DRAFT GUIDELINES FOR WETLAND CONSERVATION IN THE PERTH METROPOLITAN AREA

Report and Recommendations
by the
Environmental Protection Authority

Department of Conservation and Environment
Perth, Western Australia

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ENVIRONMENTAL PROTECTION AUTHORITY

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i. PREFACE

In 1977 the Department of Conservation and Environment published *Guidelines for the Protection and Management of Wetlands* which set out general principles for wetland conservation derived from a broad review of the extensive literature on the subject. A revised edition was published in 1980. The objectives of these publications were to inform the public on factors which cause wetland degradation and to provide guidelines for planners, local authorities and land owners about desirable approaches to land use if surviving wetlands were to be conserved. These publications were widely circulated.

The Environmental Protection Authority now sees a need to produce Guidelines which apply specifically to the environment of the Perth region and which will inform government agencies, local authorities, developers, land owners and the community of the EPA's approach to developments and land uses which impinge on wetlands and the water supply of wetlands.

Key objectives of the Guidelines are:

- to assist in identifying the valuable attributes and ecological functions of the wetlands of the Perth metropolitan region; and

- to provide direction as to the management priorities necessary to protect the conservation values and ecological functions of the wetlands, and to enhance the human environment.

Comments on these draft Guidelines are invited from all interested persons and organisations. Your comments should be addressed as follows:

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Attention Dr R Wallis

1. SETTING THE SCENE

1.1 THE IMPORTANCE OF WETLANDS

In the last decade and a half there has been a growing recognition that wetlands are important. There are many ways of justifying this recognition and some of these are outlined below. The most striking way to regard wetlands is as an index of environmental quality.

The shallow groundwater is a key factor in the environment of the region and, because the wetlands are effectively windows on the groundwater, they will be the earliest features to demonstrate the effects of stress on the system. For example:

- falling water levels in wetlands indicate high use of shallow groundwater and/or reduced replenishment of the groundwater resource;

- elevated water levels indicate a change in the water balance due to changed land use;

- nutrient enrichment of wetland catchments will be reflected in increased nutrient loadings of surface runoff and groundwaters and in turn by symptoms of increased productivity in wetlands such as algal blooms; and

- changes in wetland vegetation towards dominance by invasive species indicate one or more of the following: physical disturbance of the wetland; nutrient enrichment of its waters; and changes in the water levels reflecting alterations to the local or regional water balance.

Many wetland areas in Western Australia have been irreversibly altered by development of land for agricultural, pastoral and urban uses during the century and a half of European settlement. Others have been significantly changed but retain the capacity to function as aquatic ecosystems provided there is appropriate commitment to their conservation.

Since its establishment in 1971 the Environmental Protection Authority has consistently recognised the need to conserve wetlands. (1,2,3,4,5 & 6)

The EPA stated a number of general principles of wetland conservation in its preamble to the first Red Book and these remain relevant today.

1. Wetlands support a range of flora and fauna which require conservation.

2. Wetlands are particularly valuable as waterfowl habitats; their value in this regard can indicate their overall biological and physical condition.

3. There is a need to preserve a range of wetland types and thus biological associations.

4. Changes occur as a result of human use; for example, loss of value of wetlands affected by salinisation to species requiring fresh water. There is a need to reserve adjacent land to protect wetlands from changes consequent upon development.

5. Wetlands undergo extreme fluctuations even in the absence of man-induced changes. Waterbirds respond to such extreme seasonal conditions by moving. Extreme conditions are rarely expressed uniformly throughout an entire region. It is therefore important to preserve wetland types over a broad geographical range.

6. Coastal wetlands are of particular importance as freshwater refuges in times of drought because coastal climates are more equable, having lower rainfall variability, less severe temperatures and lower rates of evaporation than regions remote from moderating oceanic influences.

There have been increasing efforts to protect wetlands during the last decade and a half. Much more is known now about the requirements and movements of wildlife populations, particularly waterbirds and migratory waders whose habitat Australia is committed to protect under international agreements. Knowledge of aquatic ecosystems is slowly improving, particularly with regard to nutrient enrichment. With the increase in knowledge has come greater appreciation of the value of wetlands as resources for education and research, and of their aesthetic values. The need for conservation of wetlands has now been recognised in town and district planning schemes, and in water resources planning.

1.2 ECOLOGICAL FUNCTIONS OF WETLANDS

Wetland ecosystems include complex networks of biological and chemical processes. It is possible to consider these processes as 'ecological functions' which, among other things, can be valued as 'services'.

Ecological functions of the wetlands of the metropolitan region include:

- assimilation of loads of dissolved and suspended materials, including nutrients and pollutants, sediment and litter;

- retention of runoff waters during high rainfall and subsequent gradual release to groundwater and/or streams;

- support of the array of micro-organisms, plants and animals which make up the wetland food webs;

- provision of drought refuges for waterbirds affected by reduction in availability of fresh water in more arid areas resulting from the combined effects of summer drought and catchment salinisation;

- provision of summer feeding areas for transequatorial migratory wading birds which are the subject of international agreements; and

- provision of habitats for plants, animals or communities considered to be rare or of restricted occurrence or distribution.

Wetlands provide other 'services' including:

- contributions to amenity - landscape, views, access to wildlife;

- opportunities for recreation of various kinds; and

- opportunities for nature study.

The benefits of such services are reflected in economic values of land, and in turn, rate values to local authorities, and in opportunities for tourism and other aspects of the recreation industry.

1.3 WHY HAVE GUIDELINES FOR CONSERVATION?

With the benefit of increased knowledge and understanding of wetland ecological systems it is now possible to draw up Guidelines for protection and management specifically for the wetlands of the Perth region.

