4.4, and regularly breeds here as at Coongie (Rix, 1974).

Inland Dotterel Peltohyas australis. Uncommon in 8.4.4 due to the paucity of gibber, its favoured habitat. Badman and May (1983) have indicated that this species' occurrence is largely tied to local rainfall, which is supported by a long sequence of observations in the vicinity of 8.4.4 (Reese, 1927a, 1928a, 1933a, 1935a, 1936). The species was not recorded by Pedler (unpubl. data) in August, 1982 (in the middle of a long drought), yet there was a number of records in the latter half of 1983 (Pedler, unpubl. data; this survey).

Not conserved in South Australia (Reid and Vincent, 1979).

RECURVIROSTRIDAE

Black-winged Stilt Himantopus himantopus. Generally uncommon in 8.4.4, although large concentrations may occur on the Lower Cooper when the lakes contain water e.g. 100+ on Lakes Hope and Appadare (Badman and May, 1983); otherwise only regularly recorded at Coongie (e.g. Cox, 1982). Breeds when conditions are suitable (Badman and May, 1983).

Banded Stilt Cladorhynchus leucocephalus. Generally uncommon and sometimes absent, the species favours open saline lakes. There are two records in 8.4.4 - Coongie (Reese, 1931b) and ca 100 on Lake Appadare in November, 1979 (Badman and May, 1983).

Inadequately conserved (Reid and Vincent, 1979).

Red-necked Avocet Recurvirostra novaehollandiae. Generally uncommon in 8.4.4, although large concentrations are not infrequently recorded. Favours a wide range of habitats, but especially open shallow waters. Especially common on the Lower Cooper during 1978, 1979 and 1980 as the lakes were drying up e.g. 10 000 on Lake Appadare and 1 000 on Lake Hope (Badman and May, 1983). Similarly recorded on three drying lakes to the north of Coongie in May, 1980 (Mrs J.B. Paton, pers. comm.); otherwise few records from 8.4.4. Regularly recorded at Coongie (e.g. McGilp, 1931a) and there was a breeding record at Embarka Swamp in 1983 (this survey).

SCOLOPACIDAE

Whimbrel Numenius phaeopus. Rare vagrant - sole 8.4.4 (and North-East) record from Lake Apanburra in May, 1980 (Mrs J.B. Paton, pers. comm.).

Common Sandpiper Tringa hypoleucos. Occasional visitor. Few records along the Cooper in 8.4.4 e.g. Tirrawarra W.H. in August, 1982 (Pedler, unpubl. data), perhaps on passage only (Badman and May, 1983).

Greenshank T. nebularia. Uncommon, occasional visitor. A number of records along the length of the Cooper in 8.4.4. Occurs in a variety of wetland habitats (see Badman and May, 1983).

Marsh Sandpiper T. stagnatilis. Rare. One record from 8.4.4 of 14 at Lake Appadare in November, 1979 (Badman and May, 1983).

Latham's Snipe Gallinago hardwickii. Rare. Four birds on Embarka Swamp in 1983 (Pedler, this survey) is the only record from 8.4.4.

Inadequately conserved (Reid and Vincent, 1979).

Black-tailed Godwit Limosa limosa. Rare, vagrant (Badman and May, 1983) - sole record of 11 birds at Lake Toontoowaranie in August, 1979, presumably on passage.

Inadequately conserved (Reid and Vincent, 1979).

Sharp-tailed Sandpiper Calidris acuminata. Uncommon to moderately common within 8.4.4. Large concentrations (up to 500) on Lakes Hope, Appadare and Goyder have been reported (Badman and May, 1983), but there are few other records - Coongie (e.g. Rix, 1974) and 39 km south of Moomba in August, 1979 (Reid, unpubl. data), while one was seen adjacent to 8.4.4 in 1983 (this survey). C. acuminata is the most common of the trans-equatorial migrant waders of the wider North-East, where it frequents most waters (Badman and May, 1983).

Red-necked Stint C. ruficollis. Uncommon. The only records in 8.4.4 are from the Lower Cooper, where large flocks have been seen on Lakes Hope and Appadare (Badman and May, 1983).

Curlew Sandpiper C. ferruginea. Uncommon. The only records in 8.4.4 are from Lakes Hope (hundreds) and Appadare (20+) by Badman and May (1983).

GLAREOLIDAE

Australian Pratincole Stiltia isabella. Generally uncommon in 8.4.4, being more common in areas of gibber that surrounds the study area; regularly recorded around Coongie and scattered records throughout the remainder of the study area.

LARIDAE

Silver Gull Larus novaehollandiae. Uncommon to moderately common around lakes, beaches and along the Cooper. Scattered records through much of 8.4.4, but only regularly encountered on the Upper Cooper as at Coongie (McGilp, 1931a; Rix, 1974; 1979 - Reid, unpubl. data).

Gull-billed Tern Gelochelidon nilotica. Uncommon to rare in 8.4.4 and sometimes absent (not recorded in 1975 - Cox (1982) or 1982 - Pedler, unpubl. data) due to the paucity of gibber, although regularly recorded along the Cooper (e.g. Badman, 1979; Reid, this survey). Also recorded by White (1917a) along the Strzelecki, and on the gibber south of Lake Moorayepe (this survey). The species favours lakes and other waters in the vicinity of stony plains and occasionally becomes locally common, probably after heavy rains. A highly nomadic species, its regular breeding grounds (if any) are unknown. It has not yet been observed to breed in 8.4.4, but has bred in the North-East (see Brandon, 1951).

Inadequately conserved (Reid and Vincent, 1979).

Whiskered Tern Chlidonias hybrida.Generally uncommon and sometimes absent, favouring lakes, but also large waterholes. The records in 8.4.4 are from Lakes Hope, Appadare (Badman, 1979), Apanburra, Warra Warreenie, Marroocoolcanie (Mrs J.B. Paton, pers. comm.) and Coongie (e.g. Rix, 1974), as well as a few other records from along the Upper Cooper. Three birds were also seen in 1983 on the gibber south of Lake Moorayepe after rain (this survey). Perhaps largely absent from the North-East until the massive rains in the 1970's - first record of 20 at Coongie in September, 1973 (Rix, 1974).

Caspian Tern Hydroprogne caspia. Uncommon, but regularly recorded along the Cooper in 8.4.4 (e.g. White, 1917a; Rix, 1974; Badman, 1979; this survey), favouring lakes but also large waterholes such as Kudriemitchie (Reid, unpubl. data).

COLUMBIFORMES

COLUMBIDAE

Peaceful Dove Geopelia placida. Very common along the length of the Cooper in 8.4.4; it prefers coolibah lined watercourses. Uncommon along the Strzelecki and scattered records north of the Cooper as at Mudcarnie Creek (this survey). The species may be currently expanding its range. only two old records can be traced - breeding to the NW of 8.4.4 in 1932 (Reese, 1933a), and reported as very common at Coongie (and also seen at Innamincka) in 1930 (McGilp, 1931a). Significantly the species was not recorded by White (1917a), Parsons (1921), Cleland (1925), nor by Cox (1982) who spent a month in the wider North-East in 1975. Probably always present and common along the Upper Cooper in 8.4.4, but periodic population dispersals and contractions may occur, according to the nature of the records.

Diamond Dove G. cuneata. Common and widespread in suitable habitat in 8.4.4, although less common than G. placida along the Cooper. Generally restricted to watercourse and floodplain habitat, but occupies scrubbier habitats as well as coolibah and northern river red gum woodlands.

Common Bronzewing Phaps chalcoptera. Rare visitor. Only recorded at Coongie in 8.4.4 (McGilp, 1931a; Cox, 1982).

Flock Bronzewing P. histrionica. Uncommon to moderately common in 8.4.4 due to the paucity of suitable habitat (mixed gibber and floodout) - 11 near Patchawarra

Bore (Cox and Pedler, 1977), a report from the Cooper (R.A.O.U. ATLAS) and a probable sighting near Lake Moorayepe (this survey). Large numbers were breeding around Lake Hope in 1863 (Parker, 1980b), while huge numbers have been recorded adjacent to 8.4.4 ("thousands" - Reese, 1931a). The species' distribution has this century been largely reduced to the Barkly Tableland and adjacent districts accompanying its drastic decline (Frith, 1982), and the effects of cattle grazing are thought to be largely responsible (Dr M. Fleming, pers. comm.; Frith, 1979). From the centre of distribution in the Barkly Tablelands region large populations build-up and disperse widely across central-northern Australia in good seasons. Formerly abundant across its range and perhaps only a visitor to 8.4.4, the species may be more widespread here during an irruption than is suggested by the few recent records.

Nomadic, difficult to conserve (Reid and Vincent, 1979).

Crested Pigeon Ocyphaps lophotes. Common and widespread near water throughout 8.4.4; most common along the Cooper. Less common to absent in the heart of the dunefields in dry seasons.

PSITTACIFORMES

CACATUIDAE

Red-tailed Black Cockatoo Calyptorhynchus magnificus. Reported regularly and bred on Pandie Pandie in the 1920's and 1930's (e.g. Reese, 1933a). An old record from the Cooper in 8.4.4 (R.A.O.U. ATLAS). Possibly extinct here as not recorded recently; declined for unknown reasons, although may never have been resident; it may yet be found to still occur irregularly.

Inadequately conserved (Reid and Vincent, 1979).

Galah Cacatua roseicapilla. Very common near water and widespread in 8.4.4. Most common in riparian woodland (breeding habitat) and associated floodplains.

Little Corella C. sanguinea. Very common near water and widespread in 8.4.4. Similar habitat preferences as the preceding species except that this species is less dispersed and more strictly confined to water, often gathering in larger flocks; no records from the southern dunefields.

Pink Cockatoo C. leadbeateri. Rare breeding visitor. Four records from 8.4.4 - breeding at Innamincka in October, 1916 (White, 1917a) and observed at Lake Goyder in February, 1927 (Reese, 1927b), Cuttapirie Corner W.H. in April, 1931 (Reese 1931a), and a recent record from Coongie in June, 1980 (Mr W.E. Matheson, pers. comm.).

Inadequately conserved (Reid and Vincent, 1979).

POLYTELITIDAE

Red-winged Parrot Aprosmictus erythropterus. Extremely rare vagrant. Formerly a regular breeding visitor to the extreme north-east of the State (see Reese, 1927a) but apparently declined in the 1930's - the last recorded observation by Reese (1927b) was of 40 at Lake Goyder in February, 1927. An extremely rare visitor if at all nowadays (see Pedler and Ragless, 1978 for an unconfirmed sighting in the vicinity of 8.4.4 in 1967).

Cockatiel Nymphicus hollandicus. Generally uncommon breeding visitor; nomadic and at times plentiful. The few records in 8.4.4 are from the Upper Cooper e.g. Coongie (McGilp, 1931a), the Strzelecki and Patchawarra Bore (Cox and Pedler, 1977). The species favours riparian woodland.

PLATYCERCIDAE

Night Parrot Geopsittacus occidentalis. Very rare. The first specimen of this enigmatic bird was collected near Lake Goyder in October, 1845 by John McDouall Stuart on Sturt's expedition (Forshaw, 1981). Andrews (1883) collected several specimens from along the Cooper (and around Lake Eyre) in 1875. The most recent record was of four seen near Lake Perigundi in June, 1979 by Mr S.A. Parker *et al.*, and there is an additional record from near Innamincka (Parker, 1980a). Favoured habitat is succulent chenopod flats (i.e. samphire and semi-succulent Sclerolaena intricata). The causes of this species' decline cannot be properly evaluated. However, Mcgilp (1931b) quotes an early stockman as blaming feral cats and environmental degradation due to stock grazing. If the Night Parrot gives off a strong scent as indicated by Menkhorst and Isles (1981), predation by foxes and cats could well have been a significant factor. As stock grazing has been focused on the Upper Cooper in 8.4.4, suitable habitat is probably far more prevalent now on the Lower Cooper; an intensive survey is warranted; the species does not appear to have ever been common.

Budgerigah Melopsittacus undulatus. Generally moderately common but numbers fluctuate greatly depending on the season. Abundant along the Cooper in some years e.g. 1930 (McGilp, 1931a) and 1973 (Rix, 1974), but generally scattered throughout 8.4.4 if water is available.

Mallee Ringneck Barnardius barnardi. Common. A distinctive population of a pale form, which is confined to 8.4.4 in South Australia (although also occurs in SW Qld), inhabits northern river red gum woodland along the Upper Cooper between Innamincka and Chillimookoo W.H. (this survey) and the North-West Branch north to Coongie. Its precise taxonomic status has yet to be determined.

Red-rumped Parrot Psephotus haematonotus. Overall moderately common and widespread. The pale subspecies P. h. caerulus is mostly confined to woodland of the Cooper and Strzelecki Creeks in 8.4.4. Parker (1980a) has displayed pictorially all records known to him and states that the population may have only established itself in South Australia since 1900. The species is known in 8.4.4 from between Innamincka (White, 1917a) on the Upper Cooper and Waukatana W.H. on the Lower Cooper (Parker, 1980a), and was found to be moderately common between Yalcuma and Narrawalpinna W.H.'s on the Lower Cooper in 1983 (this survey). Locality records from along the Strzelecki include Merty Merty (=Murtee Murtee - Pedler, unpubl. data), Toolache W.H. and Mundibarcooloo W.H. - it was breeding at the latter locality in 1983 (this survey) and see Parker (1980a). Mrs J.B. Paton (pers. comm.) made observations to the north of the Cooper in May, 1980 at Lakes Willara, Deception and Apanburra. The species is therefore common on the Upper Cooper, and less common but widespread on the Lower Cooper and Strzelecki.

Although the species is common and secure, Reid and Vincent (1979) advise that a conservation park is warranted on the Cooper to protect the subspecies caerulus.

Bluebonnet Northiella haematogaster. Overall moderately common. The subspecies N. h. pallescens is confined to the (Diamantina,) Cooper and Strzelecki floodplains in South Australia (Parker, 1980a) primarily in riparian woodland. Common on the Lower Cooper in 8.4.4 and less common on the Upper Cooper and Strzelecki, records augmenting those of Parker (1980a) include Toolache W.H., Bookabourdie W.H., Scrubby Camp W.H. and Tirrawarra W.H. (this survey) and Lakes Apanburra and Warra Warreenie in May, 1980 (Mrs J.B. Paton, pers. comm.).

Bourke's Parrot Neophema bourkii. Rare visitor. Four records from or near the Cooper in 8.4.4. - 15 km NW of Innamincka along a miniritchie lined creek in August, 1979 (Mr D. Robinson, pers. comm.), several flocks between Moonlight Flat and Karawinnie W.H. (Mr T. Fraser *et al.*, this survey), two near Tirrawarra W.H.

(Mr K. Casperson et al., this survey), and another report from near the last locality (R.A.O.U. ATLAS).

Blue-winged Parrot Neophema chrysostoma. Uncommon, non-breeding visitor in a variety of habitats. Records along the Cooper in 8.4.4 include Lakes Lady Blanche and Warra Warreenie in May, 1980 (Mrs J.B. Paton, pers comm.), near Cooramunchena W.H. in May, 1980 (Mr L. Joseph, pers. comm.) and the North-West Branch (R.A.O.U. ATLAS). Also at Innamincka. More regularly observed to the south and south-west of 8.4.4 e.g. around Lake Eyre (Parker, 1980a).

Inadequately conserved (Reid and Vincent, 1979).

CUCULIFORMES

CUCULIDAE

Pallid Cuckoo Cuculus pallidus. Moderately common (at least seasonally) favouring all habitats in 8.4.4 and widespread e.g. recorded from at least 19 different localities (R.A.O.U. ATLAS); a nomadic species that may be common or largely absent according to the season, but is probably thinly widespread most years.

Horsefield's Bronze-Cuckoo Chrysococcyx basalis. Uncommon to moderately common in 8.4.4, where it frequents all habitats; very widespread and never abundant.

Channel-billed Cuckoo Scythops novaehollandiae. Presumed extinct in South Australia. The earliest record from along the Cooper in 8.4.4 was made by Samuel White in 1863 (Parker, 1980b). Also reported from the Strzelecki in the 1920's (Cleland, 1925). A regular breeding visitor to the NW of 8.4.4 in the 1920's and 1930's (e.g. Reese, 1924, 1932) and referred to as the "flood bird"(Parker, 1980b) because of its habit of arriving in districts generally only after a flood (e.g. see Reese, 1927b). No recent records in 8.4.4, may occur as a vagrant in the NE.

STRIGIFORMES

STRIGIDAE

Southern Boobook Ninox novaeseelandiae. Uncommon but scattered along the Cooper in 8.4.4; casual elsewhere in woodland. Most common along the Upper Cooper. Possibly a non-breeding visitor.

Barking Owl N. connivens. Moderately common in northern river red gum woodland along the Upper Cooper and scattered records downstream; recorded regularly at Innamincka (Parker, 1977), and along the North-West Branch between Tirrawarra W.H. and Coongie (e.g. this survey). Thought to be a resident but there are no breeding records as yet.

Inadequately conserved.

TYTONIDAE

Barn Owl Tyto alba. Generally uncommon to absent, although large numbers are occasionally present e.g. 1974-75 (Cox and Pedler, 1977). Largely confined to the Cooper, although likely to occur around other water bodies.

CAPRIMULGIFORMES

PODARGIDAE

Tawny Frogmouth Podargus strigoides. Moderately common in riparian woodland along the Cooper and Strzelecki in 8.4.4 (e.g. this survey), where it is a breeding resident.

AEGOTHELIDAE

Australian Owlet-nightjar *Aegotheles cristatus*. Common in riparian woodland along the Cooper and Strzelecki in 8.4.4, where it is a breeding resident.

CAPRIMULGIDAE

Spotted Nightjar *Caprimulgus guttatus*. Uncommon visitor, usually near water. Recorded at Coongie (Pedler, unpubl. data) and by White (1917a) at unknown localities in 8.4.4.

APODIFORMES

APODIDAE

Fork-tailed Swift *Apus pacificus*. Sole record for 8.4.4 (and the wider North-East) from near Lake Moorayepe (this survey) - up to 100 birds flying south on 31 October, 1983, in heavily overcast conditions and light rain. Over 25 mm of of rain had fallen in the previous 24 hours; the birds were presumed to be on passage.

CORACIIFORMES

ALCEDINIDAE

Red-backed Kingfisher *Halcyon pyrrhopygia*. Common and widespread in the study area Most common along the Cooper and Strzelecki, but occurs on sand dunes and along small watercourses in the north as well. Preference for watercourses and other timbered habitats. This species breeds in the region and birds are present all year; however individuals may not be resident.

Sacred Kingfisher *H. sancta*. Uncommon to moderately common in the study area. A summer visitor that regularly occurs along the Upper Cooper - Innamincka to Coongie along the North-West Branch in northern river red gum woodland and adjacent flats. There are a few, scattered records from elsewhere in 8.4.4.

MEROPIDAE

Rainbow Bee-eater *Merops ornatus*. Common, breeding, summer visitor along the Cooper and Strzelecki floodplains, and around watercourses and drainage lines in the north of 8.4.4. Favours lightly timbered watercourses and floodplain habitats (Badman, 1979); perhaps largely absent from core areas of gibber and dunefields.

PASSERIFORMES

ALAUDIDAE

Singing Bushlark *Mirafra javanica*. Generally uncommon nomadic, which may largely vacate the area in dry seasons. A specimen record from the Cooper Creek in 8.4.4 (Lawson and Parker, 1976), seen in May, 1980 at Koodlanie Well west of Cordillo Downs Homestead (Mrs J.B. Paton, pers. comm.), and found to be common in well grassed depressions in gibber in the north of the study area in 1983 (this survey) Favours grassy flats e.g. *Astrebla*.

HIRUNDINIDAE

White-backed Swallow *Cheramoeca leucosternum*. Common throughout 8.4.4, where it also breeds. Avoids gibber away from dunes.

Welcome Swallow *Hirundo neoxena*. Generally uncommon, but widespread in 8.4.4 and there is a breeding record at Coongie (McGilp, 1931a). Favours human habitations, sheds, bore drains and occasionally other water bodies (Badman, 1979). Probably an influx of birds occurs in winter.

Tree Martin *Cecropis nigricans*. Common along the Cooper and Strzelecki and lakes in the north of 8.4.4; less common elsewhere and avoids dunefields away from water. Birds present all year and breed regularly as at Coongie (e.g. McGilp, 1931a). Prefer woodland and lightly timbered habitats.

Fairy Martin *C. ariel*. Common (?seasonally) and widespread in 8.4.4, although avoids dunefields away from water. Breeds in all habitats where present and unlike the previous species, it will inhabit gibber provided culverts or similar structures (as nesting sites) are present. Present all year, but numbers are probably greatly swelled in spring-summer by birds from the north.

MOTACILLIDAE

Richard's Pipit *Anthus novaeseelandiae*. Common and widespread in open, flat habitats e.g. gibber, floodplain and interdune corridors, throughout 8.4.4.

CAMPEPHAGIDAE

Black-faced Cuckoo-shrike *Coracina novaehollandiae*. Moderately common in timbered habitats. Regularly encountered along the Cooper and Strzelecki floodplains. Most common along the Upper Cooper with scattered records throughout the remainder of 8.4.4, although largely absent from dunefields. The species was breeding at Toolache W.H. in 1983 (this survey).

Ground Cuckoo-shrike *C. maxima*. Uncommon visitor - records from near watercourses (major and minor) through stony plains, including 7 in miniritchie near Patchawarra Bore (8.4.4.6) in 1930 (McGilp, 1931a). At least 5 other records from the Cooper in 8.4.4 including breeding (R.A.O.U. ATLAS). Also a record from the extreme south of 8.4.4 near the Strzelecki. Favours watercourses through gibber and less often floodplain habitat.

Inadequately conserved (Reid and Vincent, 1979).

White-winged Triller *Lalage sueurii*. Moderately common to common and widespread spring-summer breeding visitor to 8.4.4, favouring lightly timbered and scrubby habitats as occurs along smaller watercourses, on floodplain back from the major channels of larger watercourses, and in groves of tall shrubs (*Acacia* spp., *Atalaya* spp. etc.) in dunefields.

*MUSCICAPIDAE

Red-capped Robin *Petroica goodenovii*. Moderately common on the Cooper and Strzelecki floodplains and adjacent dunes in 8.4.4 at least in some winters with scattered records throughout the remainder of the study area. Seen in lightly timbered and scrubby habitats. Unknown whether it inhabits dunefields generally, but this is likely. An autumn-winter visitor, it has not yet been recorded to breed within 8.4.4. Apparently some birds are in the region all year, but large winter influxes occur; Wyndham (1978) reported a similar movement adjacent to the study area.

Hooded Robin *Melanodryas cucullata*. Rare (?winter) visitor with three records along the Cooper in 8.4.4 (Cox, 1982; R.A.O.U. ATLAS) and a breeding record

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*An artificial family not reflecting true affinities of and among Australian flycatchers (e.g. Boles, 1979).

adjacent to the study area (Nappa Merrie, Qld - Chenery, 1921). Wyndham (1978) regards this species as a winter visitor in SW Qld.

Jacky Winter Microeca leucophaea. Status indeterminable, possibly rare. Confined to the Upper Cooper in 8.4.4, frequenting northern river red gum woodland from Innamincka (Cleland, 1925) to Coongie (Mr F.J.Badman, pers. comm.). Recorded by White (1917a), and there is an additional record from along the North-West Branch (R.A.O.U. ATLAS). Perhaps a rare resident(as indicated by Condon, 1969), although more likely to be a casual visitor (? from the east), judging by the paucity of records of this normally conspicuous species. It has been recorded breeding adjacent to 8.4.4 (Nappa Merrie, Qld - Chenery, 1921).

Rufous Whistler Pachycephala rufiventris. An irregular, uncommon, non-breeding visitor (largely winter) to woodland habitats in 8.4.4, with a few records from along the Cooper. Birds may be seen year round. An unconfirmed report in 1983 (This survey).

Grey Shrike-thrush Colluricincla harmonica. A distinctive pale population is common in riparian woodland along the length of the Cooper in 8.4.4 (e.g. this survey). Additional records include Lakes Apanburra and Warra Warreenie (Mrs J.B. Paton, pers. comm.), and see the distribution map in Parker (1980a).

Crested Bellbird Oreoica guttaralis. Uncommon. Largely confined to the Cooper (10 locality records) and (a) record(s) from the Strzelecki e.g. Tinga Tingana, just outside of 8.4.4 (White, 1917a). Moderately common along the Lower Cooper (this survey), less common on the Upper Cooper and apparently scarce along the Strzelecki in 8.4.4. Also recorded adjacent to 8.4.4 in the wider North-East (1 record - Reese, 1930b).

Restless Flycatcher Myiagra inquieta. Uncommon to moderately common. Largely confined to the Upper Cooper in 8.4.4 in northern river red gum woodland but also on the Lower Cooper e.g. Lake Appadare (Badman, 1979). Nomads wander widely on coolibah lined watercourses as well. No breeding records yet (? perhaps largely a winter visitor).

Willie Wagtail Rhipidura leucophrys. Very common and widespread in 8.4.4, although absent from gibber and less common in dunefields. Most common in 8.4.4 on the Cooper and Strzelecki Creek floodplains. Apparently a large winter influx of birds occurs from the south (e.g. Reese, 1924, 1928b) to the far north of S.A. and the N.T. (see Storr, 1977). Badman (1979) has many records in summer in the Lake Eyre region and so presumably a large resident and breeding population exists as well as the winter visitors.

Grey Fantail R. fuliginosa. Uncommon winter visitor, favouring woodland and scrubby thickets. Only recorded from the Cooper in 8.4.4 and largely confined to the Upper Cooper; regularly recorded at Coongie (e.g. Cox, 1982).

ORTHONYCHIDAE

Chirruping Wedgebill Psophodes cristatus. Very common in lignum flats along the Cooper in 8.4.4, and less common along the Stzrelecki and in the southern dunefields. There are northern locality records from Karawinnie W.H. (Cox, 1982) and Lake Warra Warreenie (Mrs J.B. Paton, pers. comm.). The species also occurs in some shrubby habitats.

Cinnamon Quailthrush Cinclosoma cinnamomeum. Moderately common and widespread in 8.4.4, favouring gibber and dune habitats, although less common on the Cooper floodplain and in the eastern portion of the study area. This species is thought to have benefited from overgrazing and the resulting desertification in areas where degradation has not been too severe (Parker, 1980a).

TIMALIIDAE

(?) White-browed Babbler Pomatostomus superciliosus.Palpable evidence is lacking t support this species' presence in 8.4.4 - there are two erroneous reports from the Upper Cooper (R.A.O.U. ATLAS). Similarly, the record of a second species of babbler other than P. ruficeps at Coongie by Rix (1974 - possibly P. hilli) is treated with suspicion. Confined to the extreme south of the North-East, other records (i.e. White, 1917a; Cleland, 1925) are also regarded as erroneous.

Chestnut-crowned Babbler P. ruficeps. Moderately common in shrubby thickets associated with riparian woodland along the Strzelecki and Cooper. Northern locality records in 8.4.4 are from Karawinnie W.H. (Cox and Pedler, 1977), Lake Apanburra (Mrs J.B. Paton, pers. comm.) and Patchawarra Bore (Rix, 1974). Most common along the Lower Cooper in thickets of Acacia salicina and less common along the Upper Cooper and Strzelecki, although regarded as common along the Strzelecki Creek in October, 1916 (White, 1917a).

SYLVIIDAE

Clamorous Reed-Warbler Acrocephalus stentoreus. Uncommon to moderately common in 8.4.4. Recorded at Coongie (regularly e.g. McGilp, 1931a; Cox, 1982) and Embarka Swamp (common, this survey). Also recorded at Innamincka in August, 1982 (Pedler, unpubl. data).

Little Grassbird Megalurus gramineus. Uncommon in 8.4.4. Only recorded at Coongie (e.g. McGilp, 1931a) and Embarka Swamp (this survey).

Rufous Songlark Cinclorhamphus mathewsi. Highly nomadic and varying from absent to common in riparian woodland; present in large numbers in good seasons e.g. 1930 (McGilp, 1931a), 1973 (Rix, 1974) and in some bad seasons such as August, 1982 (Pedler, unpubl. data). There are scattered records from along the Cooper and Strzelecki and it is most common along the Upper Cooper in 8.4.4. There are two breeding records adjacent to 8.4.4 (e.g. Reese, 1933a). Probably uncommon most years and there is some regularity in the species' movements (south in summer).

Brown Songlark C. cruralis. Generally uncommon to moderately common and widespread in 8.4.4 in well grassed habitats. Occurs along the Cooper and Strzelecki and grassy pockets on gibber in the north of the study area. Frequents a wide range of habitats (unlike the preceding species) provided there is sufficient ground cover, although perhaps there are few birds in dunefields. The species is nomadic and its numbers vary according to the season.

MALURIDAE

Variegated Fairy-wren Malurus lamberti. Common and widespread throughout 8.4.4. It is most regularly encountered in lignum flats and acacia thickets in dunefields but avoids very open habitats. Favours most habitats with low vegetation cover, prefering slightly larger shrubs (and denser cover) than the following species.

White-winged Fairy-wren M. leucopterus. Very common throughout 8.4.4, where it is more common than the preceding species overall. Occupies similar habitats to M. lamberti as well as more open habitats and those with a lower shrub stratum. It is the most common malurid in Zygochloa clad dunes.

Eyrean Grasswren Amytornis goyderi. Widespread and moderately common in dunefields in the Strzelecki Desert, and to the north of the Cooper in 8.4.4. Restricted to Zygochloa habitats. Parker (1980a) has plotted the wider distribution of this species (see his map 10). The two previous locality records in 8.4.4 are from near Lake Perigundi and 39 km south of Moomba. Observations this survey were made at Sites 1, 4, 6, 25 and ca 15 km south of Moomba. The record from Site 1 is of significance because of the isolation of the dune on which several groups were encountered - the nearest neighbouring dune being more than 5 km distant across gibber - indicating good dispersal ability.

Grey Grasswren A. barbatus. Recorded in South Australia for the first time in lignum swamp NW of 8.4.4 in 1975 (Cox, 1982), the species was recently recorded at Embarka Swamp by Mr I.A. May (Joseph, 1982). Its status needs to be determined at Embarka - it was not recorded there in 1983 (this survey).

Requires urgent conservation (Reid and Vincent, 1979).

ACANTHIZIDAE

Redthroat Sericornis brunneus. "Scattered" according to White (1917a), but not otherwise known from the study area(or the wider North-East); this species favours chenopod shrubland (e.g. saltbush - Pizzey, 1980) in the north-eastern part of its range i.e. Atriplex nummularia flats. Although White (1917a) did not specify any localities, it is likely that he saw Redthroats in this habitat bordering the Strzelecki. Apparently the species has become locally extinct, probably as a result of severe overgrazing that occurred in the early part of this century, causing degradation of the saltbush flats.

Reid and Vincent (1979) are uncertain whether this species is adequately conserved.

(?) Weebill Smicrornis brevirostris. There is one questionable record of this species from Scrubby Camp W.H. in August, 1979 (Dr D.H. Close, pers. comm.). This species has been recorded adjacent to 8.4.4 (Nappa Merrie, Qld, 20 km east of Innamincka - Chenery, 1921). It may occasionally wander west along the Cooper from its regular haunts in SW Qld. Riparian woodland habitats dominated by northern river red gum woddland and coolibah along the Cooper and coolibah along the Strzelecki would seem to be ideally suited to this species habitat requirements; yet strangely this species with a wide range in eucalypt woodland throughout the drier parts of Australia does not occur in the North-East.

Chestnut-rumped Thornbill Acanthiza uropygialis. Uncommon and perhaps a nomadic visitor to 8.4.4 which lies on the north-eastern extremity of this species range in Australia. It is confined to shrubby thickets in woodland along watercourses (largely the Cooper). Recorded at Karawinnie W.H. (Cox, 1982), and also Cooramunchena W.H. (Mr L. Joseph, pers. comm.), Coongie (Reid, unpubl. data), Scrubby Camp W.H. (Pedler, unpubl. data) and Toolache W.H. (this survey).

(?) Yellow-rumped Thornbill A. chrysorrhoa. Two unconfirmed reports from the Upper Cooper in 8.4.4 (R.A.O.U. ATLAS; Mr K. Casperson et al., this survey). A female Orange Chat could be mistaken for this species. Similarly with the Weebill (above), this species is found to the north, south, east and west of the study area but apparently not within it. Riparian woodland comprises suitable habitat.

Southern Whiteface Aphelocephala leucopsis. Uncommon but widespread and regularly encountered in shrubland- along the floodplains of the major watercourses and on the gibber in 8.4.4. Most common along the Cooper - many records from its entire length but nowhere common and there are scattered records from along the Strzelecki and across the northen boundary of the study area (Cleland, 1925; Cox and Pedler, 1977).

Banded Whiteface A. nigricincta. Generally uncommon and widespread, with scattered records along the Cooper and Strzelecki in 8.4.4 (e.g. White, 1917a; this survey). There are also northern records from Providence Creek (Pedler, unpubl. data) and Site 4 (this survey). The species prefers shrubby dune habitats (not pure Zygochloa habitats).

Inadequately conserved (Reid and Vincent, 1979).

CLIMACTERIDAE

Brown Treecreeper Climacteris picumnus. Locally common in 8.4.4. Largely confined to northern river red gum woodland along the Upper Cooper between Innamincka and Chillimookoo W.H. and along the North-West Branch to Lakes Apanburra and Warra Warreenie (Mrs J.B. Paton, pers. comm.). There is one record from near Merty Merty (=Murtee Murtee) on Strzelecki Creek (Mr G.B. Ragless, pers. comm.).

MELIPHAGIDAE

Spiny-cheecked Honeyeater Acanthogenys rufogularis. Uncommon to moderately common in woodland and scrubs along the length of the Cooper and along the Strzelecki north to Merty Merty (=Murtee Murtee) in 8.4.4. Perhaps largely a winter visitor as indicated by Wyndham(1978) for the adjacent region in Qld.

Yellow-throated Miner Manorina flavigula. Widespread and common in eucalypt woodland along the Cooper and Strzelecki and less common on minor watercourses and floodplains in the north of 8.4.4.

Singing Honeyeater Lichenostomus virescens. Moderately common to common and widespread in 8.4.4 in shrubland habitats; avoiding riparian woodlands and gibber. Most common in acacia thickets on dunes, in interdune corridors and on floodplains - by no means abundant in the study area.

White-plumed Honeyeater L. penicillatus. Abundant in eucalypt woodland along the channels of major and minor watercourses and around lakes in 8.4.4. Perhaps slightly less widespread than the preceding species e.g. avoiding lightly timbered (coolibah) floodout habitat in the north of the study area.

Black-chinned Honeyeater Melithreptus gularis. Rare vagrant in S.A. The northern race M. g. laetior has been recorded recently by Mr S.A. Parker (pers. comm.) from Cuttapirie Corner W.H. in 8.4.4.

White-fronted Honeyeater Phylidonyris albifrons. A highly nomadic species. There is one unconfirmed record from the south of 8.4.4 near the Strzelecki (R.A.O.U. ATLAS). A truly nectarivorous honeyeater, the scarcity of ornithophilous flowered shrubs (e.g. Eremophila spp. - see Appendix R for declines in Eremophila spp. since European settlement; see also White, 1917b) may explain the species' general absence from the study area.

Grey Honeyeater Conopophila whitei. A very scarce Australian bird with few records in S.A. The sole record in 8.4.4 (and the North-East) of this rare mulga-inhabiting honeyeater is of 2 seen by Paton (1981), 14 km WSW of Cordillo Downs Homestead in May, 1980. The decline in mulga Acacia aneura in the study area since European settlement (Appendix R) may account for this species' rarity here.

EPHTHIANURIDAE

Crimson Chat Ephthianura tricolor.Generally uncommon to moderately common in 8.4.4; usually near water or widespread after rains. Most common along the Cooper floodplain, but widespread in good seasons; may be absent in dry years. Nomadic and found in a variety of habitats e.g. dune, gibber shrublands, grassy habitats and swamp margins.

Orange Chat E. aurifrons. Generally moderately common to common and widespread in 8.4.4 - most common along Cooper Creek. More common than the preceding species but similarly a nomad, with similar habitat preferences and fairly tied to water, although avoids dune habitats and is more common in samphire and swamp habitats. In good seasons, is common in grassy gibber depressions.

Gibberbird Ashbyia lovensis. Uncommon in 8.4.4 due to the paucity of gibber. Records from Site 1, Chillimookoo W.H. (this survey)and several localities along the Cooper. Also just outside of 8.4.4 at Tinga Tingana (McGilp, 1931a). Parker (1980a) speculates that this species may have benefited from limited desertification brought about by overgrazing in the past, thus increasing the extent of its favoured habitat.

Restricted to the greater Lake Eyre region in S.A. where it varies in abundance from uncommon to common according to the season. Inadequately conserved (Reid and Vincent, 1979).

DICAEIDAE

Mistletoebird Dicaeum hirundinaceum. Uncommon to moderately common according to the season. Moderately common along the length of the Cooper in some winters (e.g. 1980 - Mr L. Joseph, pers. comm., and Mrs J.B. Paton, pers. comm.); less common along the Strzelecki and smaller watercourses in the north of 8.4.4. Largely a winter visitor in varying numbers to scrub and woodland along major and minor watercourses. Probably visits mistletoe infested shrubs in the dunefields as well.

PARDALOTIDAE

Red-browed Pardalote Pardalotus rubricatus. Common in coolibah woodland of 8.4.4. Most common along the Cooper, but regularly encountered along the Strzelecki and in coolibah (and bloodwood) habitats in the north; avoids dunefields.

Inadequately conserved (Reid and Vincent, 1979).

Striated Pardalote P. striatus. Uncommon winter visitor to 8.4.4. Recorded infrequently in riparian woodland along the length of the Cooper e.g. Waukatana W.H. (Badman, 1979), Cooramunchena W.H., Chillimookoo W.H. and near Gidgealpa Homestead (Mr L. Joseph, pers. comm.); most common in northern river red gum woodland of the Upper Cooper. Likely to occur sparingly along the Strzelecki and in the north of the study area, but as yet no records.

PASSERIDAE

House Sparrow Passer domesticus. A few records from along the Strzelecki and Moomba Tracks in 8.4.4 (R.A.O.U. ATLAS) presumably at Moomba, mining camps and homesteads; rarely strays from human dwellings. Recorded at Moomba (and Cordillo Downs Homestead this survey, but not at Innamincka).

PLOCEIDAE

Zebra Finch Poephila guttata. Generally common to abundant in 8.4.4 in a variety of habitats, although largely confined to water.

STURNIDAE

Common Starling Sturnus vulgaris. Rare vagrant in 8.4.4. Recorded at Coongie (Pedler, unpubl. data) and near Moomba (R.A.O.U. ATLAS).

ORIOLIDAE

Olive-backed Oriole Oriolus sagittatus. Rare vagrant. One seen by Pedler (unpubl.

data) at Tirrawarra W.H. in August, 1982 is the only record in 8.4.4 (and the North-East) of this rare visitor to S.A.; presumably followed the Cooper down from its regular haunts in Qld.

Vagrant in S.A. and impossible to conserve (Reid and Vincent, 1979).

GRALLINIDAE

Australian Magpie-lark Grallina cyanoleuca. Widespread near water in 8.4.4; numbers fluctuate widely according to conditions. Most common along the Cooper and regularly encountered along the Strzelecki and in dry timbered country to the north in good seasons. Avoids dunefields and dry gibber.

ARTAMIDAE

White-breasted Woodswallow Artamus leucorhynchus. Widespread and common (seasonally) in eucalypt woodland along watercourses in 8.4.4; largely restricted to water. Seasonally common along the length of the Cooper in 8.4.4, although there are only small numbers in dry seasons - most common along the Upper Cooper; similarly less common along the Strzelecki when dry, and there are records from watercourses in the north of the study region. Perhaps a spring-summer influx of birds occurs when birds are found along the length of the Cooper and Strzelecki.

Inadequately conserved (Reid and Vincent, 1979).

Masked Woodswallow A. personatus. Generally uncommon to absent in 8.4.4, with records from most of the study area. A nomadic visitor (largely spring-summer) occupying a large range of habitats in dunefields and timbered country; may be widespread and common in good seasons e.g. spring 1983 (this survey).

White-browed Woodswallow A. superciliosus. Uncommon to absent in 8.4.4. The few records are from the Cooper and Strzelecki. Much less common than the preceding species with which it is always associated when recorded.

Black-faced Woodswallow A.cinereus. Very common and widespread in 8.4.4; occupying all habitats; a true drought resistor.

CRACTICIDAE

(?) Grey Butcherbird Cracticus torquatus. Possibly a rare vagrant to the Upper Cooper in 8.4.4, from which there is one unconfirmed report (R.A.O.U. ATLAS).

Australian Magpie Gymnorhina tibicen. Common and widespread in most habitats in 8.4.4; avoids core areas of gibber (? and perhaps dunefields).

CORVIDAE

Australian Raven Corvus coronoides. Common and widespread along the Cooper and Strzelecki and watercourses carrying coolibah woodland in the north of 8.4.4; uncommon away from timber e.g. not recorded at Site 1 (gibber) or at Site 4 (dunefields) this survey. Occupies all habitats, but much more common in timbered country and most common along watercourses; a (largely) sedentary species.

Little Crow C. bennetti. Common and widespread favouring all habitats; nomadic and numbers vary according to the season. Breeds opportunistically in good seasons (in contrast to the regular spring-summer breeding of the preceding species - Mr G.B. Ragless, pers. comm.). Commonly nesting in Hakea leucoptera in dunefields and floodplains back from the main channels in 1983 (this survey); also nests in coolibah in open woodland habitats where Australian Raven is less common.

Appendix S

APPENDIX S - A CHECKLIST OF BIRDS OF THE NE OF S.A., WITH ANNOTATIONS ON GENERAL STATUS AND ABUNDANCE AND COMMENTS ON OCCURRENCE OR THE POSSIBILITY OF OCCURRENCE IN 8.4.4.

All available literature is summarised. The conservation requirements of each species are indicated.

Several abbreviations were used for the names of authors or observers, as follows:

LJ .... Mr Leo Joseph

JP .... Mrs J B Paton

LP .... Mr L P Pedler

R&V .... Reid and Vincent (1979)

STRUTHIONIFORMES Dromaiidae

Emu Dromaius novaehollandiae generally uncommon to moderately common in the Far NE in all habitats although less common in dunefields away from water. Occasionally large concentrations occur (e.g. Reese, 1935a), presumably attracted to water in dry seasons or due to a build up in numbers in good seasons.