The Environmental Protection Authority intends that the Guidelines should be adopted by individuals and organisations concerned with developments and land uses which impinge on wetlands and the water supply of wetlands.

As stated in the Preface the key objectives of the Guidelines are to identify the values and functions of the wetlands and to provide direction as to the management priorities necessary to protect them.

As a first step it was necessary to identify a range of important natural and human use attributes, and to devise a method of assessing specific wetlands in terms of those attributes. Priorities for (wetland) conservation and management could then be established.

The Guidelines also include a suggested approach for the evaluation of planning and development proposals which will have an impact on wetlands.

The EPA recognises that agencies with direct roles in planning and management will be deeply involved in the application of the Guidelines. The agencies most concerned are:

. The Department of Conservation and Land Management

. The State Planning Commission

. The Water Authority of Western Australia

Local authorities, as well the community at large, are also involved in reaching decisions about the best use of the remaining wetlands.

The development of broad policies for Western Australian wetlands is a longer term objective of the Environment Protection Authority.

1.4 THE AREA TO WHICH THE GUIDELINES APPLY

These Guidelines apply to an area of the Swan Coastal Plain extending from Gingin Brook in the north, to the foot of the Darling Scarp in the east, to the Peel Inlet, Murray River and South Dandalup River in the South and to the coast in the west. This area encompasses the unconfined groundwater systems of the Gnangara mound north of the Swan River, the Jandakot mound south of the Swan-Canning Rivers, and a number of smaller unconfined flow systems, including the Safety Bay mound, the Stake Hill mound, and those in the Serpentine, Byford and Armadale areas.

The area includes the coastal plain portion of the Perth metropolitan region.

2. THE GUIDELINES FOR WETLAND MANAGEMENT

2.1 THE GUIDELINES

Recommendations for specific wetlands are contained in the Report of the Environmental Protection Authority for System 6.(7) The recommendations relate almost entirely to wetlands in Crown reserves or in areas reserved for Parks and Recreation in the Metropolitan Region Scheme; many of

the recommendations are yet to be implemented or are in early stages of implementation. Recommendations are lacking for some of the smaller, but important inner urban wetlands. The recommendations do not establish clear-cut priorities for conservation and management. Neither do they recognise that there remains a considerable area of wetland which is in unreserved, privately owned land.

These Guidelines recognise five groups of wetlands with different priorities for management and protection according to the integrity of the natural systems, their importance for conservation and their role in rural and urban settings. The group in which a wetland is placed is determined by assessments based on the CHECKLISTS (see Section 3 Application of the Guidelines).

The groups are:

Category 1: Wetlands of exceptionally high natural and/or human use attributes.

Management priority:
- active management to maintainand enhance the wetland attributes, particularly natural attributes
- these are recognised as having the highest priority for the establishment and implementation as regional park wetlands
- where absent, active management should be put in place as a matter of highest priority

Active management is seen as meaning the degree of management currently attributed to National Parks by the Department of Conservation and Land Management. The high quality of Category 1 wetlands is already acknowledged by their current reservation status, mostly A Class reserves for conservation and recreation.

Category 2: Wetlands with relatively intact natural systems.

Management priority:
- to maintain and enhance the natural attributes and functions

Many of the wetlands in Category 2 are in Crown reserves, reserved for Parks and Recreations under the Metropolitan Region Scheme, or owned by local authorities. For these there is some stability in management.

Category 3: Wetlands which have been highly modified but which are considered to play important roles in their urban and/or rural settings.

Management priority:
- to maintain and enhance the existing human use attributes whilst maintaining and enhancing the natural attributes and functions.

Many of the wetlands in Category 3 are in Crown reserves, reserved for Parks and Recreations under the Metropolitan Region Scheme, or owned by local authorities. For these there is some stability in management.

Category 4: Wetlands which have been significantly modified and/or which do not have clearly recognised roles in their urban or rural settings.

Management priority:

- to define wetlands with respect to:
  - water supply
  - minimisation of nutrient input
  - maintenance and enhancement of natural features
  - importance for recreation, landscape, 'ecological areas' and other functions.

Many of the wetlands in Category 4 are vulnerable to impacts of intensified land use, drainage, road construction and expansion of service corridors. This group includes many wetlands which will be a focus for controversy if developments begin to impinge upon them.

Emphasis should be on maintaining the existing functions. Where development of a wetland area is essential it is proposed that a requirement be imposed for the important functions to be restored in an equivalent area.

Proponents of developments which would affect wetlands assessed as belonging to Category 4, would be required to carry out an environmental review according to the outline provided below (Section 5). In the event of the wetland being shown to have a definable function, the development may be recommended for approval provided:

(a) the wetland function is retained within the development, or

(b) an equivalent area of wetland of a similar type is generated or rehabilitated to fulfil equivalent functions.

Category 5: Wetlands with few remaining natural attributes and limited human use attributes.

Management priority: management should be seen in the context of catchment and land use planning, especially drainage, nutrient cycling, summer pastures, and residual spring waterbird habitat.

Many of the wetlands in Category 5 are vulnerable to impacts of intensified land use, drainage, road construction and expansion of service corridors. This group includes many wetlands which will be a focus for controversy if developments begin to impinge upon them.

2.2 CONSTRAINTS

The National Conservation Strategy for Australia recognises that living resource conservation and sustainable development are interdependent. The definitions (see footnote) make this clear.(8)

Conservation and sustainable development are fundamentally linked by their dependence on living resources which could be destroyed if only short term human interests are pursued. To provide for today's needs as well as to conserve the stock of living resources for tomorrow, both conservation and development are necessary.