Moderately common although declining in some southern districts of S.A. (Parker et al., 1979). Adequately conserved at present.

PODICIPEDIFORMES Podicipedidae

Great Crested Grebe Podiceps cristatus rare non-breeding visitor to southern portion of Far NE; few records in 8.4.4 only along the Cooper north to Coongie (LJ, May 1980).

Uncommon on open waters in southern S.A. Inadequately conserved (R&V).

Hoary-headed Grebe Poliocephalus poliocephalus generally uncommon to rare in 8.4.4, except after good flows along the Cooper when large concentrations can occur as at Coongie (August 1979, pers. obs.) and Embarka Swamp where it was breeding (this survey) - northern extension of breeding range (Parker et al., 1979). Also occurs on lakes and dams away from the Cooper.

Common and secure in wetlands of southern S.A.

Australasian Grebe Tachybaptus novaehollandiae less common than preceding species in the Far NE, although as widespread, being found on bore drains, casual waters and the Cooper. A northern breeding record in 8.4.4 (R.A.O.U. ATLAS).

Common and secure in wetlands of southern S.A.

PELECANIFORMES Pelicanidae

Australian Pelican Pelecanus conspicillatus the Far NE is one of the six "main centres of distribution" of this species in S.A. when conditions are appropriate (Parker et al., 1979). Within 8.4.4 mainly found along the Cooper, but also Strzelecki Ck and casual water - breeding records from Lake Goyder and Coongie (and other areas in the Far NE e.g. Lake Eyre and Goyder's Lagoon). Generally uncommon to moderately common, although large breeding populations build up occasionally; the population must crash to virtually zero in times of drought coincident with the Cooper drying completely.

Moderatly common in parts of southern S.A. Reasonably secure (R&V).

PELECANIFORMES Anhingidae

Darter *Anhinga melanogaster* an irregular and apparently non-breeding visitor to the Far NE, although common in some years e.g. 1975 (Cox, 1982), and 100+ at Coongie in August 1979 (pers. obs). Confined to the Cooper in 8.4.4; not recorded this survey.

Uncommon with a restricted distribution in S.A. Inadequately conserved.

Phalacrocoracidae

Great Cormorant *Phalacrocorax carbo* generally uncommon in the Far NE, although very large concentrations may occur along the Cooper in favourable seasons. Breeding at Coongie 1973-1975 (Rix, 1974; Cox, 1982). Few records away from the Cooper in 8.4.4.

Common in parts of southern S.A. Perhaps, adequately conserved (R&V).

Pied Cormorant *P. varius* generally uncommon to absent in the Far NE, although occasionally larger numbers occur. Largely confined to the Cooper in 8.4.4; breeding at Coongie 1973-1975 (Rix, 1974; Cox, 1982).

Basically coastal, common and secure in S.A.

Little Black Cormorant *P. sulcirostris* generally uncommon in the Far NE, although large concentrations occasionally occur along the Cooper. Confined to the Cooper in 8.4.4 including breeding at Coongie in September 1973 (Rix, 1974).

Common and secure in parts of southern S.A.

Little Pied Cormorant *P. melanoleucos* uncommon, scattered in the Far NE. Only recorded on the Cooper in 8.4.4 including breeding at Coongie in September 1973 (Rix, 1974).

Common and secure in southern wetlands and coasts of S.A.

ARDEIFORMES Ardeidae

Pacific Heron *Ardea pacifica* generally uncommon in the Far NE, although widespread. Occurs on small and casual sources of water as well as the Cooper and Strzelecki in 8.4.4; breeds occasionally as at Coongie (McGilp, 1931). This species was moderately common in the recent wet period, 1973-1980, but numbers crashed over the subsequent dry period; only a few records this survey.

Uncommon and declining in S.A. (Parker *et al.*, 1979). Inadequately conserved (R&V).

Ardeidae

White-faced Heron <u>Ardea novaehollandiae</u> generally uncommon to moderately common in the Far NE. Widespread in a variety of wetland habitats. Occurs throughout 8.4.4 when conditions are favourable, but most common along the Cooper; one breeding record (R.A.O.U. ATLAS) - northern (Parker <u>et al</u>., 1979).

Moderately common, widespread and secure in wetlands of southern S.A.

Great Egret <u>Egretta alba</u> uncommon to absent in the Far NE where generally confined to the Upper Cooper and Upper Diamantina. Also records from the Lower Cooper in 8.4.4 (Badman 1979).

Uncommon but widespread in S.A. Secure.

Little Egret <u>Egretta garzetta</u> rare; single birds at Coongie in August 1979 (pers. obs) and Lake Killamperpunna in October and November 1977 (Badman, 1979).

Uncommon with a restricted distribution in southern S.A., but increasing.

Intermediate Egret <u>E. intermedia</u> rare; Coongie (August 1979, pers. obs) and Innamincka (JP, May 1980).

Rare in southern S.A.

Rufous Night Heron <u>Nycticorax caledonicus</u> generally uncommon to absent in the Far NE where largely restricted to the Cooper and Diamantina. Reputed to breed in 8.4.4 (R.A.O.U. ATLAS).

Moderately common in a few southern regions of S.A., uncommon elsewhere. Perhaps adequately conserved (R&V).

Plataleidae

Glossy Ibis <u>Plegadis falcinellus</u> often absent from the Far NE, but in some years, a few large concentrations occur on the Cooper and Diamantina e.g. 1973 (Rix, 1974), 1979 and 1982 (LP); not recorded in 1974, 1975, 1976 and 1980 when bird observers visited the region. This species must be highly nomadic, although Badman (1979) regards it as the commonest of the three Ibis species in the Lake Eyre (greater) region. Bred in 1930 (Reese, 1930b).

Uncommon to rare and highly nomadic in S.A. Inadequately conserved (<u>contra</u> R&V).

Sacred Ibis <u>Threskiornis aethiopica</u> no early records of this species in the Far NE, but regularly recorded along the Cooper since 1973 when Rix (1974) found it to be "common" at Coongie. Subsequent records are of

Plataleidae

small numbers, and the species was not seen in this survey (following the drying up of the Cooper).

Common in the south and east of the State, casual elsewhere. Perhaps, adequately conserved (R&V).

Straw-necked Ibis *T. spinicollis* irregular visitor to the Far NE after heavy rains and flood events (Parker *et al.*, 1979), often in large numbers. Large breeding colony on the Diamantina in May 1930 (Reese, 1930b). Embarka and Tirrawarra Swamps should provide suitable nesting habitat after flooding of the Cooper. Frequents bore drains and casual waters as well as the major watercourses; not recorded this survey.

Seasonally common in the south and east of the State. Inadequately conserved (R&V).

Royal Spoonbill *Platalea regia* generally uncommon, although in some seasons common and widespread along the Diamantina and Cooper as in 1975 (Cox and Pedler, 1977). Large breeding colony on the Diamantina in May 1930 (Reese, 1930b).

Moderately common in the Lakes district and Murray; generally uncommon elsewhere. Doubtfully adequately conserved (*contra* R&V).

Yellow-billed Spoonbill *P. flavipes* uncommon to moderately common in the Far NE; generally more common and widespread than the previous species (although the situation is occasionally reversed as in 1975); found on bore streams and casual water as well as the major watercourses. Suspected to breed on Goyder's Lagoon in the 1930's, and a breeding record in 8.4.4 (R.A.O.U. ATLAS) as well as at Embarka Swamp (LP, this survey).

Widespread and moderately common in southern districts of S.A. Inadequately conserved (R&V).

ANSERIFORMES Anatidae

Magpie Goose *Anseranas semipalmata* three records along the North-West Branch and the Diamantina in the 1920's and reported to have always been present at Coongie by Reese (1924). This species has suffered a drastic decline in Australia since European settlement (Frith, 1977). Once a breeding resident throughout south-eastern Australia, it is now almost entirely restricted to the northern sub-coastal plains. Extinct in the Far NE, although it is possible that vagrants will occasionally turn up.

Virtually extinct in S.A.

Anatidae

Wandering Whistling-Duck Dendrocygna arcuata its status is unclear in the Far NE. Condon (1969) refers to a specimen from Cooper Ck (in S.A.), and there are sight records from Innamincka (Rix, 1974) and Coongie (Bird Talk 1:5). However its presence is regarded as questionable, owing to possible confusion with the following species.

This species is most unlikely to occur in S.A., being largely confined to the far north of Australia (Frith, 1977).

Plumed Whistling-Duck D. eytoni generally uncommon, often absent, occasionally common after flood events along the Cooper and Diamantina e.g. 350+ at Kooncheri WH in July 1983 (LP). Records along the length of the Cooper in 8.4.4 and large numbers along the Strzelecki in 1976 (Cupper, 1983). A few breeding records e.g. Lake Hope in October 1863 (Parker, 1980b) and more recently (Cupper, 1983). Recorded at Birdsville, Coongie and Embarka Swamp in this survey.

Rare irregular visitor to S . A., except in the Far NE where moderately common in some years. Inadequately conserved.

Black Swan Cygnus atratus generally uncommon in the Far NE. Found along the length of the Cooper when in flood; breeding reported occasionally as at Coongie in 1930 (McGilp, 1931).

Common in parts of the south and east of S.A., less common elsewhere. Adequately conserved (R&V).

Freckled Duck Stictonetta naevosa uncommon in the Far NE with only a handfull of records of small numbers along the Birdsville Track, Diamantina and Cooper. Within 8.4.4 records from Lake Goyder (Reese, 1927b), Lakes Hope and Appadare (Badman, 1979), Coongie (LP, August 1979 and 1982) and near Moomba (in January 1983, R.A.O.U. Newsletter No. 56). Despite this paucity of records, current opinion (Parker and Braithwaite, in prep.; Martindale, 1983 R.A.O.U. Newsletter No. 56) holds that the Diamantina and Cooper system in S.A. and south-western Qld may be the breeding stronghold of the species. Known to breed along the Cooper in S.A. (Mr S. A. Parker, pers. comm.).

Threatened and requiring further protection.

Australian Shelduck Tadorna tadornoides uncommon to absent in the Far NE, with occasional large concentrations along the Diamantina and Cooper e.g. ca 600 at Coongie in August 1975 (Cox and Pedler, 1977); also found on bore streams. Confined to the Cooper in 8.4.4.

A common, southern species; rare (usually) in the north of S.A. Adequately conserved (R&V).

Pacific Black Duck *Anas superciliosa* widely distributed in the Far NE, generally moderately common, occasionally abundant. Regularly breeds when conditions favourable (e.g. Rix, 1974). Most common along the Cooper in 8.4.4, but frequents casual waters as well. Surprisingly uncommon in this survey; in some years numbers are low e.g. not recorded along the Strzelecki and Cooper in 1916 by White (1917).

Common and secure in wetlands of S.A. (R&V).

Grey Teal *Anas gibberifrons* moderately common to abundant in the Far NE. Frequents all waters and regularly breeds when conditions favourable. Size of population flutuates greatly according to the season.

A highly nomadic species, common to abundant in wetlands of S.A. Secure.

Chestnut Teal *A. castanea* rare vagrant in the Far NE, recorded at Koon-cheri WH (Cox, 1982) and Coongie in August 1979 (pers. obs). The few reports of this species along the North-West Branch by officers of D.E.P. in this survey require confirmation.

Moderately common in parts of southern S.A., rare in the north. Perhaps adequately conserved (R&V).

Australasian Shoveler *A. rhynchotis* generally absent in the Far NE, occasionally small numbers along the Cooper, and further north at Minnie Downs (Reese, 1925) and Cordillo Downs (JP). "Common" at Coongie in August 1979 (pers obs).

Uncommon and declining in southern S.A., rare in the north. Threatened, inadequately conserved and deserving total protection (R&V).

Northern Shoveler *A. clypeata* the sole South Australian record is from Coongie, August 1979 (Close and Jaensch, 1981).

An extremely rare vagrant in Australia.

Pink-eared Duck *Malacorhynchus membranaceus* generally moderately common to abundant, while occasionally uncommon in the Far NE. Frequents all waters and regularly breeds along the length of the Cooper after flood events e.g. Innamincka, Embarka Swamp, Coongie and at the Birdsville Track.

Highly nomadic and generally common through much of S.A. Inadequately conserved and requiring further protection (R&V).

Hardhead *Aythya australis* generally uncommon but thinly scattered along lengths of Diamantina and Cooper in the Far NE. Occasionally reported as

Anatidae

common on the Cooper in 8.4.4 e.g. Lakes Hope and Appadare (Badman, 1979). Breeding at Coongie (Rix, 1974) and Embarka Swamp (this survey). Also recorded infrequently on dams and waterholes away from Cooper.

Moderately common although declining in restricted parts of S.A. Inadequately conserved and threatened (R&V).

Maned Duck *Chenonetta jubata* moderately common to very common in the Far NE. Most abundant along the Upper Cooper e.g. 3 000 on Lake Oolgoopiarie and 2 000 at Coongie in August 1975 (Cox and Pedler, 1977); found in small numbers on dams and casual waters as well as major watercourses. Breeding reported along the Diamantina (Morgan, 1930), and the Cooper and possibly the Strzelecki (R.A.O.U. ATLAS).

Common in S.A. and increasing in wetter pastured districts. Secure (R&V).

Blue-billed Duck *Oxyura australis* rare visitor to the Far NE. Within 8.4.4 there are three records along the length of the Cooper (e.g. Badman, 1979). The record from Embarka Swamp by officers of D.E.P. this survey requires confirmation.

Uncommon on deeper waters of southern S.A. Inadequately conserved (R&V).

Musk Duck *Biziura lobata* generally uncommon in the Far NE, sometimes absent Almost totally confined to deeper pools of the Cooper; no breeding records.

Common and secure in southern S.A. (R&V).

ACCIPITRIFORMES Accipitridae

Black-shouldered Kite *Elanus notatus* generally absent from the Far NE, although scattered records since 1950 (Brandon, 1951) and moderately common in 1974 (Cox and Pedler, 1977), perhaps in response to a mouse plague following the widespread rains in 1973 and 1974. No records north of Moomba and Innamincka in 8.4.4 (Cox and Pedler, 1977; R.A.O.U. ATLAS).

Moderately common in open habitats of southern S.A., although numbers fluctuate greatly. Secure (R&V).

Letter-winged Kite *E. scriptus* irregular breeding visitor to the Far NE, often in large numbers (Parker, 1980a), and its occurrence is geared to periodic population explosions of *Rattus villosissimus*. Reported to be breeding and common along the Cooper (e.g. Lake Hope) in 1863 by Samuel White (Parker, 1980b); another invasion occured in 1924 (Reese, 1924), and there appear to have been three since 1950 (Baker-Gabb and Pettigrew, 1982), while no doubt others occurred prior to 1950. Large concentrations reported from 8.4.4 include *ca* 50 at Patchawarra Bore in October 1974 (Cox and Pedler, 1977), and Mr T. Fraser found (this survey) more than 100 nests in a disused colony at Lake Oolgoopiarie. After the most recent invasion in 1974 - 1975, stragglers remained until at least 1980, when 12 were seen on the Strzelecki near Montecollina Bore (Baker-Gabb and Pettigrew, 1982) - a pair was breeding there in August 1979 (pers. obs). The Letter-winged Kite appears to be expanding its foraging niche as it has recently been reported (Baker-Gabb and Pettigrew, *op. cit.*) as preying on plaguing *Mus musculus* . If breeding populations can be sustained on a diet of *Mus*, perhaps appearances of this species will become more frequent in the Far NE. Favours tree-lined watercourses in which to roost and breed.

Breeds only in the Lake Eyre Drainage in S.A. Inadequately conserved.

Black Kite *Milvus migrans* generally common in the Far NE particularly around waterholes and centres of human activity (e.g. dwellings, camps and towns), although numbers fluctuate widely. During dry spells, numbers are considerably reduced (Reese, 1928a and 1935a; observations this survey), while in good seasons flocks of 500 and 2000 have been reported (Cox and Pedler, 1977).

Common inland and increasing further south in S.A. Secure (R&V).

Black-breasted Buzzard *Hamirostra melanosternon* uncommon breeding resident of tree lined watercourses in the Far NE. Probably most common along the Upper Cooper in areas of red gum woodland e.g. three pairs were seen by Cox (1982) at Coongie, although assuredly breeds along the lengths of the Cooper and Strzelecki (e.g. Condon, 1969; Dr D.J. Baker-Gabb *in litt.*; observations this survey by LP and Mr T. Fraser).

Regularly only occurs in the Lake Eyre Drainage in S.A. Inadequately conserved (R&V).

Whistling Kite *Haliaster sphenurus* moderately common and widespread in the Far NE, although fairly restricted to watered areas. Breeds along watercourses (e.g. Brandon, 1951; pers. obs, August 1979).

Common and secure in S.A. (R&V).

Brown Goshawk *Accipiter fasciatus* uncommon in the Far NE and perhaps a non-breeding visitor in the main, although breeding at Koonchera in August 1979 (pers. obs). Restricted to better wooded watercourses, waterholes and bores. Only recorded from the Cooper floodplain in 8.4.4.

Moderately common and adequately conserved in woodlands of southern S.A. (R&V).

Accipitridae

Collared Sparrowhawk *A. cirrhocephalus* uncommon and of indeterminable status in the Far NE, although probably not resident judging by the paucity of records (12) . Similar habitat preferences and easily confused with preceding species. Within 8.4.4 there are several records from Kudriemitchie to Coongie; one breeding report prior to 1950 (R.A.O.U. ATLAS).

Moderately common and probably secure in drier woodland areas of S.A.

Wedge-tailed Eagle *Aquila audax* moderately common to common and widespread breeding resident in the Far NE. Recorded throughout 8.4.4, although breeding is probably largely restricted to tree lined watercourses.

Common and secure in S.A. (R&V).

Little Eagle *Hieraaetus morphnoides* widespread but generally uncommon in Far NE, favouring riparian woodland. Moderately common along the Cooper in 8.4.4; also present on minor watercouses e.g. breeding at Mudcarnie WH (this survey).

Moderately common and secure in S.A. (R&V).

Spotted Harrier *Circus assimilis* generally uncommon in the Far NE, although occasionally widespread and common (Morgan, 1930; Cox and Pedler, 1977; Cox, 1982). Forages over all habitats and breeding not confined to timbered watercourses (e.g. 39 km S Moomba, pers. obs).

Moderately common and secure in S.A. (R&V).

Marsh Harrier *C. aeruginosus* generally uncommon, although may be regularly encountered at bore drains, swamps and lakes in the Far NE in some years (Cox, 1982; JP) - confined to such habitats. Old breeding record from Lake Hope in 1863 (Parker, 1980b). A large population buid-up occurred in 8.4.4 between 1975 and 1980, when the Cooper and its lakes often contained large amounts of water. Few birds were seen in 1982 (LP) and 1983 (this survey).

Moderately common in wetlands of southern S.A. Perhaps secure (R&V).

Falconidae

Black Falcon *Falco subniger* this highly nomadic species varies from uncommon to common in the Far NE and breeds along watercourses (cox, 1982), but forages in a wide range of habitats. Particularly common in 1974, 1975 (Cox and Pedler, 1977) and 1979 (pers. obs). Widespread when common.

Moderately common (nomadic) and secure in drier parts of S.A. (R&V).

Peregrine Falcon *F. peregrinus* vagrant in the Far NE; one at Lake Killal-

Falconidae

paninna (Badman, 1979) and reported at Coongie (R.A.O.U. ATLAS); a breed-record just outside of 8.4.4 at Nappa Merri, Qld (Chenery, 1921).

Uncommon and with a restricted distribution (at least where regularly seen) in S.A. Inadequately conserved (R&V).

Australian Hobby F. longipennis uncommon but regularly encountered along wooded watercourses in the Far NE, usually near water. Confined to the Cooper in 8.4.4 and moderately common along the North-West Branch; breeding at Tirrawarra WH in August 1982 (LP). A winter influx may occur.

Uncommon generally and inadequately conserved in S.A. (R&V).

Grey Falcon F. hypoleucos rare in the Far NE. A handful of records along the Strzelecki and Cooper in 8.4.4, including (indications of) breeding along both creeks.

Rare and nomadic throughout its central Australian range. Inadequately conserved in S.A. (R&V).

Brown Falcon F. berigora generally common and widespread in the Far NE. Breeds regularly in 8.4.4 (e.g. Parker, 1980b). Numbers vary.

Common in open habitats and secure in S.A. (R&V).

Australian Kestrel F. cenchroides generally common and widespread in all habitats in the Far NE and 8.4.4.

Common and secure in S.A. (R&V).

GALLIFORMES Phasianidae

Stubble Quail Coturnix novaezelandiae uncommon, breeding (Reese, 1936) visitor (?) to the Far NE, although large numbers are recorded some years (Morgan, 1930; Reese, 1933a). Favours grassland and other well grassed habitats, as are found after heavy rains or flooding. Scattered records throughout 8.4.4.

Common and secure in grasslands of S.A. (R&V).

GRUIFORMES Turnicidae

Little Button-quail Turnix velox generally uncommon, breeding (Reese, 1936) visitor to the Far NE, although large numbers recorded in some years (Morgan, 1930). Favours grassed habitats with scattered records throughout 8.4.4.

Common (seasonally) and secure in S.A. (R&V).

GRUIFORMES Rallidae

Buff-banded Rail <u>Rallus philippensis</u> three records of this vagrant in the Far NE, none within 8.4.4. Likely to occur in densely vegetated swamps and bore drains in 8.4.4.