The NSCA, which the Government of Western Australia has endorsed, establishes priorities for policy planning and coordination. Where developments appear likely to affect wetlands and rivers there is a commitment to:

- integrate land use planning and environmental assessment by taking a multidisciplinary approach (including socioeconomic effects) to ensure that conservation and development issues are not addressed in isolation; and

- conduct thorough environmental and socioeconomic assessments of proposals and policies that are likely to have a significant effect on living resources.

Appropriate management and allocation of surface waters and groundwaters is of particular relevance in this regard.

3. APPLICATION OF THE GUIDELINES

3.1 DEFINITIONS

The Environmental Protection Authority has previously used the following definition of wetlands:

> Areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh or saline, eg waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries.

For the purposes of these Guidelines an adaptation of the definition of Paijmans et al, (12) has been adapted to increase the stringency of definition:

> Wetlands are lands permanently or temporarily under water or waterlogged; temporary wetlands must have surface water or waterlogging of sufficient frequency and/or duration to affect the biota and/or the soils. The occurrence at least sometimes of hydrophytic vegetation or use by water birds are necessary attributes.

The definition embraces the types of wetlands described below.

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*CONSERVATION is ... the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations. Thus conservation is positive, embracing preservation, maintenance, sustainable utilization, restoration, and enhancement of the natural environment. Living resource conservation is specifically concerned with plants, animals and microorganisms, and with those non-livingelements of the environment on which they depend. Living resources have two important properties the combination of which distinguishes them from non-living resources: they are renewable if conserved; and they are destructible if not.(9 & 10)

**DEVELOPMENT is ... the modification of the biosphere and the application of human, financial, living and non-living resources to satisfy human needs and improve the quality of human life. For development to be sustainable it must take account of social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long term as well as the short term advantages and disadvantages of alternative actions.(11)

The natural qualities and attributes of wetlands and the level of human use were assessed using checklists (see Section 3.3). Separate checklists were used for the large wetlands of the western half of the coastal plain with well-defined boundaries, and for the more seasonal and intermittent wetlands characteristic of the eastern coastal plain.

3.2 TYPES OF WETLANDS

As these Guidelines have a non-technical application terms in common usage have been selected, with definitions used by Paijmans et al.(13) It is recognised that there may be some disagreement with other definitions used in the technical literature on wetlands.

Wetland types in the Perth region are defined below. In recognition that the wetlands are strongly influenced by the structural features of the coastal plain, they are grouped according to the geomorphic category of the landform in which they are situated. Those wetlands which are the subject of area-specific recommendations in the Report of the Environmental Protection Authority for System 6 are indicated by an asterisk (*)(14).

For purposes of assessment wetlands are defined arbitrarily as PERMANENT AND SEASONAL WETLANDS WITH WELL-DEFINED BOUNDARIES - such as occur in interbarrier depressions between the Quindalup and Spearwood dunes, within the Spearwood dunes and between the Spearwood and Bassendean dunes; and SEASONAL AND EPISODIC WETLANDS WITH POORLY DEFINED BOUNDARIES - such as occur in interdunal swales in the Bassendean dunes and on the alluvial plains on the eastern coastal plain. Separate checklists are used for both wetland types (see Section 3.3 Assessment of Wetlands).

PHYSIOGRAPHIC CATEGORY: QUINDALUP DUNES

Interdunal (or inter-ridge) swale
examples: ephemeral swamps in Warnbro region

Lake
examples: Lakes Richmond*, Cooloongup* and Walyungup*

PHYSIOGRAPHIC CATEGORY: SPEARWOOD DUNES

Swamp/lake in low level interbarrier depressions with prominent karstic features
examples: Loch McNess*; Yonderup Lake*; Wilgarup Swamp*; Pipidinny Swamp*; Beonaddy Swamp*; Lake Mindarie*; Coogee Springs*; Lake Carabooda; Lake Nowergup*; Lake Neerabup; 'North Joondalup'; Lake Joondalup*; Beenyup Swamp*; Walluburnup Swamp*; Lake Goollelal*.

Swamp/lake in low level interbarrier depressions
examples: Lake Manning*; Market Garden Swamps*; Lake Coogee*; Brownman Swamps*; Lake Mount Brown*; Long Swamp; Leda Swamps*; Sloans Reserve Swamps; Tamworth Hill Swamp; Anstey's Swamp; other unnamed swamps in Baldivis.

Swamp in interdunal swale
examples: Shenton Park Lake; Mason Gardens lake; Jackadder Lake*; Lake Claremont*; Perry Lakes; Shenton Park Lake; Herdsman Lake*; Mongers Lake; Lake Gwelup*; Careniup Swamp*; Lake Karrinyup; Carine Swamps*; Osborne Park swampland; Star Swamp*; Bluegum Lake; Booragoon Lake*; Piney Lake; Marmion Reserve Lake; small swamps in Spearwood dunes west of the Serpentine River.

PHYSIOGRAPHIC CATEGORY: BASSENDEAN DUNES

Swamp/lake in high level interbarrier depression
examples: Lake Bindiar*; Lake Pinjar*; Lake Adams*; Lake Mariginiup*; Little Mariginiup*; Lake Jandabup*; Lake Badgerup*; Lake Gnangara*; Emu Lake*; North Lake*; Roe Swamp*; Bibra Lake*; Little Rush Lake*; South Lake*; Yangebup Lake*; Kogolup Lake*; Thomsons Lake*; Banganup Lake*; swamps in Wattleup/Mandogalup localities*; Mandogalup Swamp (now entirely utilised for horticulture); Large Eye Spectacle; Small Eye Spectacle; Bollard Bullrush Swamp; extensive areas of peats and lacustrine deposits associated with the Serpentine River south of Karnup.