Uncommon, nomadic inhabitant of wetlands (usually) in S.A. Inadequately conserved (R&V).

Baillon's Crake <u>Porzana pusilla</u> rare visitor to well vegetated bore drains and margins of lakes and waterholes in the Far NE (five records). The sole record for 8.4.4 is of one at Coongie in August 1975 (Cox, 1982).

Uncommon, (?) spring-summer migrant in wetlands of S.A. Inadequately conserved (R&V).

Australian Crake <u>P. fluminea</u> perhaps a recently established resident in bore drains of the Far NE, where perenially suitable rank vegetation (e.g. <u>Typha</u>) exists. Probably a regular and moderately common visitor to lignum swamps along the Cooper after flooding; known from Coongie and Embarka Swamp in 8.4.4, where common at both localities in 1979 and 1983 respectively (pers. obs).

Moderately common and secure for the present in suitable wetland habitat in S.A.

Spotless Crake <u>P. tabuensis</u> rare in the Far NE; may be resident in thick cover on some bore drains. Within 8.4.4 only recorded at Coongie (August 1979, pers. obs).

Uncommon and inadequately conserved in S.A. (R&V).

Black-tailed Native-hen <u>Gallinula ventralis</u> Parker (1980a) stated that the drainage system of south-west Qld and the Far NE is the main centre of distribution and the breeding stronghold of this species in Australia. Huge numbers have been recorded along the Cooper after floods e.g. "thousands" at Coongie in late 1930 (McGilp, 1931), 5 000 at Coongie and 10 000 at Lake Oolgoopiarie in August 1975 (Cox, 1982). Raglass (1978, <u>Bird Talk</u> <u>1</u> : 64) reported "hundreds" nesting near the Cooper crossing, Birdsville Track. As the Cooper (and Diamantina) dry up following large flood events, massive declines in the local population occur resulting in Australia wide irruptions (Parker, 1980a; and see Matheson, 1975, 1978). This species is at least moderately common in 8.4.4; favourable habitat most often is found along the Cooper.

Of irregular occurrence in southern S.A., this species' stronghold is the Far NE. Inadequately conserved (R&V).

Rallidae

Dusky Moorhen G. tenebrosa rare visitor to the Far NE in small numbers. Records from Coongie (e.g. Cox, 1982) and Embarka Swamp (this survey) in 8.4.4. First recorded from the Far NE in August 1975 (Cox, 1982), this species may be expanding its range northwards.

Common and secure in southern wetlands of S.A. (R&V).

Purple Swamphen Porphyrio porphyrio generally uncommon in swamps and bore drains in the Far NE. Within 8.4.4 several records from the Coongie district (e.g. Cox, 1982) and Embarka Swamp (this survey); it has been reported as moderately common at both these localities, but no breeding.

Common and probably secure in southern wetlands of S.A. (R&V).

Eurasian Coot Fulica atra generally uncommon and sometimes absent from the Far NE, favouring open water of lakes, swamps and waterholes. Occasionally large concentrations along the Cooper e.g. in the Coongie district (August 1979, pers. obs) and breeding there in September 1973 (Rix, 1974), and "thousands" on the Lower Cooper in 1977 (Badman, 1979). All records in 8.4.4 are from the Cooper.

Common and secure in S.A. (R&V).

Gruidae

Brogla Grus rubicundus generally uncommon but widespread resident near water in the Far NE; frequenting bore streams, lakes, swamps and waterholes and their surrounds. Often recorded from entire length of Cooper; also districts to the north in 8.4.4. 109 birds on Lake Goyder in February 1924 (Reese, 1924). Breeding records in April 1936 (Reese, 1936) and June 1963.

Uncommon and declining in the South-East, better numbers in the Far NE. Inadequately conserved (R&V).

Otidae

Australian Bustard Ardeotis australis moderately common and widespread in good seasons after heavy rains and/or big floods (Reese, 1925, 1930b, 1931b) in the Far NE as was the case between 1974 and 1980; otherwise uncommon to rare. Favours well grassed flats. Records widespread in 8.4.4 and known to breed (R.A.O.U. ATLAS). Not recorded in 1982 (LP) nor 1983 (LP; this survey). This species has declined in the Far NE this century (contra Environmental Research and Planning Group, 1980) - the "hundreds" that used to occur (Reese, 1930b) are no longer reported.

Declining (extinct in parts of southern S.A.) and inadequately conserved in S.A.

CHARADRIIFORMES Burhinidae

Bush Thick-knee _Burhinus magnirostris_ declined this century to be rare in the Far NE (Badman and May, 1983), although uncommon at times along the Cooper. Recorded twice by White (1917), once by Reese (1925), several times by Messrs Parker and May (in Badman and May, 1983), and there is at least one other record (R.A.O.U. ATLAS) - mostly from the Cooper in 8.4.4. Apparently an irregular visitor favouring riparian woodland and nearby grassy flats.

Rare and declining on mainland S.A., requiring urgent study (R&V).

Masked Lapwing _Vanellus miles_ Charadriidae
Common and widespread around bore drains, swamps, lakes and occasionally waterholes in the Far NE. The two subspecies _V. m. miles_ and _V. m. novaehollandiae_ as well as hybrid _miles_ X _novaehollandiae_ are regularly encountered. Breeds regularly (Badman and May, 1983).

Common and secure in southern S.A. (R&V).

Banded Lapwing _V. tricolor_ uncommon but widespread in the Far NE with occasional irruptions (Badman and May, 1983). Recorded fairly regularly along the Cooper and Strzelecki in 8.4.4 including breeding. Favours open flats and short grasslands near water.

Common and secure in S.A. (R&V).

Lesser Golden Plover _Pluvialis dominica_ vagrant - one at Lake Goyder in August 1982 (Badman and May, 1983).

Uncommon arctic breeding migrant to (sub)coastal areas of S.A. Inadequately conserved (R&V).

Red-kneed Dotterel _Erythrogonys cinctus_ regarded as common in the Far NE (Badman and May, 1983) although nomadic. Regularly frequents ephemeral swamps, bore drains and less often other wetland habitats (Badman and May, 1983). Only known from the Cooper floodplain in 8.4.4, where uncommon to locally common may better describe this species' status judging by the few records from other observers. Breeds regularly (Badman and May, 1983).

A moderately common, nomadic, inland species that is irregularly plentiful in sub-coastal districts of S.A. (? drought refuge). Inadequately conserved (R&V).

Oriental Plover _Charadrius veredus_ one at Andrewilla WH, Diamantina, is the sole record from the Far NE. Likely to occur irregularly in 8.4.4.

Vagrant in S.A.; moderately common in the far north of Australia.

Charadriidae

Red-capped Plover C. ruficapillus regarded as common on fresh and salt lakes, bore drains, and less so at other water bodies (and occasionally gibber) in the Far NE (Badman and May, 1983). Large concentrations can occur on some lakes e.g. 2 000 at Lake Goyder and large numbers at Coongie, Lakes Toontoowaranie, Hope and Appadare (Badman and May, 1983). Generally infrequently seen by other observers in 8.4.4 - along the Cooper, and once on the Strzelecki (Rix, 1974), although White (1917) regarded it as widespread in 1916. Breeding at Embarka Swamp (this survey).

Common and secure in S.A. (R&V).

Black-fronted Plover C. melanops common and widespread wherever water in the Far NE (Badman and May, 1983). Widespread and moderately common to common in 8.4.4, and regularly breeds as at Coongie (e.g. Rix, 1974).

Common and secure in S.A. (R&V).

Inland Dotterel Peltohyas australis common and widespread in good seasons, virtually absent in dry seasons (Badman and May, 1983), but generally moderately common on stony plains in the Far NE. Uncommon in 8.4.4 due to a lack of gibber, its favoured habitat. Badman and May (1983) have indicated that this species' occurrence is largely tied to local rainfall. A long sequence of observations made by Reese (1927a, 1928a, 1933a, 1935a, 1936) certainly supports this notion. The species was not recorded by LP while on a two week long ornithological trip in the region in August 1982 (in the middle of a long drought), yet there was a number of records in the latter half of 1983 (LP; this survey) following the breaking of the drought

Widespread in the interior on stony plains; seasonally not uncommon in the Far NE and Nullabor (Parker, 1980a). Not conserved in S.A. (R&V).

Recurvirostridae

Black-winged Stilt Himantopus himantopus common on most waters in the Far NE and breeding when conditions suitable (Badman and May, 1983). Generally uncommon in 8.4.4, although large concentrations may occur on the Lower Cooper when the lakes contain water e.g. 100+ at Lakes Hope and Appadare (Badman and May, 1983); otherwise only regularly recorded at Coongie (e.g. Cox, 1982).

Common and secure in S.A. (R&V).

Recurvirostridae

Banded Stilt <u>Cladorhynchus</u> <u>leucocephalus</u> generally uncommon, sometimes absent from the Far NE. Favours open saline lakes. Two records in 8.4.4 - Coongie (Reese, 1931b) and <u>ca</u> 100 on Lake Appadare in November 1979 (Badman and May, 1983).

Common at times in S.A. Inadequately conserved (R&V).

Red-necked Avocet <u>Recurvirostra</u> <u>novaehollandiae</u> generally uncommon in the Far NE, although large concentrations not infrequently recorded. Favours a wide range of habitats but especially open shallow waters. Especially common on Lower Cooper during 1978, 1979 and 1980 as lakes were drying up (Badman and May, 1983) e.g. 10 000 on Lake Appadare and 1 000 on Lake Hope. Similarly recorded on three drying lakes to the north of Coongie in May 1980 (JP); otherwise few records from 8.4.4. Regularly recorded at Coongie (e.g. McGilp, 1931) and a breeding record at Embarka Swamp (this survey).

Moderately common, widespread and nomadic in S.A. Conservation status indeterminable (R&V), but probably secure for the present.

Scolopacidae

Whimbrel <u>Numenius</u> <u>phaeopus</u> sole vagrant record from Lake Appanburra in May 1980 (JP).

Rare in S.A.; coastal districts.

Wood Sandpiper <u>Tringa</u> <u>glareola</u> regular visitor in small numbers to bore drains and occasionally other waters in the Far NE (Badman and May, 1983). Not recorded as yet in 8.4.4, but nearby at Pandiburra Bore (LP) and at the Cooper crossing, Birdsville Track (Badman and May, 1983).

Uncommon visitor to fresh water habitats in S.A. Inadequately conserved (R&V).

Common Sandpiper <u>T.</u> <u>hypoleucos</u> occasional visitor to the Far NE, perhaps on passage only (Badman and May, 1983). Few records along the Cooper in 8.4.4 e.g. Tirrawarra WH in August 1982 (LP)

Moderately common in a range of wetland habitats and secure in S.A. (R&V).

Greenshank <u>T.</u> <u>nebularia</u> moderately common visitor to the Far NE in a variety of wetland habitats (see Badman and May, 1983). A number of records along the length of the Cooper in 8.4.4 but uncommon.

Widespread, moderately common and secure in S.A. (R&V).

Marsh Sandpiper <u>T.</u> <u>stagnatilis</u> uncommon, irregular visitor to the Far NE usually on bore drains and lakes (Badman and May, 1983). One record from

Scolopacidae

8.4.4 - 14 at Lake Appadare in November 1979 (Badman and May, 1983).

Widespread, uncommon but secure in S.A. (Reid and Vincent, 1979).

Latham's Snipe Gallinago hardwickii three previous records from the far north of S.A. (Badman and May, 1983). Additionally, a male at Pandiburra Bore in August 1982 (LP), and four birds on Embarka Swamp (LP, this survey) is the only record from 8.4.4.

Uncommon and declining in swamps in southern S.A. Inadequately conserved (R&V).

Black-tailed Godwit Limosa limosa vagrant (Badman and May, 1983) - sole record of 11 birds at Lake Toontoowaranie in August 1979, presumably on passage.

Uncommon and favouring freshwater swamps in southern S.A. Inadequately conserved (R&V).

Sharp-tailed Sandpiper Calidris acuminata most common of the trans-equatorial migrant waders in the Far NE, frequenting most waters (Badman and May, 1983). Within 8.4.4 large concentrations (up to 500) on Lakes Hope, Appadare and Goyder (Badman and May, 1983), but few other records - Coongie (e.g. Rix, 1974) and 39 km S Moomba in August 1979 (pers. obs), while one was seen on Caves Dam, Pandie Pandie (just outside of 8.4.4) this survey.

Common and secure in S.A. (R&V).

Red-necked Stint C. ruficollis uncommon, regular visitor to the Far NE, frequenting bore drains and lakes (Badman and May, 1983). Only records in 8.4.4 are from the Lower Cooper where large flocks seen on Lakes Hope and Appadare (Badman and May, 1983),

Common and secure in S.A. (R&V).

Long-toed Stint C. subminuta vagrant; one at Cannuwaukaninna Bore in December 1980 (Badman and May, 1983). Odd bird likely in 8.4.4 on swamps.

Rare but regular visitor to southern S.A.

Curlew Sandpiper C. ferruginea uncommon, irregular visitor to the Far NE (Badman and May, 1983). Only records in 8.4.4 from Lakes Hope (hundreds) and Appadare (20+) by Badman and May (1983).

Common and secure in coastal districts of S.A. (R&V).

CHARADRIIFORMES

Glareolidae

Oriental Pratincole <u>Glareola maldivarum</u> vagrant in S.A. One bird seen at Andrewilla WH in August 1982 (LP) is first record in Far NE.

Australian Pratincole <u>Stiltia isabella</u> common, breeding spring-summer visitor to the Far NE occupying a variety of habitats (Badman and May, 1983); more abundant in good seasons. Generally uncommon in 8.4.4, being more common in areas of gibber that surround the study area; regularly recorded around Coongie and scattered records throughout.

Moderately common (seasonally) and probably secure in drier open habitats of S.A. (R&V).

Laridae

Silver Gull <u>Larus novaehollandiae</u> uncommon to moderately common in the Far NE around lakes, beaches and along the Cooper. Scattered records through much of 8.4.4, but only regularly encounterd on the Upper Cooper as at Coongie (McGilp, 1931; Rix, 1974; pers. obs, 1979).

Common and secure in coastal S.A. (R&V).

Gull-billed Tern <u>Gelochelidon nilotica</u> uncommon generally in the Far NE and sometimes absent e.g. not recorded by Cox (1982) in 1975, nor in 1982 (LP); occasionally locally common, probably after heavy rains. Favour lakes and other waters in the vicinity of stony plains (e.g. many records along the Birdsville Track). Less common in 8.4.4 due to the lack of gibber although recorded regularly along the Cooper (e.g. Badman, 1979; pers. obs, this survey). Recorded by White (1917) along the Strzelecki, and on the gibber at Moorayepe (this survey). Bred at Lake Harry in September 1950 (Brandon, 1951).

Highly nomadic, uncommon generally, occasionally common inland in S.A.; regular breeding grounds (if any) unknown. Inadequately conserved (R&V).

Whiskered Tern <u>Chlidonias hybrida</u> generally uncommon and sometimes absent from the Far NE. Occasionally extraordinary concentrations around Lake Eyre (see Badman, 1979). Favours lakes, but also large waterholes. Records from Lakes Hope, Appadare (Badman, 1979), Appanburra, Warra Warreenie, Marroocoolcannie (JP) and Coongie (e.g. Rix, 1974), as well as a few records along the Upper Cooper in 8.4.4. Also three birds seen on the gibber after rains at Moorayepe (this survey). Perhaps largely absent from the Far NE until the massive rains in the 1970's - first record of 20 at Coongie in September 1973 (Rix, 1974).

Widespread, generally common and probably secure in S.A. (R&V).

Laridae

Caspian Tern Hydroprogne caspia largely confined to Lake Eyre, the Diamantina and especially the Cooper in the Far NE. Uncommon but regularly recorded along the Cooper in 8.4.4 (e.g. White, 1917; Rix, 1974; Badman, 1979; pers. obs, this survey), favouring lakes but also any large waterhole such as Kudriemitchie (pers. obs., 1979).

Common and secure in coastal S.A. (R&V).

COLUMBIFORMES Columbidae

Feral Pigeon Columba livia previously only recorded at Marree in the Far NE (Badman, 1979). Observations of feral birds at Birdsville and Cordillo Downs this survey, adjacent to 8.4.4.

Exotic commensal of people; feral populations well established in southern S.A.

Peaceful Dove Geopelia placida common along coolibah lined watercourses in the eastern portion of the Far NE; scattered records to the west in similar habitat. Very common along the length of the Cooper in 8.4.4, uncommon further downstream. Uncommon along the Strzelecki and scattered records north of the Cooper as at Mudcarnie Ck (this survey). The Far NE lies on the western margin of this species' range at this latitude; it is thought that this species may be currently expanding its range in this region. Only two old records can be traced - a breeding record in 1932 at Minnie Downs (Reese, 1933a), and reported as very common at Coongie (and also seen at Innamincka) in 1930 (McGilp, 1931). Significantly the species was not recorded by White (1917), Parsons (1921), Cleland (1925), nor by Cox (1982) who spent a month in the region in 1975. Recorded along the Diamantina several times in August 1982 (LP) and at Birdsville (this survey). Badman (1979) lists a few records further to the west. To summarize, it is likely that this species has always been present and common along the Upper Cooper in 8.4.4, but that periodic population dispersals and contractions may occur, accounting for the irregular pattern of records; apparently increasing at present.

Moderately common in semi-mesic woodland habitats in eastern S.A. and perhaps secure (R&V).

Diamond Dove G. cuneata more widespread than preceding species and throughout the Far NE. Less common than Peaceful Dove along the Cooper in 8.4.4. Generally restricted to watercourse and floodplain habitats but occupies scrubbier habitats as well as coolabah and red gum woodland. Common and widespread in suitable habitat in 8.4.4.

Columbidae

Common and secure in arid scrubs of S.A. (R&V).

Common Bronzewing Phaps chalcoptera rare visitor to the Far NE; only recorded at Coongie in 8.4.4 (McGilp, 1931; Cox, 1982). Very few records in adjacent districts.

Common and secure through much of S.A. (R&V).

Flock Bronzewing P. histrionica this species' centre of distribution has been reduced this century to the Barklay Tableland and adjacent districts (Frith, 1982), although after good seasons large populations build up and subsequently disperse widely across central-northern Australia. Formerly abundant across much its range. Perhaps never was a resident in the Far NE. Large numbers were breeding around Lake Hope in 1863 (Parker, 1980b), while huge numbers ("thousands" - Reese, 1931a) used to flock into floodout country of the Diamantina e.g. Goyder's Lagoon and similar habitat to the north on Pandie Pandie (Reese, 1931a). Still moderately common at times along the Birdsville Track north of and including Goyder's Lagoon (e.g. Wall, 1967; Cox and Pedler, 1977). Less common in 8.4.4 due to a lack of suitable habitat (mixed gibber and floodout) - 11 near Patchawarra Bore (Cox and Pedler, 1977), a report from the Cooper (R.A.O.U. ATLAS) and a probable sighting at Moorayepe (this survey). Probably during an irruption this species is more widespread than these few records would suggest.

Nomadic, difficult to conserve (R&V).

Crested Pigeon Ocyphaps lophotes common and widespread near water throughout the Far NE and 8.4.4; less common to absent in the heart of dunefields in dry seasons. Most common along the Cooper in 8.4.4.

Common and secure in open woodland in S.A. (R&V).

PSITTACIFORMES

Cacatuidae

Red-tailed Black Cockatoo Calyptorhynchus magnificus reported regularly and bred on Pandie Pandie in the 1920's and 1930's (e.g. Reese, 1933a). An old record from the Cooper in 8.4.4 (R.A.O.U. ATLAS). Possibly extinxt as not recorded recently in the Far NE; declined for unknown reasons , although may never have been resident; it may yet be found to still occur irregularly.

Both restricted poulations (in the South-East and the Far North) have declined. Inadequately conserved (R&V).

Galah Cacatua roseicapilla very common near water and widespread in the Far NE and 8.4.4. Most common in riparian woodland (breeding habitat) and associated floodplains.

Cacatuidae

Common and secure in S.A. (R&V).

Little Corella C. sanguinea very common near water and widespread in the Far NE and 8.4.4. Similar comments apply as for preceding species except that this species is less dispersed and more strictly confined to water, often gathering in larger flocks; no records from the southern dunefield.

Common and secure in S.A. (R&V).

Pink Cockatoo C. leadbeateri rare breeding visitor to the extreme north-east of the State. Five records from 8.4.4 or adjacent viz. Lake Goyder in February 1927 (Reese, 1927b), Cuttapirie Corner WH in April 1931 (Reese, 1931a), breeding at Innamincka in October 1916 (White, 1917) and Nappa Merri (Qld) in September 1920 (Chenery, 1921), and a recent record from Coongie in June 1980 (Mr W.E. Matheson, pers. comm.).

Uncommon in southern arid woodlands of S.A. Inadequately conserved (R&V).

Polytelitidae

Red-winged Parrot Aprosmictus erythropterus formerly a regular breeding visitor to the extreme north-east of the State (see Reese, 1927a), but apparently declined in the 1930's - the last recorded observation made by Reese (1927b) was 40 at Lake Goyder in February 1927. An extremely rare visitor if at all to the Far NE nowadays (see Pedler and Raglass, 1978 for an unconfirmed sighting in 1967).

Declined to vagrant status in the north-east of S.A.

Cockatiel Nymphicus hollandicus generally uncommon, breeding visitor to the Far NE; nomadic and at times plentiful. Few records in 8.4.4 from the Upper Cooper e.g. Coongie (McGilp, 1931), the Strzelecki and Patchawarra Bore (Cox and Pedler, 1977), favouring riparian woodland.

Common (seasonally) in drier parts of S.A. and probably secure (R&V).

Platycercidae

Night Parrot Geopsittacus occidentalis the first specimen of this enigmatic bird was collected near Lake Goyder in October 1845 by John McDouall Stuart on Sturt's expedition (Forshaw, 1981). Andrews (1883) collected several specimens from along the Cooper and around Lake Eyre in 1875, although the fate of these specimens has never been established (Forshaw et al., 1976). The most recent record was of four seen near Lake Perigundi in June 1979 by Mr S.A. Parker et al., and there is an additional record from near Innamincka (Parker, 1980a). Favoured habitat is succulent chenopod flats (e.g. samphire and succulent bassias). In addition Storr (1973) regards two records, from the Cooper in Qld but near the S.A. border, as acceptable. The causes of this species' decline cannot be properly evaluated. McGilp (1931b) quotes an early stockman as blaming predation by feral cats and environmental degradation due to stock grazing. If the Night Parrot gives off a strong scent as indicated by Menkhorst and Isles (1981), predation by foxes and cats could well have been a significant factor. As stock grazing has been focused on the Upper Cooper in 8.4.4, suitable habitat is probably far more prevalent along the Lower Cooper; an intensive survey is warranted

Budgerigah Melopsittacus undulatus generally moderately common but numbers fluctuate greatly depending on the season in the Far NE. Abundant along the Cooper in some years e.g. 1930 (McGilp, 1931) and 1973 (Rix, 1974), but generally scattered throughout 8.4.4 if water is available.

Seasonally common in drier parts of S.A. and secure (R&V).

Mallee Ringneck Barnardius barnardi a distinctive, pale form that inhabits red gum woodland along the Upper Cooper from Innamincka to the Chillimookoo WH area (this survey) including the North-West Branch north to Coongie; this population extends east into south-western Qld. Its precise taxonomic status is yet to be determined.

This distinctive population is confined to 8.4.4 in S.A. The species is common and secure in drier woodlands of eastern S.A.

Red-rumped Parrot Psephotus haematonotus the pale subspecies P. h. caeruleus is confined to woodland of the Cooper and Strzelecki floodplains in the Far NE. Parker (1980a) has displayed pictorially all records known to him and states that the population may have only established itself in S.A. since 1900. Parker had one record from the Strzelecki - recent records from Murtee Murtee (LP), Toolache and Mundibarcooloo WH (this survey) and breeding at the latter locality. White (1917) gives a record from Innamincka, while a surprising early observation was made at the Cooper crossing, Birdsville Track in 1920 (Parsons, 1921), a long way downstream from the nearest locality record viz. near Waukatana WH (see map 6 in Parker, 1980a). Found to be moderately common between Yalcuma and Narrawalpinna WH (this survey) on the Lower Cooper. Northern observations at Lakes Willata, Deception and Appanburra in May 1980 (JP). To summarize, this species is common along the Upper Cooper and less common but widespread along the Lower Cooper and Strzelecki. Parker's claim (1980a) that the population is recently established is questionable.

The species is common and secure in woodland in eastern S.A., although R&V advise that a conservation park is warranted on the Cooper to protect

Platycercidae

the subspecies caeruleus.

Bluebonnet Northiella haematogaster the subspecies N. h. pallescens is confined to the Diamantina, Cooper and Strzelecki floodplains in S.A. (Parker, 1980a); effects riparian woodland. Common along the Lower Cooper in 8.4.4 and less common on the Upper Cooper and Strzelecki. Records augmenting those of Parker (1980a) include Toolache, Bookabourdie, Scrubby Camp and Tirrawarra WH (this survey) and Lakes Appanburra and Warra Warreenie in May 1980 (JP).

Moderately common and secure in drier woodland habitats in parts of S.A. (R&V).

Bourke's Parrot Neophema bourkii rare visitor to the Far NE; all five records from or near the Cooper - Birdsville Track (Cox, 1982), 15 km NW Innamincka along a miniritchie lined creek in August 1979 (Mr D. Robinson, pers. comm.), several flocks between Moonlight Flat and Karawinnie WH (Mr T. Fraser et al., this survey), two near Tirrawarra WH (Mr K. Casperson et al., this survey), and another report from near the last locality (R.A.O.U. ATLAS).

Moderately common and widespread in tall shrublands (especially mulga) of western S.A.; probably secure (R&V).

Blue-winged Parrot N. chrysostoma an uncommon, non-breeding visitor to the Far NE in a variety of habitats. Four records along the Cooper in 8.4.4 viz. Lakes Lady Blanche and Warra Warreenie in May 1980 (JP), near Cooramunchena WH in May 1980 (LJ) and North-West Branch (R.A.O.U. ATLAS). Another four records just outside of study area at Innamincka, Koonchera, lower Strzelecki and west of Lake Perigundi. More regularly observed to the south and south-east of 8.4.4 e.g. around Lake Eyre (Parker, 1980a).

Uncommon in stringybark woodland in the South-East; less common (seasonally) to the north in eastern S.A. Inadequately conserved (R&V).

CUCULIFORMES

Cuculidae

Pallid Cuckoo Cuculus pallidus moderately common (at least seasonally) in the Far NE. Favours all habitats in 8.4.4 and widespread e.g. recorded from at least 19 different localities in the R.A.O.U. Field ATLAS Scheme; a nomadic species that may be common or largely absent according to the season, but probably thinly widespread most years.

Moderately common and secure in drier habitats throughout S.A. (R&V).

Cuculidae

Black-eared Cuckoo Chrysococcyx osculans vagrant in the Far NE - two records in 1975 (Cox, 1982); not recorded in 8.4.4 but a possible visitor.

Uncommon but widespread and secure in drier habitats in S.A. (R&V).

Horsefield's Bronze-Cuckoo C. basalis generally uncommon to moderately common in the Far NE and 8.4.4, frequenting all habitats; very widespread but never abundant.

Common, widespread and secure in S.A. (R&V).

Channel-billed Cuckoo Scythrops novaehollandiae a regular breeding visitor to Pandie Pandie and Minnie Downs in the 1920's and 1930's according to Reese (e.g. 1924, 1932). Earlier record from along the Cooper in 1863 (Parker, 1980b). Referred to as the "flood bird" (Parker, 1980b) because of its habit of arriving in districts generally only after a flood (e.g. see Reese, 1927b). Also reputed to be on the Strzelecki in the 1920's (Cleland, 1925). No recent records.

Presumed extinct in S.A.

STRIGIFORMES

Strigidae

Southern Boobook Ninox novaeseelandiae uncommon but scattered along the Diamantina and Cooper in the Far NE; casual elsewhere in woodland. More common along the Upper Cooper in 8.4.4. Possibly a non-breeding visitor.

Common and secure in woodlands in S.A. (R&V).

Barking Owl N. connivens moderately common in red gum woodland along the Upper Cooper and scattered records downstream; recorded regularly at Innamincka (Parker, 1977b), and the North-West Branch between Tirrawarra and Coongie (e.g. this survey). Thought to be resident but no breeding record.

Uncommon in red gum woodland in eastern S.A. - restricted to small pockets of suitable habitat e.g. Cooper Ck and northern Flinders Rgs; rare elsewhere. Inadequately conserved.

Tytonidae

Barn Owl Tyto alba generally uncommon to absent in the Far NE, although large numbers present occasionally e.g. 1974-1975 (Cox and Pedler, 1977). Largely confined to the Cooper in 8.4.4, although likely to occur around other water bodies.

Nomadic but overall moderately common in lightly timbered country and secure in S.A.(R&V).

Tytonidae

Eastern Grass Owl T. longimembris first State record at Kooncheri in August 1975 (Cox, 1976). Birds still there (Pandiburra Bore) over a year later, and 15 at Mirra Mitta Bore in November 1976 (Parker, 1977a). Their occurrence was linked with the plaguing of Rattus villosissimus (Parker, 1980a); not recorded in 8.4.4 but a possibility in suitable habitat when rats are plaguing (e.g. Embarka and Tirrawarra Swamps).

CAPRIMULGIFORMES

Podargidae

Tawny Frogmouth Podargus strigoides moderately common in riparian woodland along the Cooper and Strzelecki in 8.4.4 (this survey), where breeding resident. Few records elsewhere in Far NE e.g. Cooper crossing, Birdsville Track (Badman, 1979) and Diamantina, Clifton Hills (Cox, 1982).

Common and secure in woodlands in S.A. (R&V).

Aegothelidae

Australian Owlet-nightjar Aegotheles cristatus common in riparian woodland in the Far NE, including along the Cooper and Strzelecki in 8.4.4. Breeding resident.

Common and secure in woodland and forest habitats in S.A. (R&V).

Caprimulgidae

Spotted Nightjar Caprimulgus guttatus uncommon visitor to the Far NE, usually near water. Recorded at Coongie (LP) and by White (1917) at unknown localities in 8.4.4. Two records from the Diamantina (e.g. Cox, 1982) and one bird at Farina Ck. (Raglass, 1978, Bird Talk 1 : 64).

Widespread in drier woodlands in S.A.; common only in the Murray Mallee. Probably adequately conserved (R&V). Northward movements may occur.

APODIFORMES

Apodidae

Fork-tailed Swift Apus pacificus sole record for the Far NE at Moorayepe (this survey) - up to a 100 birds flying south on 31 October 1983 in heavily overcast conditions and light rain. Over 25 mm of rain had fallen in the previous 24 hours; the birds were presumed to be on passage. A large flock of swifts (presumably of this species) was seen at Mooloowatana in February 1921 (McGilp, 1921).

Regular summer non-breeding migrant to southern Australia.

CORACIIFORMES Alcedinidae

Red-backed Kingfisher _Halcyon pyrrhopygia_ widespread and common along watercourses and in other timbered habitats in the Far NE. Most common along the Cooper and Strzelecki in 8.4.4, but occurs in sand dunes and along small watercourses in the north as well. This species breeds in the region and birds are present all year; however individuals may not be resident.

Moderately common and secure in drier areas of S.A. (R&V).

Sacred Kingfisher _H. sancta_ a summer visitor (probably breeding but no records) to the Far NE, that regularly occurs only along the Upper Cooper - Innamincka to Coongie along the North-West Branch in red gum woodland and adjacent flats. Few, scattered records elsewhere in 8.4.4 and the Far NE e.g. Cooper crossing, Birdsville Track (Cox and Pedler, 1977).

Meropidae

Rainbow Bee-eater _Merops ornatus_ common, breeding, widespread summer visitor to the Far NE. Favours lightly timbered watercourses and floodplain habitats (Badman, 1979); perhaps largely absent from core areas of gibber and dunefields. Common along the Cooper and Strzelecki flood plains, and around watercourses and drainage lines in the north of 8.4.4.

Common (summer) and secure in drier sandy areas of S.A. (R&V).

PASSERIFORMES Alaudidae

Singing Bushlark _Mirafra javanica_ few records in the Far NE, although undoubtedly moderately common in the far north of the region in suitable habitat. Nomadic and perhaps the species largely vacates the region in dry seasons. Regularly recorded in the Goyder's Lagoon district (e.g. Morgan, 1930). A specimen record from the Cooper in 8.4.4 (Lawson and Parker, 1976), and found to be common in well grassed depressions in gibber in the north of 8.4.4 (this survey, and seen in May 1980 at Koodlanie Well, west of Cordillo Downs HS by JP) and further north to the State border (pers. obs, August 1979 and this survey). Favours grassy flats e.g. _Astrebla_ .

Generally uncommon but secure in some grasslands of S.A. (R&V).

Hirundinidae

White-backed Swallow _Cheramoeca leucosternum_ common and widespread in the Far NE, although avoiding gibber away from dunes; common throughout 8.4.4 and breeding.

Moderately common and secure in drier sandy areas of S.A. (R&V).

Welcome Swallow _Hirundo neoxena_ regularly seen and breeding, but generally

Hirundinidae

uncommon in the Far NE, favouring human habitations, sheds, bore drains and occasionally other water bodies (Badman, 1979). Widespread in 8.4.4 and breeding at Coongie (McGilp, 1931). Probably an influx of birds in winter.

Common and secure near water in S.A. (R&V).

Tree Martin Cecropis nigricans common in woodland and lightly timbered habitats along watercourses or near water in the Far NE. Birds present all year and breed regularly as at Coongie (e.g. McGilp, 1931). Common along the Cooper and Strzelecki and lakes in the north of 8.4.4; less common elsewhere and avoids the dunefields away from water.

Common and secure in eucalypt woodland in S.A. (R&V).

Fairy Martin C. ariel common (?seasonally) in all habitats where breeding requirements are met in the Far NE. Similar preferences to preceding species. Widespread in 8.4.4, although avoids dunefields away from water. Unlike previous species, will inhabit gibber provided culverts or similar structures are present (nesting sites). Present all year, but numbers probably greatly swelled in spring-summer by birds from the north.

Moderately common (spring-summer) in parts of S.A. Probably secure.

Motacillidae

Richard's Pipit Anthus novaeseelandiae common and widespread in open, flat habitats in the Far NE e.g. gibber, floodplain, interdune corridors. Throughout 8.4.4.

Common and secure in open and grassy plains in S.A. (R&V).

Campephagidae

Black-faced Cuckoo-shrike Coracina novaehollandiae moderately common in timbered habitats in the Far NE; regularly encountered along the Diamantina, Cooper and Strzelecki floodplains. Most common along the Upper Cooper but scattered records throughout 8.4.4, although largely absent from dunefields Breeding at Toolache WH (LP, this survey).

Common and secure in wooded habitats in S.A. (R&V).

Ground Cuckoo-shrike C. maxima uncommon visitor to the Far NE - seven records from near watercourses (major and minor) through stony plains, including seven in miniritchie near Patchawarra Bore (8.4.4.6) in 1930 (McGilp, 1931) and two at the Cooper crossing, Birdsville Track in November 1977 (Badman, 1979). At least five other records from the Cooper in 8.4.4 in-

Campephagidae

cluding breeding, and one Lower Cooper record (R.A.O.U. ATLAS). Also a record from the extreme south of 8.4.4 near the Strzelecki. Favours watercourses through gibber and less often flood plain habitats.

Generally uncommon in open scrubland in drier parts of S.A. Inadequately conserved (R&V).

White-winged Triller Lalage sueurii moderately common to common spring-summer breeding visitor to the Far NE, favouring lightly timbered and scrubby habitats as along smaller watercourses, on floodplains back from the major channels of larger watercourses, and in groves of tall shrubs (Acacia spp, Atalaya etc.) in dunefields. Widespread in 8.4.4 with annual numbers probably varying according to the season.

Common (seasonally) and secure in drier woodlands and scrubs of S.A.

Muscicapidae (an artificial family not reflecting true affinities of and among Australian flycatchers e.g. Boles, 1979)

Red-capped Robin Petroica goodenovii largely a non-breeding, autumn-winter visitor to the Far NE, although breeding at Lake Letty (Morgan, 1930). Seen in lightly timbered and scrubby habitats, often along the floodplains of the Diamantina, Cooper and Strzelecki and in adjacent dunes. Moderately common on Cooper and Strzelecki floodplains in 8.4.4 at least in some winters and scattered records throughout 8.4.4. Unknown whether it inhabits dunefields as well but likely. Apparently some birds in the region all year but large winter influxes occur; Wyndham (1978) reported a similar movement in an adjacent region across the Qld border.

Common and widespread in drier woodlands and shrublands in S.A. Adequately conserved (R&V).

Hooded Robin Melanodryas cucullata rare (?winter) visitor to the Far NE - three records along the Cooper in 8.4.4 (Cox, 1982; R.A.O.U. ATLAS) and a breeding record on the Cooper at Nappa Merri, Qld (Chenery, 1921). Wyndham (1978) regards this species as a winter visitor to the south-western Qld region adjacent to the Far NE,

Moderately common and secure in a variety of wooded and scrubby habitats in drier parts of S.A. (R&V).

Jacky Winter Microeca leucophaea rare (status indeterminable), confined to the Upper Cooper in the Far NE. Frequents red gum woodland from Innamincka (Cleland, 1925) to Coongie (Mr F.J. Badman, pers. comm.). Recorded by White (1917), two at Calamurra and one at Bulloo Bulloo WH in August 1982 (LP), and an additional record along the North-West Branch (R.A.O.U. ATLAS).

Breeding at Nappa Merri, Qld (Chenery, 1921). Perhaps a rare resident (as indicated by Condon, 1969), although more likely to be a casual visitor (? from the east), judging by the paucity of records of this normally conspicuous species.

Common and secure in drier woodlands of S.A. (R&V).

Rufous Whistler Pachycephala rufiventris an irregular, uncommon, non-breeding visitor (largely winter) to woodland habitats in the Far NE; birds may be seen year round. The few birds have been seen along the Diamantina and Cooper, with a record in May 1980 from Cordillo Downs (JP).

Common in spring-summer in woodland habitats in southern S.A. Adequately conserved (R&V).

Grey Shrike-thrush Colluricincla harmonica a distinctively pale population inhabits riparian woodland of the Diamantina and Cooper in the Far NE. Parker (1980a) displays its distribution - additional records include Lakes Appanburra and Warra Warreenie (JP), Dickaree WH and Birdsville (LP; this survey). Common alomg the length of Cooper in 8.4.4 (LP; this survey), but no records further downstream.

Common and secure in southern S.A. (R&V).

Crested Bellbird Oreoica gutturalis uncommon in the southern portion of the Far NE, with one northerly record from Minnie Downs (Reese, 1930b). Largely confined to the Cooper (10 locality records) and (a) record(s) from the Strzelecki e.g. Tinga Tingana (White, 1917). Moderately common along the Lower Cooper (LP; this survey), less common on the Upper Cooper and apparently scarce along the Strzelecki in 8.4.4.

Common and secure in (semi)arid woodland habitats and scrubs in S.A. (R&V).

Restless Flycatcher Myiagra inquieta largely confined to the Upper Cooper in 8.4.4, where uncommon to moderately common; scattered records elsewhere in the Far NE in riparian woodland e.g. Lake Appadare (Badman, 1979), Yaningurie WH (LJ) and Cordillo Downs (JP). Favours red gum woodland in 8.4.4 where regularly if uncommonly encountered, but nomads wander widely along coolabah lined watercourses as well. No breeding records as yet (? perhaps largely a winter visitor).

Widespread and secure in woodland habitats in S.A. (R&V).

Willie Wagtail Rhipidura leucophrys very common and widespread in the Far NE, although absent from gibber and less common in dunefields. Most common on the Cooper and Strzelecki floodplains in 8.4.4. Apparently a large win-

Muscicapidae

ter influx of birds from the south occurs (e.g. Reese, 1924, 1928b) in the Far North of S.A. and the N.T. (see Storr, 1977). Badman (1979) has many records in summmer in the Lake Eyre region and so presumably a large resident and breeding population exists as well as the winter visitors.

Common and secure in S.A. (R&V).

Grey Fantail R. fuliginosa uncommon winter visitor to the Far NE, favouring woodland and scrubby thickets along major and minor watercourses e.g. Diamantina, Cooper, Clayton and Petermorra. Only recorded from the Cooper in 8.4.4 and largely confined to the Upper Cooper; regularly recorded at Coongie (e.g. Cox, 1982)

Common and secure in woodland and forest habitats in southern S.A. (R&V).

Orthonychidae

Chirruping Wedgebill Psophodes cristatus common in lignum and some other shrubby habitats in the Far NE, although uncommon in the far north. Very common in lignum flats along the Cooper in 8.4.4, less common along Strzelecki and in southern dunefield; northern locality records from Karawinnie WH (Cox, 1982), Cordillo Downs and Lake Warra Warreenie (JP) and outside of 8.4.4 at Koonchera (pers. obs).

Common and secure in low shrublands in eastern interior of S.A.

Cinnamon Quailthrush Cinclosoma cinna momeum common and widespread in the Far NE favouring gibber and dune habitats. Moderately common and widespread in 8.4.4 although less common on Cooper floodplain and eastern portion of study region. This species is thought to have benifited from overgrazing and the resulting desertification in areas where the degradation has not been too severe (Parker, 1980a)

Widespread in open stony habitats with sparse vegetative cover in the interior of S.A. Seemingly secure (R&V).

Timaliidae

White-browed Babbler Pomatostomus superciliosus confined to the extreme south of the Far NE and the records from further north are regarded as erroneous. The records by Pedler and Raglass (1978) at Mooloowatana and near Marree by Badman (1979) are acceptable. Likewise Brandon (1951) saw a "few" between Marree and Kopperamanna (presumably at the Marree end of this long stretch). White (1917) found this species in "the driest part of the country" but no localities were mentioned, whereas he stated that the Chest nut-crowned Babbler was common along the Strzelecki. White travelled with a

Timaliidae

S.A. Museum expedition by camel from near Lyndhurst to Innamincka via the Strzelecki Ck and then followed the Cooper to the Birdsville Track and then finished the journey at Marree. It is inferred that White regarded the "driest country" as that part of his journey when his party was not following the Strzelecki and Cooper Cks i.e. at the beginning and end of the expedition. If this were the case, his records fall into the same pattern as the others. Cleland (1925) recorded 95 individuals of this species between Lyndhurst and Cordillo Downs. Almost surely Cleland mistook the common Chestnut-crowned Babbler for this species (at least north of Lake Blanche) despite him being positive of his identification at Tinga Tingana. Palpable evidence is lacking to support this species' presence in 8.4.4 - there are two erroneous reports (R.A.O.U. ATLAS) from the Upper Cooper. Similarly the record of a second species of babbler other than P. ruficeps at Coongie by Rix (1974 - possibly P. halli) is treated with suspicion.