Swamp in interdunal swales in deep Bassendean sands
examples: swamps of Melaleuca Park* (swamps 1 - 45, Muir, 1983); Yeal Swamp* swamps elsewhere in State Forest 65 e.g. east of Lake Pinjar, Lake Jandabup* unnamed swamps north of Lake Jandabup*; Little Dundarbar Swamp; Lenzo Road Swamps*; Tomato Lake; MacDougall Park Lake; wetlands of Willeton/Canning Vale area (now mostly urbanised); wetlands of Jandakot, Banjup, Wandi, Ankatell, and Wellard localities; wetlands west of Serpentine and Keysbrook and east of Serpentine River.

Swamp/lake/channel in interdunal swale in shallow sands over alluvial deposits (Southern River and Yanga formations of Churchward and McArthur)
examples: Lakes Muckenburra*, Bambun, Nambung and Mungala*; Lake in Reserve 31241*; Quins Brook; Lake Catambro; seasonal tributaries to Gingin Brook; seasonal tributaries on western side of Ellen Brook; Twin Swamps Reserve*; headwater streams of Henley Brook; headwater streams and upper reaches of Bennett Brook (Whiteman Park)*; Malaga wetlands; Hazelmere Lakes* and related wetlands; wetlands of South Guildford, Newburn, Kewdale, Welshpool, Queens Park localities; wetlands of the Southern River, Huntingdale, Gosnells, Forrestdale localities e.g. Lake Ballanup, Mary Carroll Park*; Lake Forrestdale*; wetlands of lowlands - Hymus Swamp and others*, Punrak Drain, Yangedi Swamp areas.

PHYSIOGRAPHIC CATEGORY: ALLUVIAL PLAINS

Swamp on alluvial plains
examples: Lake Chandala*; Ellen Brook Reserve*; Bennett Brook-Pyrton*; wetlands of the Kenwick locality eg Yule Brook reserve*; wetlands associated with Wungong Brook in Wungong locality; wetlands associated with the coastal plain sections of Manjedal Brook, Cardup Brook,etc.

Freshwater swamp on river floodplain and river terrace
examples: swamps on Canning River upstream from Kent Street Weir*; swamps above tidal influence on the estuarine reaches of the Swan and Canning Rivers e.g. at Wilson*, Riverton* and Ferndale*, Clontarf*, Bull Creek*, Ashfield Flats*.

Swamp on river floodplain and river terrace under tidal influence
examples: Canning River wetlands at Riverton*, Ferndale* and Wilson*, Clontarf*, Salter Point*, Swan River at Alfred Cove*, Maylands*, Bayswater*, Redcliffe*, Ashfield Flats*, South Guildford*.

River terrace subject to winter inundation
examples: lower reaches of Ellen Brook, lower reaches of Jane Brook*; lower reaches of Helena River*.

River pool, cut-off meander, ox-bow etc.
examples: features in the Swan Valley, Folly Pool, Maramanup Pool, Yalbanberup Pool.

3.3 ASSESSMENT OF WETLANDS: CHECKLIST FOR ASSESSING WETLAND QUALITY ON THE SWAN COASTAL PLAIN

A. PERMANENT AND SEASONAL WETLANDS WITH WELL-DEFINED BOUNDARIES

I. NATURAL ATTRIBUTES - FACTORS ASSESSABLE FROM MAPS, AIR PHOTOS AND FIELD VISIT

1. How many wetlands exist within the same landform classification? (refer to physiographic categories, Section 3.2)
   0 - 2 (5)
   3 - 4 (4)
   5 - 6 (3)
   7 - 8 (2)
   9 + (1 .....( )

2. What proportion of the wetland or its surroundings has been modified by, for example: landfill, paved areas, cultivated gardens/playing fields, irrigated agriculture, grazing, etc?
    0 - 10% (5)
   11 - 20% (4)
   21 - 30% (3)
   31 - 40% (2)
   > 40% (1) .....( )

3. Is the wetland affected by drains? If so estimate the area of the drainage catchment.
   zero (5)
   <1 km2 (4)
   1 - 2 km2 (3)
   2 - 3 km2 (2)
   3 - 4 km2 (1)
   > 4 km2 (0) .....( )

4. Does the wetland have a buffer of native vegetation 50 metres or wider surrounding it?
   100 - 90% of perimeter with buffer (5)
   89 - 80% of perimeter with buffer (4)
   79 - 70% of perimeter with buffer (3)
   69 - 60% of perimeter with buffer (2)
   59 - 50% of perimeter with buffer (1)
   <50% of perimeter with buffer (0)
   .....( )

5. How much of the wetland is covered with emergent wetland vegetation?
   40 - 60% (5)
   30 - 40%; 60 - 70% (4)
   20 - 30%; 70 - 80% (3)
   10 - 20%; 80 - 80% (2)
   <10%;> 90% (1) .....( )

6. Have adverse water quality indicators been noted in course of current inspection or reported, or are likely because of adjacent land uses; eg extremes of pH; algal blooms; pollution; high nutrient levels,

   No aspect observed or reported (5)
   1 aspect observed or reported (2)
   2 aspects observed or reported (1)
   3 or more aspects observed or reported (0).....( )

7. Which of the following habitat types are represented?
(score 1 for each type represented)
. paperbark thicket
. paperbark fringe
. fringing rushes - sedges eg *Baumea*
. fringing rushes - eg *Typha*
. extensive beds of rushes - sedges eg *Baumea*
. extensive beds of rushes eg *Typha*
. permanent shallow open water < 50 cm deep
. permanent deep open water >50 cm deep
. flooded grasslands in winter/spring
. mud flats
. islands (natural and man-made)
. samphire or salt marsh
. fringing woodland or heath eg *Eucalyptus rudis* or non-wetland species
.....( )

8. Estimate of the size of the wetland (hectares)
> 100 ha (5)
75 - 100 ha (4)
50 - 75 ha (3)
25 - 50ha(2)
<25 ha (1)
.....( )

9. Estimate of the wetland's effectiveness as a conservation unit - ratio of wetland proper to total wetland and buffer
< 0.1 (5)
0.1 - 0.25 (4)
0.25 - 0.5 (3)
0.5 - 0.75 (2)
0.75 - 1.0 (1).....( )

10. Does the wetland provide a drought refuge for waterbirds?
YES (5)
NO (0) .....( )

II. NATURAL ATTRIBUTES REQUIRING DETAILED SURVEY AND ASSESSABLE FOR ONLY A LIMITED NUMBER OF WETLANDS

1. Is the wetland used by waterbirds the conservation value of which is recognised in international agreements?
. major use (5)
. transitory (3)
. nil (0).....( )
2. Are rare species of plants or animals present or are there communities represented which have a limited distribution?
. YES (5)
. NO (0).....( )

III. HUMAN USE ATTRIBUTES ASSESSABLE FROM MAPS, AIR PHOTOS, AND FIELD INSPECTIONS

1. Status of the wetland
. A Class reserve for conservation/recreation; MRS reserve for Parks and Recreation (5)
. Other class of reserve - vested (3)
. Other class of reserve - unvested (2)
. Other e.g. private (1).....( )

2. Does the System 6 Study make an area-specific recommendation for the wetland?
. YES (5)
. NO (0).....( )

3. Use of the wetland:
Which of the following is currently provided or catered for by the wetland? (score 1 for each)
. nature study/birdwatching
. walking and jogging
. education (school within 500 m; study centre)
. picnic and/or barbecue facilities
. sports or playgrounds
. protection and preservation of flora
. protection and preservation of fauna
. protection and preservation of other attributes
. recognised research function
  - biological
  - archaeological
  - other
. landscape and amenity
. private ownership
. water contact recreation
. model boats
. recognised tourist venue
. drainage function
. service corridor - roads, power lines, pipelines etc
. mining
. housing estate development
. water supply.....( )

4. Does the wetland have the following aesthetic components? (score 1 for each)
. a sense of isolation from surroundings conducive to relaxation
. variation in topography and/or vegetation
. views of water and wildlife
. wildflowers.....( )

5. Does the wetland have any of the following historical or archaeological components? If two or more score (5); if one score (3); otherwise score (0).
. aboriginal sacred sites
. aboriginal relics
. pioneer relics
. pioneer operations that are still operative or classified by the National Trust.....( )

IV. HUMAN USE ATTRIBUTES REQUIRING RESEARCH INTO COUNCIL, MUSEUM AND OTHER RECORDS, SURVEYS ETC.

A more detailed evaluation would be required to assess the full extent of human use. Factors that could be assessed include:

- contribution of the wetland/lake to amenity as reflected in local authority rates and real estate values
- value to, for instance, tourist coach operators who include visits to the area in itineraries
- savings to drainage authorities who use the wetland depression to accept runoff
- value as infiltration basins allowing runoff to recharge groundwater.

The economic value of these 'services' would need to be offset against the cost of management.

B. SEASONAL AND EPISODIC WETLANDS WITH POORLY-DEFINED BOUNDARIES

I. NATURAL ATTRIBUTES - FACTORS ASSESSABLE FROM MAPS, AIR PHOTOS AND FIELD VISIT

1. Seasonal and episodic wetlands are common on the alluvial plains on the eastern coastal plain where the presence of alluvial deposits prevents infiltration of rainfall. In periods of high rainfall, when the unconfined aquifers are fully charged, surface expressions of the water table in interdunal swales and groundwater discharge on the flanks of the groundwater mounds will also be manifest as seasonal and episodic wetlands. The abundance of these features is related to the nature of the soils and the characteristics of the landforms.

What landform does the wetland occur in?
Quindalup (5) (wetlands relatively rare)
Spearwood (4)
Bassendean (3)
Alluvial plains (2) (wetlands abundant).....( )

2. What proportion of the wetland or its surroundings has been modified by, for example: landfill, paved areas, cultivated gardens/playing fields, irrigated agriculture, grazing, etc?
0 - 10% (5)
11 - 20% (4)
21 - 30% (3)
31 - 40% (2)
> 40% (1).....( )

3. Has the water regime of the wetland been affected by drainage - either inflow or outflow?
YES (0)
NO (5).....( )

4. What percentage of the wetland is covered by vegetation indicative of wetland conditions eg paperbarks, rushes and sedges, etc?
40 - 60% (5)
30 - 40%; 60 - 70% (4)
20 - 30%; 70 - 80% (3)
10 - 20%; 80 - 80% (2)
< 10%; > 90% (1) .....( )

5. Which of the following habitat types are represented?
(score 1 for each type represented)
. paperbark fringe
. paperbark thicket
. fringing rushes - sedges eg *Baumea*
. fringing rushes - eg *Typha*
. extensive beds of rushes - sedges eg *Baumea*
. extensive beds of rushes eg *Typha*
. flooded grasslands in winter/spring
. mud flats
. samphire or salt marsh
. fringing woodland or heath eg *Eucalyptus rudis* or non-wetland species
(score 1/2 for the following)
. scattered paperbarks
. scattered rushes..... .....( )