Common and secure for the present in S.A. although it has disappeared from localised parts of its large range.

Chestnut-crowned Babbler P. ruficeps moderately common in shrubby thickets associated with riparian woodland along the Strzelecki and Cooper; occasionally along minor watercourses in the south of the Far NE. Also recorded on the Diamantina at New Kalamurina and Andrewilla WH (Cox and Pedler, 1977). Northern locality records in 8.4.4 are Karawinnie WH (Cox and Pedler, 1977), Lake Appanburra (JP) and Patchawarra Bore (Rix, 1974). Most common along the Lower Cooper in thickets of Acacia salicina, less common along the Upper Cooper and Strzelecki, although regarded as common by White (1917) along the Strzelecki in 1916.

Moderately common and probably secure in drier woodland and shrubland habitats in eastern S.A. (R&V).

Sylviidae

Clamorous Reed-Warbler Acrocephalus stentoreus moderately common in dense reedbeds of bore drains in the Far NE; occasionally recorded in vegetated swamp habitats along the major watercourses. Within 8.4.4 only recorded at Coongie (regularly e.g. McGilp, 1931; Cox, 1982) and Embarka Swamp (common, this survey). Also recorded at Innamincka in August 1982 (LP) and Birdsville (this survey).

Common and secure in wetlands in S.A. (R&V).

Little Grassbird Megalurus gramineus common in dense reedbeds of bore drains in the Far NE; occasionally recorded in vegetated swamp habitats a-

Sylviidae

long the major watercourses. Within 8.4.4, only recorded at Coongie (e.g. McGilp, 1931) and Embarka Swamp (this survey). Also along the Diamantina at Goyder's Lagoon (morgan, 1930) and Birdsville (this survey).

Rufous Songlark Cinclorhamphus mathewsi highly nomadic and varying from absent to common in riparian woodland throughout the Far NE; present in large numbers in good seasons e.g. 1930 (Morgan, 1930, McGilp, 1931), 1973 (Rix, 1974) and in some bad seasons such as August 1982 (LP). Scattered records along the Cooper and Strzelecki and most common along the Upper Cooper in 8.4.4. Two breeding records at Minnie Downs (e.g. Reese, 1933a). Probably uncommon most years ; some regularity in this species' movements (south in summer).

Moderately common if irregular spring-summer migrant to drier woodland in S.A. Secure (R&V).

Brown Songlark C. cruralis nomadic and numbers variable according to the season, but generally uncommon to moderately common in well grassed habitats in the Far NE. Frequents a wide range of habitats (unlike preceding species) provided there is sufficient ground cover, although perhaps there are few birds in dunefields. Widespread in 8.4.4 along the Cooper and Strzelecki and grassy pockets on gibber in the north.

Seasonally common and secure in grasslands throughout S.A. (R&V).

Maluridae

Variegated Fairy-wren Malurus lamberti common and widespread in the Far NE, favouring most habitats with low vegetation cover, preferring slightly larger shrubs (and denser cover) than the following species. Found throughout 8.4.4; most regularly encountered in lignum flats and acacia thickets in dunefields, avoiding very open habitats.

Common and secure in drier parts of S.A. (R&V).

White-winged Fairy-wren M. leucopterus very common throughout the Far NE and 8.4.4, more abundant than preceding species overall. Occupies similar habitats as M. lamberti as well as more open habitats and with a lower shrub stratum. Most common malurid in Zygochloa clad dunes.

Common and secure in low (often chenopod) shrublands in drier parts of S.A.

Rufous-crowned Emu-wren Stipiturus ruficeps recently found to be moderately common in the Simpson Desert (Parker et al., 1978) in the extreme north-western portion of the Far NE. Frequents areas of Triodia, although May (1977, S. Aust. Orn. 27 : 172) found the species in a Zygochloa community

Maluridae

without _Triodia_ in the Qld sector of the Simpson Desert. There is a chance that this species is thinly distributed in the northern dunefields of 8.4.4 - there is certainly suitable _Triodia_ habitat in 8.4.4.6 and .7. The Diamantina floodplain may have been/be an effective barrier, preventing the eastward spread of this species, although Schodde (1982b) concluded that the barrier is ineffective in the case of the Eyrean Grasswren. Specific searches were carried out for this species at Sites 4 and 6 without success during this survey.

Perhaps adequately conserved in S.A. (R&V).

Eyrean Grasswren _Amytornis goyderi_ widespread and moderately common in dunefields in the Simpson and Strzelecki Deserts, and to the north of the Cooper and east of the Diamantina. Restricted to _Zygochloa_ habitats. Parker (1980a) has plotted the distribution of this species (see map 10). The two previous locality records in 8.4.4 are from near Lake Perigundi and 39 km S Moomba. Observation this survey were made at Sites 1, 4, 6, 25 and _ca_ 15 km S Moomba. Recent records along the Birdsville Track and Diamantina (LP) near Lake Callabonna by Mr I.A. May. The record from Site 1 is of significance because of the isolation of the dune on which several groups were encountered - the nearest neighbouring dune being more than 5 km distant across gibber - perhaps indicating good dispersal ability.

Grey Grasswren _A. barbatus_ known from a few areas of lignum swamp in the Far NE. Discovered at Kooncheri in 1975 by Cox (1976) and recently recorded at Embarka Swamp by Mr I.A. May (Joseph, 1982). Its status needs to be determined at Embarka (not recorded there this survey).

Requires urgent conservation (R&V).

Thick-billed Grasswren _A. textilis_ confined to stony plains in the south-western portion of the Far NE, and no suitable habitat (chenopod steppe) exists in 8.4.4.

Inadequately conserved (R&V) and uncommon in the central interior of S.A.

Acanthizidae

Redthroat _Sericornis brunneus_ "scattered" according to White (1917) but recorded by no other observers in the Far NE; this species favours chenopod shrubland (e.g. saltbush) in the north-eastern part of its range, and it has been seen as far north as Winton, Qld in channel country occurring in _Atriplex nummularia_ flats (Readers Digest Complete Book of Australian Birds 1979). Although White (1917) did not specify any localities, it is likely that he saw Redthroats in this habitat bordering the Strzelecki. Apparently the species has become locally extinct, probably as a result of the severe overgrazing that occurred in the early part of this century, causing degradation of the saltbush flats. Alternatively, White may have seen this species only on the stony plains to the east of Lyndhurst around the northern Flinders.

Widespread and uncommon in semi-arid shrublands in S.A. Perhaps adequately conserved (R&V).

Calamanthus S. fuliginosus uncommon and localized in stony habitats with scattered cover of small chenopod shrubs in the Far NE. A few records from along the Birdsville Track north to Mt Gason Bore (Cox, 1982) and Strzelecki Track west of Lake Blanche (pers.obs., 1979) comprise the north-eastern range limits of this species in Australia. Unlikely to occur in 8.4.4 due to lack of suitable habitat.

Common and secure in a variety of low shrublands in scattered parts of S.A. Refer to Parker and Eckert (1983) for taxonomic changes in this species complex.

Weebill Smicrornis brevirostris the one record in the Far NE is therefore questionable. Dr D.H. Close (pers. comm.) recorded this species at Scrubby Camp WH in August 1979, although it was not seen by eight competent bird watchers in his company. This species has been recorded at Nappa Merri (20 km E Innamincka) by Chenery (1921), and so Close's priceless record cannot be discounted. Perhaps the species occasionally wanders west along the Cooper from its regular haunts in south-western Qld. The riparian woodland habitats dominated by red gum and coolabah along the Diamantina, Cooper and Strzelecki would seem to be ideally suited to this species habitat requirements; yet strangely this species with a wide range in eucalypt woodland throughout the drier parts of Australia does not occur in the Far NE.

Common and secure in drier eucalypt woodlands of S.A. (R&V).

Chestnut-rumped Thornbill Acanthiza uropygialis confined to shrubby thickets in woodland along watercourses (largely the Cooper) in the Far NE. Records from near the Cooper crossing, Birdsville Track (Cox, 1982), near Cooramunchena WH (LJ), Coongie (pers. obs), Scrubby Camp WH (LP), Cordillo Downs (JP) and Toolache WH (this survey). Uncommon and perhaps a nomadic visitor to the region which lies on the north-eastern extremity of this species range in Australia. Also recorded at Karawinnie WH (Cox, 1982).

Common and secure in drier woodlands of S.A. (R&V).

Acanthizidae

Yellow-rumped Thornbill A. chrysorrhoa two unconfirmed reports from the Upper Cooper in the Far NE (R.A.O.U. ATLAS; Mr K.C. Casperson et al., this survey). A female Orange Chat could be mistaken for this species. Similarly with the Weebill, this species is found to the north, south, east and west of 8.4.4 but apparently not within it. The riparian woodland comprises suitable habitat.

Common and secure in open woodland over much of S.A. (R&V).

Southern Whiteface Aphelocephala leucopsis uncommon but widespread and regularly encountered in shrubland - along the floodplains of the major watercourses and on gibber. In 8.4.4, most common along the Cooper - many records from its entire length but nowhere common, scattered along the Strzelecki and across the northern boundary of the study region at Cordillo Downs (Cleland, 1925) and 30 km SSE Koonchera (Cox and Pedler, 1977). Scattered records along the Birdsville Track and Diamantina.

Moderately common and secure in open woodland and scrubs in the drier parts of S.A. (R&V).

Chestnut-breasted Whiteface A. pectoralis four records of this rare inhabitant of sparsely vegetated (chenopods) gibber plains from the Far NE (western gibber). Cox (1982) saw three birds 30 km SSE Koonchera in August 1975, just a few km outside of 8.4.4. Virtually nothing is known about this species' habits, although it is assumed to wander widely on the gibber plains in the Lake Eyre region according to the season.

Rare and not conserved.

Banded Whiteface A. nigricincta generally uncommon in shrubby dune habitats (not in pure Zygochloa habitats), and occasionally straying into gibber (e.g. Stewart, 1977) in the Far NE. Moderately common around and to the north of Lake Eyre (Badman, 1979), and in the southern Strzelecki Desert. Scattered records along the Cooper and Strzelecki in 8.4.4 (e.g. White, 1917; this survey). Northern records in the Far NE from Site 4 (this survey), Providence Ck and Lake Surprise Sandhill (LP).

Widespread and generally uncommon in the north of the State. Inadequately conserved (R&V).

Climacteridae

Brown Treecreeper Climacteris picumnus largely confined to red gum woodland along the Upper Cooper between Innamincka and Chillimookoo WH and along the North-West Branch to Lakes Appanburra and Warra Warreenie (JP), where locally common; one record from near Murtee Murtee (Mr G.B. Raglass, Climacteridae

pers. comm.).

Common and secure in open woodland in eastern S.A. (R&V).

Meliphagidae

Spiny-cheecked Honeyeater Acanthogenys rufogularis generally uncommon in woodland and scrubs along watercourses across the southern portion of the Far NE. Uncommon to moderately common along the length of the Cooper in 8.4.4 and along the Strzelecki north to Murtee Murtee. Perhaps largely a winter visitor as indicated by Wyndham (1978) for the adjacent region in Qld.

Common and secure in a wide variety of habitats in S.A. (R&V).

Yellow-throated Miner Manorina flavigula common and widespread in the Far NE in eucalypt woodland along major and minor watercourses and floodplains. Common along the Cooper and Strzelecki and less common on minor watercourses and floodplains in the north of 8.4.4.

Common and secure in drier woodlands in S.A. (R&V).

Singing Honeyeater Lichenostomus virescens moderately common to common and widespread in shrubland habitats throughout the Far NE; avoiding riparian woodland and gibber. Most common in acacia thickets on dunes, in interdune corridors and floodplains of 8.4.4 - widespread and common but by no means abundant.

Widespread, common and secure in shrubland throughout S.A. (R&V).

White-plumed Honeyeater L. penicillatus abundant in eucalypt woodland along the channels of major and minor watercourses and around lakes in the Far NE. Perhaps slightly less widespread than preceding species (e.g. avoiding lightly timbered (coolabah) floodout habitat in the north of 8.4.4.

Common and secure in gum woodland in eastern S.A. (R&V).

Black-chinned Honeyeater Melithreptus gularis the northern race M. g. laetior has been recorded twice in the Far NE; the recent record by Mr S.A. Parker (pers. comm.) was from Cuttipirie Corner WH. Rare vagrant in the region and S.A.

Painted Honeyeater Grantiella picta the sole record from the Far NE was of one bird 12.3 km S Murtee Murtee HS in June 1980 (Matheson, 1981)

Rare vagrant in S.A.

White-fronted Honeyeater Phylidonyris albifrons one unconfirmed record (R.A.O.U. ATLAS) from the south of 8.4.4 near the Strzelecki is the only

Meliphagidae

record from the Far NE - its absence is surprising as it is found in adjacent regions. A truly nectarivorous honeyeater, it favours shrublands with Eremophila and Hakea spp. being favoured feed shrubs (Readers Digest Complete Book of Australian Birds, 1979), and it is highly nomadic. Likely to occur in 8.4.4 in good seasons although the scarcity of ornithophilous flowered shrubs may explain the species' absence.

Moderately common although nomadic visitor to drier shrublands of S.A. Probably secure.

Grey Honeyeater *Conopophila whitei* the sole record in the Far NE of this rare mulga-inhabiting honeyeater is of two seen by Paton (1981), 14 km WSW of Cordillo Downs HS in May 1980.

Very scarce Australian bird with few records in S.A.

Black Honeyeater *Certhionyx niger* recorded in the Far NE by Chenery in 1917 (Ford, 1978). This is the only record in the region although Chenery (1921) found them breeding at Nappa Merri, Qld in 1920. Perhaps a rare, nomadic visitor to the region.

An uncommon and irregular nomadic visitor to drier areas of S.A.; it occasionally irrupts. Difficult to conserve.

Pied Honeyeater *C. variegatus* rare, nomadic visitor to,the Far NE - a few records from near Lyndhurst and Marree (Rix, 1974; Mr G.B. Raglass, pers. comm.). White (1917) found several groups breeding along the lower Strzelecki,north to Tinga Tingana, in 1916.

Similar comments apply as for preceding species.

Ephthianuridae

Crimson Chat *Ephthianura tricolor* generally uncommon to moderately common in the Far NE; usually near water or widespread after rains. Nomadic and found in a variety of habitats e.g. dune, gibber shrublands,grassy habitats and swamp margins. Most common along the Cooper floodplain in 8.4.4, but widespread in good seasons; may be absent in dry years.

Moderately common (seasonally) and perhaps secure in S.A.

Orange Chat *E. aurifrons* generally moderately common to common in the Far NE; more common than preceding species but similarly a nomad, with similar habitat preferences and fairly tied to water, although avoids dune habitats and more common in samphire and swamp habitats. In good seasons, common in grassy gibber depressions. Widespread in 8.4.4. most common along the Cooper.

Ephthianuridae

Moderately common (seasonally) and perhaps secure in S.A.

Yellow Chat E. crocea first record in S.A. in August 1982 from Pandiburra Bore (Black et al., 1983), where seen again in July 1983 (LP). Inhabits reed beds in bore drains there and in south-western Qld (e.g. Lovell, 1978). Not recorded in 8.4.4 and perhaps unlikely due to lack of habitat.

White-fronted Chat E. albifrons rare vagrant along the Birdsville Track in the Far NE, north of this species' customary range. A northern record from Mirra Mitta Bore (Morgan, 1930); none from 8.4.4 and unlikely to occur.

Common, widespread and secure in southern S.A. (R&V).

Gibberbird Ashbyia lovensis common in gibber in the Far NE; uncommon in open stoneless habitats such as floodplain. Therefore uncommon in 8.4.4. Records from Site 1, Chillimookoo WH (this survey), Tinga Tingana (McGilp, 1931) and several localities along the Cooper. Parker (1980a) speculates that this species may have benifited from limited desertification brought about by overgrazing in the past, thus increasing the extent of favoured habitat.

Restricted to the greater Lake Eyre region in S.A. where it varies from uncommon to common according to the season. Inadequately conserved (R&V).

Dicaeidae

Mistletoebird Dicaeum hirundinaceum largely a winter visitor in varying numbers to scrub and woodland along major and minor watercourses in the Far NE; uncommon to moderately common according to the season. Moderately common along the length of the Cooper in some winters (e.g. 1980, LJ, JP); less common along the Strzelecki and smaller watercourses in the north of 8.4.4. Probably visits mistletoe infested shrubs in the dunefields as well.

Common, nomadic and secure in woodland and scrubland of S.A. (R&V).

Pardalotidae

Red-browed Pardalote Pardalotus rubricatus common in coolibah woodland throughout the Far NE. Most common along the Cooper in 8.4.4, but regularly encountered along the Strzelecki and in coolibah (and bloodwood) habitats in the north; avoids dunefields.

Common in woodland in the Far North of S.A. where inadequately conserved (R&V).

Striated Pardalote P. striatus uncommon, winter visitor to the Far NE in riparian woodland. Recorded infrequently along the length of the Cooper e.g. Waukatana WH (Badman, 1979), Cooramunchena, Chillimookoo WH and near

Pardalotidae

Gidgealpa HS (LJ) in 8.4.4; most common in red gum of the Upper Cooper. Likely to occur sparingly along the Strzelecki and in the north of the study region, but as yet no records.

Common and secure in woodland and forest in southern S.A. (R&V).

Passeridae

House Sparrow Passer domesticus apparently established in all towns and most homesteads in the Far NE, rarely straying far from human dwellings. A few records from along the Strzelecki and Moomba Tracks in 8.4.4 (R.A.O.U. ATLAS) presumably at Moomba, mining camps and homesteads. Recorded at Moomba and Cordillo Downs (this survey), but not at Innamincka.

Ploceidae

Zebra Finch Poephila guttata generally common to abundant in the Far NE, in a variety of habitats although largely confined to water.

Common and secure in drier parts of S.A. and aviaries (R&V).

Sturnidae

Common Starling Sturnus vulgaris rare vagrant in the Far NE. Recorded at Coongie (LP) and near Moomba (R.A.O.U. ATLAS) in 8.4.4.

Oriolidae

Olive-backed Oriole Oriolus sagittatus one seen by Mr L.P. Pedler at Tirrawarra WH in August 1982 is the only record of this rare visitor to S.A. from the Far NE; presumably followed the Cooper downstream from its regular haunts in Qld.

Vagrant in S.A. and impossible to conserve (R&V).

Grallinidae

Australian Magpie-lark Grallina cyanoleuca widespread near water in the Far NE; numbers fluctuate widely according to conditions. Most common along the Cooper in 8.4.4 and regularly encountered along the Strzelecki and in timbered country to the north in good seasons. Avoids dunefields and dry gibber.

Common, widespread and secure in S.A. (R&V).

Artamidae

White-breasted Woodswallow Artamus leucorhynchus widespread and common (seasonally) in eucalypt woodland along watercourses in the Far NE; largely restricted to water. Seasonally common along the length of the Cooper in

Artamidae

8.4.4, although only small numbers in dry sections - most common on Upper Cooper; similarly less common along Strzelecki when dry, and there are records from watercourses in the north of the study region. Perhaps a spring-summer influx of birds occurs when birds found along length of Cooper and Strzelecki.

An irregular spring-summer migrant to interior eastern S.A. (near water); only regularly encountered in the Far NE. Inadequately conserved (R&V).

Masked Woodswallow A. personatus generally uncommon, nomadic visitor (largely spring-summer) to the Far NE, where it occupies a large range of habitats in dunefields and timbered country; may be widespread and common in good seasons e.g.spring 1983 (this survey). Records from most of 8.4.4 but generally uncommon to absent.

Seasonally if irregularly uncommon to common; widespread in S.A. and adequately conserved (R&V).

White-browed Woodswallow A. superciliosus much less common than preceding species with which it is always associated when recorded in the Far NE. Uncommon to absent and the few records are from the Cooper and Strzelecki in 8.4.4.

As for preceding species.

Black-faced Woodswallow A. cinereus very common and widespread in the Far NE and 8.4.4; occupying all habitats; a true drought resistor.

Common and secure in dry open parts of S.A. (R&V).

Cracticidae

Grey Butcherbird Cracticus torquatus one unconfirmed report (R.A.O.U. ATLAS) from the Upper Cooper in 8.4.4 in the Far NE, although additionally recorded at Nappa Merri (Chenery, 1921). Possibly a rare vagrant to the Upper Cooper in 8.4.4.

Common and secure in drier woodlands of S.A. (R&V).

Australian Magpie Gymnorhina tibicen common and widespread in a variety of habitats in the Far NE; avoiding core areas of bare gibber (? and perhaps dunefields). Common, widespread and seen in all habitats in 8.4.4.

Common and secure in S.A. (R&V).

Corvidae

Australian Raven *Corvus coronoides* common and widespread in the Far NE; occupies all habitats, but much more common in timbered country and most common along watercourses; sedentary (largely). Widespread and common along the Cooper and Syrzelecki and watercourses carrying coolibah woodland in the north of 8.4.4; uncommon away from timber e.g. not recorded at Sites 1 (gibber) and 4 (north-western dunefields) this survey.