6. Does the wetland have a buffer of native vegetation 50 metres or wider surrounding it?

100 - 90% of perimeter with buffer (5)
89 - 80% of perimeter with buffer (4)
79 - 70% of perimeter with buffer (3)
69 - 60% of perimeter with buffer (2)
59 - 50% of perimeter with buffer (1)
< 50% of perimeter with buffer(0).....( )

II. NATURAL ATTRIBUTES REQUIRING DETAILED SURVEY AND ASSESSABLE FOR ONLY A LIMITED NUMBER OF WETLANDS

1. Is the wetland used by waterbirds the conservation value of which is recognised in international agreements?

. major use (5)
. transitory (3)
. nil (0).....( )

2. Are rare species of plants or animals present or are there communities represented which have a limited distribution?

. YES (5)
. NO (0).....( )

III. HUMAN USE ATTRIBUTES ASSESSABLE FROM MAPS, AIR PHOTOS AND FIELD VISITS

1 Status of the wetland
. A Class reserve for conservation/recreation; MRS reserve for Parks and Recreation (5)
. Other class of reserve - vested (3)
. Other class of reserve - unvested (2)
. Other eg private (1).....( )

2 Does the System 6 Study make an area-specific recommendation for the wetland?
. YES (5)
. NO (0).....( )

3 Use of the wetland:
Which of the following is currently provided or catered for by the wetland? (score 1 for each)
. nature study/birdwatching
. walking and jogging
. education (school within 500 m; study centre)
. picnic and/or barbecue facilities
. sports or playgrounds
. protection and preservation of flora
. protection and preservation of fauna
. protection and preservation of other attributes
. recognised research function
  - biological
  - archaeological
  - other
. landscape and amenity
. private ownership
. water contact recreation
. model boats
. recognised tourist venue
. drainage function
. service corridor - roads, power lines, pipelines etc
. mining
. housing estate development
. water supply
. agricultural activities - grazing
. agricultural activities - horticulture
. agricultural activities - other .....( )

4 Does the wetland have the following aesthetic components? (score 1 for each)
. a sense of isolation from surroundings conducive to relaxation
. variation in topography and/or vegetation
. views of water and wildlife
. wildflowers..... ( )

5 Does the wetland have any of the following historical or archaeological components? If two or more score (5); if one score (3); otherwise score (0).
. aboriginal sacred sites
. aboriginal relics
. pioneer relics
. pioneer operations that are still operative or classified by the National Trust..... ( )

IV HUMAN USE ATTRIBUTES REQUIRING RESEARCH INTO COUNCIL, MUSEUM AND OTHER RECORDS, SURVEYS ETC.

A more detailed evaluation would be required to assess the full extent of human use. Factors that could be assessed include:

- contribution of the wetland/lake to amenity as reflected in local authority rates and real estate values
- value to, for instance, tourist coach operators who include visits to the area in itineraries
- savings to drainage authorities which use the wetland depression to accept runoff
- value as infiltration basins allowing runoff to recharge groundwater.

The economic value of these 'services' would need to be offset against the cost of management.

4. LISTING OF WETLANDS ALREADY ASSESSED

A number of wetlands from both the 'Permanent and Seasonal Wetlands with Well-Defined Boundaries' and 'Seasonal and Episodic Wetlands with Poorly Defined Boundaries' types (defined in Section 2) have been assessed. See Appendix 1 for Checklist scores and graphs.

Category 1: Wetlands of exceptionally high natural and/or human use attributes.

Loch McNess, Joondalup, Cooloongup, Alfred Cove (M6), Canning River Wetlands (M68).

Category 2: Wetlands with relatively intact natural systems.

Yonderup, Banganup, wetlands of Melaleuca Park, Brownman Swamp, Lake Richmond, Thomsons, Walyungup, Yangebup, Lake Mt Brown, Jandabup, Nowergup, Bennett Brook-Pyrton, Anstey's Swamp, Yule Brook Reserve, Twin Swamps.

Category 3: Wetlands which have been highly modified but which are considered to play important roles in their urban and/or rural settings.

Bibra, Wilgarup, Gnangara, Goollelal, Pipidinny, Forrestdale, Star Swamp, Gwelup, The Spectacles, North, Little Rush, Manning, Piney, Herdsman, Carine, Booragoon, Perry Lakes, Mary Carroll Park, Coogee, Claremont, Jackadder, Monger, Belmont/Maylands (M51), Maylands (M50), Heirisson Island, Tomato.

Category 4: Wetlands which have been significantly modified and/or which do not have clearly recognised roles in their urban or rural setting.

Tamworth Hill Swamp, Roe Swamp, Coogee Springs, Mariginiup, Neerabup, Adams, Hazelmere Lakes, McDougall Park,* Beonaddy, Pinjar, Blue Gum,* Shenton Park,* Pickle Swamp, Wetland 32° 14'N 115° 50'E, Wetland 32° 08'N 115° 56'E+ (Mason Road), Queens Gardens, Freeway interchange wetlands.

Category 5: Wetlands with few remaining natural attributes and limited human use attributes.

Carabooda, Wright Lake, Mindarie, Bollard Bullrush, Snake Swamp, Careniup, Malaga, Yangedi Swamp, Little Mariginiup, Banjup, Balannup, Wetlands 32° 08' 7"N 115° 54' 20"E,32° 10' 8"N 115° 57'E, 32° 22'N 115° 52'E, 31° 42'N 115° 50'E.

* Wetlands which, although allocated to this category, are already managed for a specific purpose, mostly drainage and stormwater purposes.

\+ Latitude and longitude are given for unnamed wetlands.

++ Estuarine and riverine wetlands are defined by boundaries shown in Part 2 of the Report of the Environmental Protection Authority for System 6, (15) hence inclusion of the recommendation numbers eg (M68).

5 INTERIM EVALUATION GUIDELINES FOR PLANNING AND DEVELOPMENT PROPOSALS AFFECTING WETLANDS (not exhaustive)

1 DESCRIBE THE PROPOSED PROJECT

1.1 Location of project
1.2 Status of project (including stage of planning and timetable)
1.3 The need for the project
1.4 Consideration of other alternatives

2 DESCRIBE THE WETLAND ECOSYSTEM (existing environment)

2.1 Physical structure: physiographic setting, shape, depth (bathymetry), nature of sediments, relationship to other wetlands

2.2 Water supply: source; inflow and outflow (including existing drainage); season of input; seasonal variations in water supply, seasonal variations in water level; longer term variations in water level ie WATER BALANCE (with groundwater influx/efflux computed by a method other than difference)

2.3 Water chemistry:
- salinity - seasonal variation
- nutrient levels in both lake waters and source waters
- nutrient loads....mass balances
- pH, oxygen levels, heavy metals
- also water quality parameters such as bacterial counts, BOD
- existing biocide levels in biota/sediments

2.4 Biology (processes):
- producers and fixers - plants, phytoplankton, algal mats, metaphyton etc
- consumers - detrital, first order, higher order etc

2.5 Biology (conservation and amenity)
- microbiology
- plant communities - buffers and wetland - habitat requirements
- animal communities of buffers and wetland - habitat requirements
- interrelationships with other wetlands
- rare or threatened species and/or communities

2.6 Scientific and educational uses and values

2.7 Aboriginal sites and areas of other cultural significance

2.8 Current management issues:
Off-road vehicles, litter, domestic and feral animals, weeds, insect pests, fire and others

3 DESCRIBE IMPACTS OF DEVELOPMENT ON WETLAND

3.1 Physical structure: eg mining of lake sediments, dredging, drainage

3.2 Water supply: eg on groundwater and surface inputs, drainage, seasonal and longer term variations in supply and level

3.3 Water chemistry:
- salinity
- nutrient levels of water inputs - surface and groundwater
- nutrient loadings to lake

. pH, oxygen levels, heavy metals
. also water quality parameters such as bacterial counts, and BOD.

3.4 Biology (processes):
. changes to vegetation buffers
. changes to populations of producers and fixers
. changes to populations of consumers- detrital, first order and higher order
. effect of use of biocides
. wetland capacity to assimilate projected nutrient loadings - using an assimilative capacity model if possible (16)

3.5 Biology (conservation and amenity):
. changes to plant communities
. changes to animal communities and habitat requirements
. changes to aesthetic components

3.6 Scientific and educational uses and values

3.7 Aboriginal sites and other areas of cultural significance

3.8 Management requirements:
. fire
. weeds
. domestic animals and feral animals
. recreation demands
. educational and scientific requirements
. insect pest control

4 DESCRIBE PLANNING AND MANAGEMENT INITIATIVES NECESSARY TO AMELIORATE THE EFFECTS OF THE PROPOSED DEVELOPMENT OR SUBSTITUTE WETLAND FUNCTIONS ELSEWHERE

6. REFERENCES

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8. Department of Home Affairs and Environment (1984), A National Conservation Strategy for Australia, Living Resource Conservation for Sustainable Development, AGPS, Canberra.

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13. Ibid.

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APPENDIX 1

Checklist scores and graphs of representative wetlands of boths types:

1. Permanent and Seasonal Wetlands with Well-Defined Boundaries; and

2. Seasonal and Episodic Wetlands with Poorly-Defined Boundaries.

Wetland	Natural Attribute Score	Human - Use Attribute Score	Code to figure A1
Bollard Bullrush	15	9	46
Little Rush	25	17	47
Roe Swamp	25	5	48
Wright L	17	8	49
Hazelmere Lakes	21	11	50
Snake Swamp	12	8	51
Wilgarup	31	16	52
Mindarie	15	8	53
Coogee Springs	24	10	54
L Pinjar	18	9	55
Tamworth Hill	27	7	56
Ansty's Swamp	31	7	57
Alfred Cove (M6)	30 + 10*	25	58
Canning River Wetlands(M68)	33 + 5*	34	59
Belmont/Maylands (M51)	24 + 3*	22	60
Maylands (M50)	21 + 3*	17	61
Heirisson Island	20	16	62
Queens Gardens	17	10	63
Interchange wetlands	13	14	64

. Continue for at least 15 minutes.

. Seek medical attention immediately.

If pesticide is spilled on the skin:

. Remove all contaminated clothing and cover the patient with clean clothing or a clean blanket.

. Wash the skin thoroughly with plenty of soap and water **immediately and repeat again.**

. Clean under finger-nails and toe-nails.

. Wash contaminated skin with methylated spirits.

If respiration becomes weak or irregular:

. Give artificial respiration. Maintain breathing.

. Oxygen can be beneficial.

If heartbeat ceases:

. Apply cardio-pulmonary resuscitation and artificial respiration.

Artificial respiration takes precedence over all other first aid.

If convulsions occur:

. Keep the patient warm and dry.

. Use gentle restraint to prevent injury.

If unconsciousness occurs:

. Ensure patient can breathe adequately. It may be necessary to pull tongue forward to prevent blocking of the throat.

. Keep the patient warm and dry.

. **Do not give anything by mouth to an unconscious person.**

If pesticide is an organophosphate or carbamate and the symptoms are severe:

. Atropine must be administered, but only on the direction of a physician (doctor).

If you know the type of pesticide:

. Check the appropriate pesticide group and label, if available, for first aid treatment and information.