Common and secure over much of S.A. (R&V).

Little Crow *C. bennetti* common and widespread in the Far NE, favouring all habitats; nomadic and numbers vary according to the season. Breeds opportunistically in good seasons (*cf.* regular spring-summer breeding by preceding species - Mr G.B. Raglass, pers. comm.). Commonly nesting in *Hakea leucoptera* in dunefields and floodplain back from the main channels of the Cooper and Strzelecki this survey; also nests in coolibah in open woodland habitats where Australian Raven less common.

Common and secure in drier parts of S.A. (R&V).

Appendix T

Appendix T - List of plant species (vascular) encountered in the Cooper Creek Environmental Association (8.4.4) previously or collected during the present survey; their palatabilities and their status.

Columns: 1. Palatability from Jessup(1951): 1= very palatable, 2= quite palatable, 3= moderately palatable, 4= slightly palatable and 5= unpalatable.

2. Palatability from Dawson and Boyland (1974): H= high, M= medium and L= low or unknown
≠= in drying off state.

3. Status in South Australia from Specht et al. (1974): Ex= extinct; En= endangered; R= rare, D= depleted and G= of geographical importance. Jessop (1977): En. = endangered.

4. Status based on this survey: VC = very common, C= common, FC = fairly common, U= uncommon, R = rare, VR = very rare, VR/E = very rare if not locally extinct (See Appendix R. for the determination of Status in 8.4.4).
* = possibly misidentified

	1.	2.	3.	4.
ACANTHACEAE				
Rostellularia pogonanthera	—	L	—	VR
ADIATACEAE				
Cheilanthes tenuifolia sensu Tate (1889)	—	—	—	*VR/E
C. vellea sensu Tate (1889)	—	—	En	VR/E
AIZOACEAE				
Glinus lotoides	—	L	—	U
G. orygioides	—	—	En	VR/E
Gunniopsis quadrifida	2	—	—	U
Mollugo cerviana	—	L	—	R
Trianthema pilosa	—	L	—	VR
T. triquetra	—	≠M	—	U
Zoleya galericulata	—	L	—	U
AMARANTHACEAE				
Alternanthera nodiflora	—	L	—	C
Amaranthus grandiflorus	—	L	D	U
A. mitchellii	—	≠H	D	FC
Ptilotus atriplicifolius var. atriplicifolius	—	—	—	FC

T2

Ptilotus latifolius	—	L	—	FC
P. murrayi	—	L	En	VR
P. obovatus var. obovatus	3	M	—	FC
P. polystachus var. polystachus	4	M	—	VC
AMARYLLIDACEAE				
Calostemma luteum	—	M/L	R	VR/E
Crinum flaccidum	—	—	D	C
C. luteolum	—	—	—	*VR
APIACEAE (UMBELLIFERAE)				
Daucus glochidiatus	—	H	—	FC
Eryngium plantagineum	—	H	R	VR
E. supinum	—	—	R	U
Trachymene glaucifolia	—	H/M	—	C
ASCLEPIADACEAE				
Cynanchum floribundum	—	—	R	C
Rhycharrhena linearis	—	—	—	U
Sarcostemma australe	5	M	—	R
ASPLENIACEAE				
Pleurosorus rutifolius	—	—	—	VR/E
ASTERACEAE				
Brachycome campylocarpa	—	—	R	R
B. ciliaris	—	H	—	R
B. ciliaris var. lanuginosa	—	H	—	U
B. leariloba	—	—	—	VR/E
B. melanocarpa	—	H	R	VR/E
Calocephalus knappii	—	—	R	R
C. platycephalus	—	—	—	VC
Calotis ancyrocarpa	—	L	R	FC
C. cymbacantha	3	—	—	VR/E
C. erinacea	—	M	—	FC
C. hispidula	5	H	—	VC
C. multicaulis	—	M	—	FC
C. porphyroglossa	—	M	R	C
Centipeda cunninghamii	—	—	—	U
C. minima	—	L	—	FC
C. thespidioides	—	L	—	FC
Chrysocoryne pusilla	4	—	—	VR
Craspedia chrysantha	—	H	—	U
C. pleiocephala	4	M	—	VR
Epaltes australis	—	—	R	FC

Epaltes cunninghamii	4	L	—	U
Erodiophyllum elderi	—	—	—	VR/E
Gnaphalium indicum	—	—	—	FC
G. indutum	—	—	—	*VR
G. luteoalbum	—	—	—	FC
Gnephosis eriocarpa	—	M	—	C
G. foliata	—	M	—	C
Helichrysum ambiguum	—	—	—	R
H. apiculatum	—	—	—	VR
H. basedowii	—	—	R	VR/E
H. podolepidium	—	—	—	R
H. semifertile	—	—	—	VR
Helipterum corymbiflorum	—	M	—	VR
H. demissum	—	—	—	*VR/E
H. floribundum	5	M	—	C
H. hyalospermum	—	M	—	*VR/E
H. microglossum	—	M	—	U
H. moschatum	—	M	—	VC
H. pterochaetum	—	M	—	R
H. strictum	4	M	—	C
H. troedelii	—	—	—	VR
H. uniflorum	—	—	R	R
Ixiolaena brevicompta	—	H	R	U
I. leptolepis	4	H	—	VR
Leptorhychos tetrachaetus	—	—	—	*VR/E
Millotia greevesii	—	M	R	VR/E
Minuria cunninghamii	—	—	—	U
M. denticulata	4	M	—	C
M. integerrima	—	M	—	U
M. leptophylla	4	M	—	R
M. rigida	—	—	—	FC
Myriocephalus rudallii	—	L	R	U
M. stuartii	5	L	—	VC
Pluchea rubelliflora	—	—	R	R
P. tetranthera	—	—	En	U
Podolepis arachnoidea	—	—	En	VR/E
P. canescens	—	M	—	VR/E
P. capillaris	—	—	—	VR/E
P. muelleri	—	—	—	VR
Pterocaulon serrulatum	—	—	R	R
P. sphacelatum	—	L	—	U

T4

Rutidosis helichrysoides	—	M	—	R
Senecio cunninghamii	—	—	—	FC
S. sp. aff. cunninghamii	—	—	—	VR
S. glossanthus	—	M	—	VR/E
S. gregorii	—	M	—	VC
S. lautus ssp. dissectifolius	—	L	—	U
S. lautus ssp. maritimus	—	L	—	FC
S. odoratus	—	—	—	R
Sonchus asper	—	—	—	U
S. megalocarpus	—	—	—	R
S. oleraceus	—	H	—	FC
Streptoglossa adscendens	—	H	—	U
Vittadinia dissecta var. hirta	4	M	—	R
V. pterochaeta	—	—	R	*R
Vittadinia sp.	—	—	—	U
AZOLLACEAE				
Azolla filiculoides	—	L	—	FC
BORAGINACEAE				
Coldenia procumbens	—	—	Ex(prob.)	VR/E
Cynoglossum australe var. drummondii	—	L	—	VR/E
Heliotropium curassavicum	—	L	—	U
H. europaeum	—	—	—	FC
H. filaginoides	—	—	R	VR/E
H. ovalifolium	—	—	Ex(prob.)	VR/E
H. undulatum	—	—	R	R
Omphalolappula concava	—	—	—	U.
Trichodesma zeylanicum	—	M	—	VC
BRASSICACEAE (CRUCIFERAE)				
Alyssum linifolium	—	—	D	VR
Arabidella eremigena	—	H	R	R
A. glaucescens	—	—	—	R
A. procumbens	—	—	R	U
A. trisecta	5	H	—	VR/E
Blennodia canescens	2	H	—	U
B. sp. aff. canescens	—	—	—	U
B. pterosperma	—	H	—	FC
Brassica tournefortii	—	—	—	FC
Harmsiodoxa blennodioides	—	H	—	VR
H. brevipes var. brevipes	—	—	—	VR/E
Lepidium muelleriferdinandii	—	—	—	U

Lepidium papillosum	4	—	—	*VR
L. rotundum	—	H	—	R
Menkea crassa	—	—	R	R
Pachymites cardaminoides	—	—	—	*VR
? *Scambopus curvipes*	—	—	—	*VR
Stenopetalum lineare	—	H	—	R
S. nutans	—	—	R	VR/E
S. velutinum	—	—	R	VR/E
CAESALPINACEAE				
Cassia artemisioides	3	L	—	VR
C. desolata	4	L	—	VR
C. desolata var. *planipes*	—	L	—	VR
C. helmsii	—	L	R	U
C. nemophila var. *nemophila*	4	L	—	VC
C. nemophila var. *zygophylla*	—	L	—	C
C. oligophylla	—	L	R	FC
C. phyllodinea	4	M	—	FC
C. pleurocarpa var. *pleurocarpa*	—	L	—	FC
C. pruinosa	—	L	G	VR/E
C. sturtii	1	M	—	VR
Lysiphyllum gilvum	—	H	R	VC
CALLITRICHACEAE				
Callitriche stagnalis	—	—	—	*VR
CAMPANULACEAE				
Isotoma petraea	—	L	—	VR
Pratia puberula	—	L	En	VR/E
Wahlenbergia gracilis	—	L	—	VR
W. sieberi	—	L	—	R
Wahlenbergia sp.	—	—	—	FC
CAPPARACEAE				
Capparis mitchellii	—	H	R	U
CARYOPHYLLACEAE				
Polycarpaea arida	—	L	R	R
P. indica sensu Tate (1889)	see	Appendix	R	?
P. spirostylis ssp. *glabra*	—	L	R	R
CHENOPODIACEAE				
Atriplex angulata	—	M	—	VC
A. crassipes	—	M	—	U
A. eardeyae	—	M	—	U
A. sp. aff. *eardleyae*	—	—	—	U

T6

Atriplex holocarpa	—	M	—	R
A. sp. aff. holocarpa	—	—	—	U
A. incrassata	—	L	—	*U
A. inflata	—	L	—	*R
A. leptocarpa	—	—	—	C
A. limbata	—	M	—	U
A. lindleyi	—	L	—	U
A. lobativalvis	—	—	En	FC
A. muelleri	—	*H	—	FC
A. nummularia	—	H	—	VC
A. rhagodioides	5	—	—	*R
A. spongiosa	3/4	M	—	VC
A. velutinella	5	—	—	VC
A. vesicaria	2	M	—	C
Babbagia acroptera	—	—	—	FC
B. dipterocarpa	5	L	—	U
Chenopodium auricomum	—	*H	R	VC
C. cristatum	4	M	—	U
C. nitrariaceum	4	—	—	C
Dissocarpus biflorus var. biflorus	—	—	—	U
D. biflorus var. cephalocarpa	—	—	—	U
D. paradoxa var. latifolius	—	L	—	U/FC
D. paradoxa var. paradoxa	4	M	—	VR
Dysphania littoralis	—	M	R	VR
Einadia nutans	3	M	—	FC
Enchylaena tomentosa	4	M	—	VC
Halosarcia halocnemoides	5	M/L	D	R
H. indica ssp. leiostachya	4	M/L	D	C
Maireana aphylla	4	M	—	C
M. astrotricha	—	—	—	R
M. ciliata	—	—	—	VR/E
M. coronata	—	M	—	C
M. eriantha	2/1	—	—	VR/E
M. georgei	2-4	M	—	U
M. microcarpa	—	M	—	FC
M. pyramidata	5	L	—	U
M. sedifolia	3/4	—	—	VR/E
Malacocera tricornis	—	L	—	R
Neobassia proceriflora	—	M	R	C
Rhagodia gaudichaudiana	—	—	—	U
R. spinescens	4	M	—	U

Salsola kali var. kali	2	*H/M	—	VC
S. kali var. strobilifera	—	—	—	VR
Schlerochlamys brachyptera	4	M	—	U
Sclerolaena andersonii	—	L	R	U
S. bicornis	5	L	—	VC
S. bicuspis	—	—	R	VR/E
S. calcarata	—	H	—	U
S. costata	—	—	—	U
S. diacantha	—	L	—	VC
S. divaricata	5	L	—	*VR
?S. holtiana	—	—	R	*U
S. intricata	—	L	—	VC
S. lanicuspis	3	L	—	FC
S. muricata var. muricata	—	—	—	U
S. parallelicuspis	—	L	—	U
S. sp. aff. tatei	—	—	—	U
S. sp. (between S. bicornis & S. tricuspis)	—	—	—	U
S. tricuspis	5/4	L	—	R
S. uniflora	—	—	—	R
S. ventricosa	3	L	—	FC
Sclerostegia tenuis	4	M/L	—	R
CHLOANTHACEAE				
Dicrastylis costelloi	—	—	R	U
D. lewellinii	—	—	R	R
Newcastelia cephalacantha	—	L	R	R
CLEOMACEAE				
Cleome viscosa	—	L	—	VR
CLUSIACEAE (GUTTIFERAE)				
Hypericum gramineum	—	—	—	*U
H. japonicum	—	—	—	*VR/E
CONVULVULACEAE				
Bonamia media	—	M	—	VR/E
Convulvulus erubescens	1	H	—	C
Cressa cretica	—	—	—	R
Evolvulus alsinoides var. villosicalyx	—	H	R	U
Ipomaea muelleri	—	H	—	VR
I. racemigera	—	—	R	VR
Polymeria angustata sensu Tate (1889)	see	Appendix	R	?
P. longifolia	—	M	—	*VR/E

CRASSULACEAE				
Crassula sieberiana	—	—	—	VR/E
CUCURBITACEAE				
Cucumis melo ssp. agrestis	—	—	—	U
Mukia maderaspatana	—	M	—	FC
CYPERACEAE				
Bulbostylis turbinata	—	—	—	VR
Cyperus cunninghamii	—	—	—	U
C. sp. aff. cunninghamii	—	—	—	U
C. dactylotes	—	L	R	VR
C. difformis	—	L	—	VR
C. eragrostis sensu Tate (1889)	—	—	—	*VR/E
C. exaltatus	—	L	—	U
C. gilesii	—	L	R	R
C. gymnocaulos	—	L	—	FC
C. iria	—	L	R	R
C. pygmaeus	—	—	—	VR
C. rotundus ssp. retzii	—	—	—	VR
C. squarrosus	—	—	R	R/VR
C. vaginatus	—	—	—	VR
Eleocharis acuta	—	—	—	U
E. pallens	—	L	R	FC
Fimbristylis dichotoma	—	M	R	VR
Isolepis australiensis	—	—	R	R
I. marginata	—	—	—	*VR/E
Schoenoplectus litoralis	—	—	—	R
Scirpus maritimus	—	—	—	R
EHRETIACEAE				
Halgania cyanea	—	L	—	R
ELATINACEAE				
Bergia ammannioides	—	—	—	*VR
B. trimera	—	—	R	R
EUPHORBIACEAE				
Adriana hookeri	—	—	—	U
Euphorbia australis	—	M	—	U
E. boophthona	—	M	—	R
E. drummondii	4	M	—	U
E. parvicaruncula	—	—	—	U
E. stevenii	—	M	—	*R
E. tannensis ssp. eremophila var. eremophila	3	M	—	VC

Euphorbia wheeleri	—	M	—	U
Phyllanthus fuernrohrii	5	—	—	C
P. lacunarius	5	—	—	C
P. sp. aff. lacunarius	—	—	—	FC
P. maderaspatensis var. angustifolius	—	M	En	R
Sauropus trachyspermus	—	—	R	U
FRANKENIACEAE				
Frankenia angustipetala	—	—	En.	U
F. cinerea	—	—	R/En.	U
F. cordata	—	—	—	*R
F. cupularis	—	—	R	R
F. foliosa	—	—	—	*R
F. gracilis	—	—	—	R
F. pseudo-flabellata	—	—	En	U
F. serpyllifolia	5	L	—	U
F. uncinata	—	L	—	FC
GENTIANACEAE				
Centaurium spicatum	—	—	—	U
GERANIACEAE				
Erodium aureum	—	—	—	U
E. crinitum	—	H	—	U
E. cygnorum ssp. cygnorum	1	—	—	*R
E. cygnorum ssp glandulosum	1	H	—	FC
GOODENIACEAE				
Goodenia cycloptera	4	L	—	R
G. fascicularis	—	—	—	VR
G. glauca	—	—	R	FC
G. sp. aff. havilandii	—	—	—	U
G. heterochila	—	—	R	R
G. lobata	—	—	R	U
G. lunata	—	M	En	R
Lechenaultia divaricata	—	L	R	C
Scaevola aemula	—	—	—	U
S. collaris	—	—	—	VR
S. depauperata	—	L	R	U
S. ovalifolia	—	L	—	FC
S. spinescens	—	L	—	R
GYROSTEMONACEAE				
Codonocarpus continifolius	5	L	D	R
Gyrostemon ramulosus	—	L	D	VR

HALORAGACEAE				
Haloragis aspera	—	—	—	C
H. glauca forma sclopetifera	—	L	R	U
H. gossei	—	L	R	R
Myriophyllum muelleri	—	—	—	*VR
M. verrucosum	—	—	—	VR
JUNCACEAE				
Juncus planifolius	—	L	—	*VR/E
JUNCAGINACEAE				
Triglochin calcitrapum	—	—	—	VR
LAMIACEAE (LABIATAE)				
Mentha australis	—	—	—	U
Prostanthera striatiflora	—	—	—	VR/E
Teucrium racemosum var. racemosum	3	L	—	VC
T. racemosum var. tripartitum	—	—	—	U
LILIACEAE				
Bulbine alata	—	M	—	C
Thysanotus exiliflorus	—	—	R	VR/E
Tricoryne elatior	—	—	—	*VR/E
LORANTHACEAE				
Amyema maidenii	—	H	—	R
A. preissii	—	—	—	C
A. quandang	—	H	—	VR/E
Diplatia grandibractea	—	—	En	C
Lysiana exocarpi ssp. exocarpi	1	—	—	VC
L. linearifolia	—	H	—	VR
LYTHRACEAE				
Ammania multiflora	—	—	—	VR
Lythrum hyssopifolia	—	—	—	*R
MALVACEAE				
Abutilon fraseri	—	L	—	FC
A. halophilum	4	—	—	VR/E
A. leucopetalum	5	L	—	VR
A. otocarpum	—	M	—	C
A. theophrasti	—	—	—	*VR/E
Alyogyne pinoniana	—	—	—	*R
Hibiscus krichauffianus	—	M	—	FC
H. trionum var. vesicarius	—	L	—	VR/E

Lavatera plebeia	—	M	—	C
Lawrencia glomerata	—	—	—	VR
Malvastrum americanum	—	M	—	R
Sida ammophila	—	—	—	C
S. corrugata	4	M	—	U/R
S. cunninghamii	—	M	R	U/R
S. fibulifera	—	M	—	U/R
S. intricata	3	—	—	R
S. sp. D	3	—	—	U
S. trichopoda	4	H	—	U
MARSILIACEAE				
Marsilia drummondii	2/4	M	—	VC
M. hirsuta	4	M	En	VR
M. mutica	—	—	—	*VR
MELIACEAE				
Owenia acidula	—	H	R	C
MENYANTHACEAE				
Nymphoides crenata	—	—	D	VR
MIMOSACEAE				
Acacia aneura	1	H	—	VR
A. brachystachya	1	M	—	R
A. cambagei	—	L	—	VR
A. cyperophylla	—	M	—	U
A. dictyophleba	—	L	R	U
A. farnesiana	—	H	En	U
A. ligulata	5	L	—	VC
A. murrayana	—	L	—	VC
A. oswaldii	3	M	—	C
A. ramulosa	4	M	R	R
A. salicina	—	M	—	C
A. stenophylla	—	M	G	VC
A. tetragonaphylla	4	H	—	C
A. victoriae ssp. arida	3	H	—	FC
A. victoriae ssp. victoriae	3	H	—	VC
A. sp.	—	—	—	R
Neptunia dimorphantha	—	M	En	VR
MYOPORACEAE				
Eremophila bignoniiflora	—	H	R	VC
E. clarkei	—	—	—	*VR/E
E. dalyana	—	L	R	R

Eremophila duttonii	4	L	—	VR/E
E. freelingii	—	L	—	R
E. glabra	3	M	—	VR/E
E. latrobei	1	M	—	R
E. longifolia	3	H	—	C
E. macdonnellii	—	—	—	FC
E. macgillivrayi	—	L	R	U
E. maculata	4	H	—	C
E. obovata	—	L	—	R
Myoporum acuminatum	—	H	—	VR/E
MYRTACEAE				
Eucalyptus camaldulensis var. obtusa	—	L	—	C
E. microtheca	—	M	—	VC
E. terminalis	—	L	—	FC
Melaleuca glomerata	—	—	—	*VR/E
M.leariifolia var. trichostachya	—	L	R	R
NYCTAGINACEAE				
Boerhavia diffusa	—	H	G	VR
Commicarpus chinensis	—	—	—	VR
ONAGRACEAE				
Ludwigia peploides ssp. montevidensis	—	—	—	FC
ORCHIDACEAE				
Caladenia deformis	—	—	—	VR/E
Cymbidium canaliculatum sensu Tate (1889)	—	—	—	VR/E
PAPILIONACEAE				
Aeschynomene indica	—	L/M	—	U
Clianthus formosus	1	—	—	VR
Crotalaria cunninghamii	—	L	—	C
C. eremaea ssp. eremaea	4	H	—	VC
C. smithiana	—	—	R	FC
Glycine canescens	—	—	—	U
G. falcata	—	—	En	VR/E
G. tomentosa	—	—	En	VR/E
Indigofera brevidens	—	L	—	R
I. colutea	—	L	En	R
I. linnaei	—	—	—	VR
Isotropis wheeleri	—	L	En	R
Lotus cruentus	4	H	—	U
?Medicago polymorpha	—	—	—	U