In any case obtain medical attention as quickly as possible.

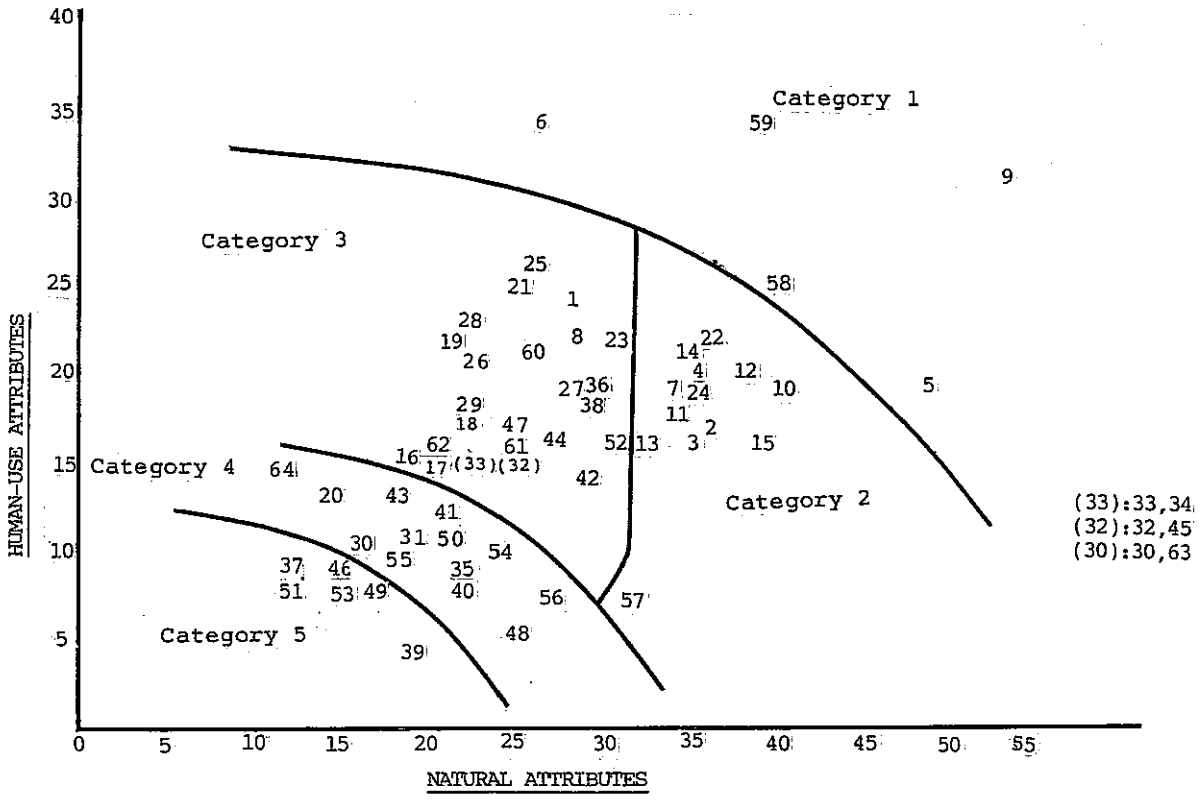

Figure A1. Permanent and Seasonal Wetlands with well-defined boundaries.

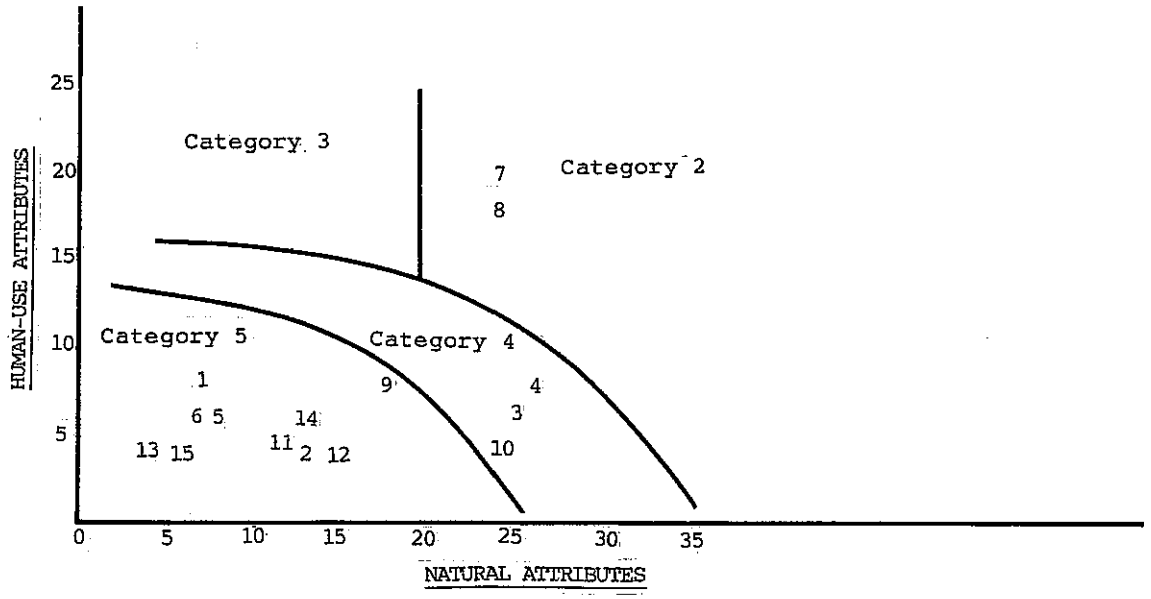

Figure A2. Seasonal and episodic wetlands with poorly-defined boundaries.