Psoralea australasica	—	—	—	FC
P. cinerea	—	M/L	—	U
P. eriantha sensu Tate (1889)	—	M/L	—	U
P. pallida	—	—	—	U
P. patens sensu Tate (1889)	—	M/L	—	U
Rhychosia minima	—	M	En	U
Sesbania cannabina	—	L/M	R	R/VR
Swainsona campylantha	—	M	—	VR
S. flavicarinata	—	—	—	R
S. lessertiifolia	—	—	—	R
S. microphylla	—	M	—	VR
S. oligophylla	—	M	—	VR
S. oroboides	—	M	—	FC
S. phacoides	—	—	—	FC
S. rigida	—	—	R	FC
S. stipularis	—	—	—	VR/E
?Templetonia egena	4	—	—	*U
Tephrosia sphaerospora	—	—	R	C
Trigonella suavissima	1	H	—	FC
Vigna lanceolata	—	H	—	VR
PITTOSPORACEAE				
Pittosporum phylliraeoides var. microcarpa	2	H/M	—	FC
PLANTAGINACEAE				
Plantago turrifera	—	—	—	*R
P. varia	—	—	—	C
POACEAE				
Agrostis avenacea	—	—	—	FC
Alopecurus geniculatus	—	—	—	VR
Aristida anthoxanoides	3	M	—	FC
A. browniana	4	M	—	VC
A. contorta	3	M	—	C
A. ramosa	—	—	—	*VR
?A. strigosa	—	—	—	VR
Astrebla lappacea	—	H	—	U
A. pectinata	3	H	—	C/VC
Bothriochloa bladhii	—	—	R	*VR
Brachiaria notochthona	—	—	—	VR
Brachyachne ciliaris	—	—	R	VR
Chloris pectinata	—	H	—	VR

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Chloris scariosa	—	L	R	VR
Chrysopogon fallax	—	H	R	R/VR
Cymbopogon sp.	—	—	—	R
Cynodon dactylon	—	H	—	FC
Dactyloctenium radulans	2	H	—	FC
Dichonthium affine	—	H	R	R
Digitaria ammophila	—	H	—	*R
D. brownii	—	H	—	VR
Diplachne fusca	—	—	—	FC
Echinochloa crus-galli	—	—	—	VR
E. inundata	—	H	R	FC
Enneapogon avenaceus	2/1	H	—	C
E. cylindricus	3	—	—	U
E. nigricans	—	M	—	VR
E. polyphyllus	2/1	M	—	U
Enteropogon acicularis	—	H	—	VR
Eragrostis australasica	4	M	—	C
E. basedowii	—	M	R	U
E. confertifolia	—	M	R	VR
E. dielsii	1	H	—	C
E. eriopoda	4	M	—	FC
E. falcata	3	—	—	VR
E. japonica	—	—	—	VR
E. leptocarpa	—	M	—	U
E. parviflora	—	M	—	VR
E. setifolia	2	M	—	VC
E. speciosa	—	—	R	U
E. xerophila	—	H	R	VR
Eriachne aristidea	—	M	—	C
E. ovata	—	—	—	VR
Eriochloa pseudo-acrotricha	—	H	—	U
Eulalia fulva	1	H	—	R
Iseleima membranaceum	2	H	—	VR
Leptochloa digitata	—	M	R	FC
? Panicum australiense	—	L	R	*VR/E
P. decompositum	3	M	—	FC
P. whitei	—	M	R	U
Paractaenum novae-hollandiae	—	L	—	U
Paspalidium gracile	2	—	—	*VR
Perotis rara	—	L	—	*VR/E
Plagiosetum refractum	3	H	—	FC

Sporobolus actinocladus	1	H	—	U
S. caroli	—	H	R	VR
S. mitchellii	—	L	R	FC
S. virginicus	—	—	—	*R
Stipa semibarbata	—	—	—	*VR/E
Themeda australis	—	H	—	VR
Tragus australianus	3	M	—	FC
Triodia basedowii	—	L	R	VC
Tripogon loliiformis	—	H	R	R
Triraphis mollis	3	H	—	C
Zygochloa paradoxa	—	M	—	VC
POLYGONACEAE				
Muehlenbeckia coccoloboides	—	—	En	R
M. cunninghamii	—	M	—	VC
Polygonum attenuatum	—	—	En	VR/E
P. plebeium	—	—	—	FC
Rumex crystallinus	—	—	—	C
PORTULACACEAE				
Calandrinia balonensis	—	H	R	VR
C. eremaea	—	—	—	R
C. polyandra	—	—	—	R
C. ptychosperma	—	M	En	R
C. remota	1	—	—	U
Portulaca intraterranea	2	H	—	VC
P. oleracea	—	—	—	*VR
PROTEACEAE				
Grevillea pterosperma	—	—	—	*VR/E
G. stenobotrya	—	M	R	FC
G. striata	—	H	—	C
Hakea eyreana	—	L	—	FC
H. ivoryi	—	L	—	VR
H. leucoptera	5	M	—	C
RUBIACEAE				
Asperula gemella	—	—	—	FC
Dentella pulvinata var. pulvinata	—	—	R	FC
Synaptantha tillaeacea	—	—	R	R
SANTALACEAE				
Santalum lanceolatum	1	H	—	C
SAPINDACEAE				
Atalaya hemiglauca	—	H	R	VC

Dodonaea angustissima	4	L	—	C
D. microzyga	4	—	—	VR/E
D. viscosa	—	—	—	U
Heterodendrum oleaefolium	1	H	—	VR
SCROPHULARIACEAE				
Glossostigma diandrum	—	—	R	VR
Mimulus gracilis	—	L	R	R
M. prostratus	—	—	R	U
Morgania floribunda	—	L	—	FC
M. glabra	—	—	—	FC
Peplidium sp. D	—	—	—	U
SOLANACEAE				
Nicotiana excelsior	5	—	R	*VR
N. velutina	5	L	—	VC
Solanum chenopodium	—	—	R	VR/E
S. ellipticum	5	L	—	R
S. esuriale	—	H	—	VR
S. oligacanthum	—	—	R	C
S. sturtianum	—	M	—	VR/E
STERCULIACEAE				
Keraudrinia integrifolia	—	—	R	R
Melhania oblongifolia	—	—	R	R
Rulingia loxophylla	—	—	—	R
TETRAGONIACEAE				
Tetragonia tetragonioides	1	*H	—	VC
THYMELAEACEAE				
Pimelea microcephala	—	L	—	VR
P. simplex ssp. continua	—	—	En	U
P. simplex ssp. simplex	—	—	—	VR
P. trichostachya	—	L	—	U
VERBENACEAE				
Verbena bonariensis	—	—	—	*R
V. macrostachya sensu Tate (1889)	see	Appendix	R	?
V. officinalis	—	—	—	FC
VIOLACEAE				
Hybanthus monopetalus	—	—	D	VR
ZYGOPHYLLACEAE				
Nitraria billardieri	—	—	—	R
Tribulus hystrix	—	M	R	U

Tribulus occidentalis	—	L	—	C
T. terrestris	2	H	—	U
Zygophyllum ammophilum	4	L	—	C
Z. aurantiacum	4	—	—	R
Z. billardieri	—	—	—	*VR/E
Z. crenatum	4	—	—	VR/E
Z. howittii	—	L	—	F C
Z. iodocarpum	4	L	—	U

Appendix U

Preliminary identifications of the aquatic invertebrates collected during the survey of 8.4.4 - by the Biology Laboratories of the E. & W.S.

FORM 1089

W2

LABORATORY WORK SHEET

Cooper Creek

1. Tirrawarra Swamp S/N 9.xi.83

2. Near to advancing front (500 m. from front) near Lake Renjunda. S/N 9.xi.83.

3. Scrubby Camp Waterhole S/N 9.xi.83.

4. Tirrawarra Waterhole. S/N. 9.xi.83

5. Scrubby Camp Waterhole 1mm Siew 9.xi.83

6. Embarka Swamp. S/N 29.ix.83

7. Chillimookoo Water Hole 27.ix.83

8. " " " " S/N 27.ix.83

9. U/S side of Innonink Causeway S/N 8.xi.83

10. Puddle - Strzelecki Tk near Mundi Bore 30.ix.83.

LABORATORY WORK SHEET

	1	2	3	4	5	6	7	8	9	10
MOLLUSCA										
THIARIDAE										
Plotiopsis			X	X						
ANCYLIDAE										
Ferrissia	X				X					
PLANORBIDAE										
Glyptophysa	X				X	X				
Isidorella										
CORBICULINAE										
Corbiculina	X		X							
HIRUDINEA			X							
CRUSTACEA										
NOTOSTRACA										
Triops australiensis							X			
MALOCOSTRACA										
EUCARIDA										
DECAPODA										
Macrobrachium	X		X	X	X				X	
Cherax				X						
INSECTA										
EPHEMEROPTERA										
CAENIDAE										
Tasmanocoenis tillyardi	X		X							
ODONATA				X						
Gomphidae			X							
Hemicordulia tau				X						
HEMIPTERA										
CORIXIDAE										
Agraptocorixa parvipunctata					X		X	X J.		
Micronecta	X								X	
NOTONECTIDAE										
[illegible]	X	X		X	X	X	X			

W4

FORM 108

LABORATORY WORK SHEET

	1	2	3	4	5	6	7	8	9	10
DIPTERA.										
CHIRONOMIDAE										
Tanypodinae										
Ablabesmyia			X	X						
Pentaneura	X		X							
Procladius						X				
CHIRONOMINAE										
TANYTARSINI										
Tanytarsus & NMV 4.	X									
CHIRONOMINI										
Polypedilum	X		X	X						
Dicrotendipes						X				
Kiefferulus intertinctus (?)						X.				
CERATOPOGONIDAE							X			
COLEOPTERA										
DYTISCIDAE										
Dytiscus L		X		X		X	X			
Eretes australis		X +e								X
Antiporus gilberti				X		X	X			
BEROSUS		X				X	X			
STERNOPRISCUS		X								
HYDRAENIDAE				X						
Ochthebius								X		

Appendix V

APPENDIX V

GAZETTEER

Akalanna Crossing	28°55'S, 140°08'E
Apanburra Channel	27°02'S, 140°05'E
Barcoo River, Qld	24°18'S, 145°14'E
Barkly Tableland, NT	19°27'S, 137°05'E
Big Lake Moonba	28°20'S, 140°21'E
Birdsville, Qld	25°54'S, 139°21'E
Birkett's Woolshed W.H. (=Chilcarrie W.H.)	28°59'S, 140°04'E
Boggy Lake	27°30'S, 139°49'E
Bookabourdie W.H.	27°33'S, 140°29'E
Bradys W.H.	26°53'S, 140°37'E
Brolga #2 Well Site	27°36'S, 140°00'E
Cadelgo Downs	26°05'S, 140°24'E
Callamurra W.H. (=Kullamurra)	27°42'S, 140°52'E
Candradecka Creek	27°10'S, 140°47'E
Cartoonganie W.H.	27°11'S, 139°52'E
Chillimookoo W.H.	27°24'S, 139°58'E
Christmas Creek	27°14'S, 139°52'E
Clifton Hills	27°01'S, 138°54'E
Cobbler Sandhills	29°00'S, 139°45'E
Coongie (Ruin)	27°11'S, 140°09'E
Coongie Lake	27°11'S, 140°10'E
Coongie W.H.	27°11'S, 140°09'E
Cooper Creek	27°44'S, 140°15'E
Coorambalapinna W.H.	26°53'25"S, 140°31'55"E
Cooramunchena W.H.	27°45'S, 139°32'E
Coque W.H.	28°46'S, 140°10'E
Cordillo Downs	26°42'S, 140°37'E
Currareva, Qld	25°20'S, 142°44'E
Cuttapirie Corner W.H.	27°36'S, 139°54'E
Cuttapirie Field (petroleum)	27°14'S, 140°22'E
Dalhousie	26°28'S, 135°29'E
Daralingie Field (petroleum)	28°22'S, 139°58'E
Daralingie Well	28°24'S, 140°25'E
Darbys W.H.	27°31'S, 139°52'E
Derawalkillie W.H.	27°14'S, 140°33'E
Diamantina River	26°11'S, 139°24'E
Dickinna Hill	26°43'S, 139°53'E
Durham Downs, Qld	27°05'S, 141°54'E
Eagle Hawk W.H.	27°56'S, 139°24'E
Embarka Swamp	27°38'S, 140°09'E
Embarka W.H.	27°41'S, 140°12'E
Farina (Ruin)	30°04'S, 138°17'E
Fly Lake	27°35'S, 140°00'E
Fort Grey Depot	29°05'S, 141°12'E
Gidgealpa	27°41'S, 140°12'E
Gidgealpa W.H.	27°50'S, 140°09'E
Goyder Lagoon	26°46'S, 139°08'E
Haddon Downs	26°21'S, 140°50'E
Innamincka	27°44'S, 140°46'E
Innamincka (Ruin)	27°45'S, 140°44'E
Kanowana	27°51'S, 139°38'E
Karawinnie W.H.	27°12'S, 139°42'E
Kernacoopina W.H.	27°20'S, 139°53'E
Killalpaninna	28°36'S, 138°33'E

King Lookout	26°56'S, 140°38'E
Koodlanie Well	26°44'S, 140°26'E
Koonchera Dune	26°44'S, 139°31'E
Kopperamanna	28°40'S, 138°42'E
Kudiemitchie O.S.	27°22'S, 140°11'E
Kudriemitchie W.H.	27°21'S, 140°11'E
Kullamurra (see Callamurra)	
Lake Apachirie	27°11'S, 140°07'E
Lake Apanburra	27°01'S, 140°04'E
Lake Appadare	28°13'S, 139°12'E
Lake Blanche	29°14'S, 139°30'E
Lake Callabonna	30°03'S, 140°08'E
Lake Deception	26°54'S, 140°17'E
Lake Etamunbanie	26°16'S, 139°42'E
Lake Eyre (Sth)	29°20'S, 137°20'E
Lake Eyre (Nth)	29°02'S, 137°20'E
Lake Goyder	27°00'S, 140°10'E
Lake Gregory	29°01'S, 139°02'E
Lake Hope or Pando	28°23'S, 139°17'E
Lake Hope (Ruin)	28°23'S, 139°15'E
Lake Lady Blanche	27°02'S, 140°21'E
Lake Marrakoonamooka	27°39'S 140°04'E
Lake Marroocoolcanie	27°11'S, 140°13'E
Lake Massacre	27°20'S, 140°06'E
Lake Moorayepe	26°21'S, 139°59'E
Lake Oolgoopiarie	27°08'S, 139°52'E
Lake Padriepooreninie	26°38'S, 140°07'E
Lake Perigundi	27°47'S, 139°24'E
Lakes Crossing	29°30'S, 139°55'E
Lake Speckman	27°38'S, 139°48'E
Lake Toontoowaranie	27°06'S, 140°10'E
Lake Warrakalanna	28°12'S, 139°19'E
Lake Warra Warreenie	27°03'S, 140°17'E
Lake Willara	26°44'S, 140°06'E
Leigh Creek	30°29'S, 138°25'E
Malagarga, Qld	26°22'S, 142°17'E
Marianna W.H.	26°45'S, 140°52'E
Marree	29°39'S, 138°04'E
Merty Merty (=Murtee Murtee, Murteree, Murta Murta)	28°36'S, 140°16'E
Mickiepooloo Hill	26°30'S, 139°58'E
Minkie W.H.	27°47'S, 140°39'E
Minnie Downs (?=Clifton Hills)	27°01'S, 138°58'E
Moomba	28°07'S, 140°12'E
Moonlight Flat	27°29'S, 139°47'E
Mudcarnie Creek	26°55'S, 140°31'E
Mudcarnie W.H.	26°51'S, 140°32'E
Mudcarnie Well	26°50'S, 140°34'E
Mudlalee W.H.	28°17'S, 140°28'E
Mundibarcooloo W.H.	28°24'S, 140°13'E
Mundil Bore	28°30'S, 140°20'E
Mundowdna	29°44'E, 138°14'E
Mungeranie	28°01'S, 138°40'E
Ooranie Creek	27°47'S, 140°36'E
Nappa Coongee (- Nappa Coonie W.H., Nappaoonie W.H.)	27°41'S, 140°36'E
Nappa Merrie, Qld (=Nappamerrie, Qld, Nappa Merry, Qld)	27°36'S, 141°06'E
Nappa Merrie W.H., Qld (=Nappa merrie W.H., Qld, Nappa Merry W.H., Qld)	27°36'S, 141°06'E

Narrawalpinna W.H.	27°50'S, 139°29'E
North West Branch (of Cooper Creek) . .	27°30'S, 140°09'E
Nowrie Crossing (see Straw Bridge)	
Nullarbor (Plain)	31°06'S, 131°15'E
Pandie Pandie	26°08'S, 139°23'E
Patchawarra Bore	27°21'S, 140°41'E
Pilalchilpna W.H.	27°56'S, 139°26'E
Providence Creek	26°30'S, 140°27'E
Queerbidie W.H.	27°45'S, 140°43'E
Roxby Downs	30°42'S, 136°46'E
Scrubby Camp W.H.	29°39'S, 140°23'S
Simpson Desert	24°52'S, 134°10'E
Stokes Range, Qld	28°40'S, 141°13'E
Straw Bridge (=Nowrie Crossing, 19 km NNW of Embarka W.H.)	27°33'S, 140°06'E
Strzelecki Creek	28°23'S, 140°23'E
Tambo, Qld	24°53'S, 146°15'E
Thomson River, Qld	24°35'S, 143°11'E
Tinga Tingana (=White Catch) . . .	28°48'S, 140°10'E
Tirrawarra Field (petroleum) . . .	27°38'S, 140°09'E
Tirrawarra Swamp	27°24'S, 140°08'E
Tirrawarra W.H.	27°26'S, 140°09'E
Toolache W.H.	28°21'S, 140°25'E
Toonman W.H.	27°25'S, 140°04'E
Tooroowatchie W.H. (= Toorawatchy W.H.) .	27°02'S, 139°39'E
Wancoocha #1 Well Site	28°32'S, 139°58'E
Warburton Groove (Lake Eyre) . . .	29°02'S, 137°20'E
Waukatanna W.H.	28°04'S, 139°16'E
White Lake	27°37'S, 139°21'E
Windorah, Qld	25°25'S, 142°39'E
Yalcuma W.H.	27°57'S, 139°23'E

Appendix W

REFERENCE SHEET

73 74 75 76 77 78

REFERENCE NUMBER __ __ __ __ __ __

COLUMN 73-74 : 10 Dept. Env.& Planning Library
20 Barr-Smith Library
30 State Library
40 Keith Casperson
or NPWS Data Store

COLUMN 75-78 Unique reference number
COLUMN 79 80 Each line must be numbered

YEAR, AUTHOR(S): __ __ __ __ ______________________________

KEY WORDS: (SPECIES MNEMONICS) ______________________________

HIGHLIGHT OTHER RELEVANT KEYWORDS FROM THE FOLLOWING LIST ALTHOUGH MOST KEYWORDS ARE SELF EXPLANATORY THE FOLLOWING REGIONAL CODINGS HAVE BEEN ADOPTED: AP - ADELAIDE PLAIN; EP - EYRE PENINSULA; KI - KANGAROO ISLAND; LN - LOWER NORTH; MLR - MOUNT LOFTY REGION; MM - MURRAY MALLEE; NE - NORTH EAST; NW - NORTH WEST; SE - SOUTH EAST; YP - YORKE PENINSULA; FR - FLINDERS RANGES; MO - MARINE OFFSHORE; O - OCEANIC; (AREAS ARE SHOWN ON MAP PRODUCED BY THE SOUTH AUSTRALIAN ORNITHOLOGICAL ASSOCIATION, IN: A FIELD LIST OF BIRDS OF SOUTH AUSTRALIA, 1980.

THESAURUS(AS OF SEPT-1-82)
ABORIGINES AMPHIBIANS AP AUSTRALIA BATS BEHAVIOUR BIBLIOGRAPHY BIOGEOGRAPHY BIOLOGY BIRDS BOOK BREEDING CONSERVATION DISEASES DISTRIBUTION DOVES ECOLOGY ENDANGERED EP FALCONS FAUNA FERAL FIRE FLORA FOREST FROGS GEOLOGY GRAZING HABITAT HABITS HAWKS HONEYEATERS HUNTING INSECTS ISLANDS KANGAROOS KI LIFE- HISTORY LIZARDS LN MAMMALS MANAGEMENT MARSUPIALS MLR MM MONOTREMES MO NEW GUINEA NEW NE NSW NT NW OWLS O PARASITES PARKS PARROTS PESTICIDES PHYSIOLOGY PIGEONS PLANNING POPULATION QLD RAPTORS REGENERATION REPRODUCTION REPTILES RESERVES REVIEW RODENTS SA SE STATUS TAS TAXONOMY TECHNIQUES TEMPERATUR THESES TOOTH VEGETATION VIC WADERS WALLABIES WATERBIRDS WA WETLANDS WILDLIFE YP

NEW KEYWORDS): ______________________________

TITLE: ______________________________

PUBLICATION(CALL NO.): ______________________________

ABSTRACT: ______________________________