A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area

An update to EPA Bulletin 374

Report of the Environmental Protection Authority

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Section 1. Introduction

1.1 Purpose of this document

The purpose of this Bulletin is to update the information contained in Bulletin 374)released in 1990), which was, in turn preceded by Bulletin 227 (released in 1986). The full history of the evolution of this Bulletin is included as an Appendix. The specific objectives of each Bulletin are the same, which are to:

- outline broad management objectives for wetlands on the Swan Coastal Plain in the near Perth region; and
- provide an evaluation method so that individual wetlands can be allocated a specific management category.

1.2 Context

This document should be read in conjunction with the Environmental Protection Authority's Strategy for the protection of Lakes and Wetlands of the Swan Coastal Plain, Bulletin 685 (hereafter called the Lakes and Wetland Strategy) released simultaneously with this Bulletin. The Strategy paper provides the broad principles within which this Bulletin has been written.

1.3 Background

In 1986 the Environmental Protection Authority released for public comment Bulletin 227 'Draft Guidelines for Wetland Conservation in the Perth Metropolitan Area'. These guidelines were to assist in establishing management priorities for wetlands in the vicinity of Perth. These priorities should protect wetland conservation values, both for wildlife and for humans.

Bulletin 227 included a wetland evaluation method (in the form of a questionnaire) which sought to establish the values of individual wetlands. The identified values could then be translated into a broad management framework within which a wetland should be viewed by landuse planners and managers as well as the broader community.

As part of the review of these draft Guidelines the Water Authority and Murdoch University carried out surveys of the wetlands in the Shires of Serpentine-Jarrahdale and Gingin applying the wetland evaluation method. This survey work together with other public input provided useful feedback for the revision of Bulletin 227. In 1990 the Guidelines were released in final form as Environmental Protection Authority Bulletin 374 ' A guide to wetland management in Perth'.

The modified wetland evaluation method outlined in Bulletin 374 has now been applied to most of the wetlands from Gingin to Mandurah (refer to Section 2.3). This information is available in digital form from the Water Authority of Western Australia. That work has highlighted some shortcomings in the evaluation method which has lead to the publishing of this update.

1.4 Who should use this document?

This Bulletin has been written for a wide range of people including community groups, state and local government authorities and private landowners. A detailed technical knowledge of wetlands is not required and users should be able to determine the management category of a wetland by using the enclosed questionnaire.

The document should be especially useful to developers to assist in their planning and to identify issues that they will have to address to obtain statutory approvals.

1.5 Structure of the document

Four main Sections follow. Section 2 provides basic background information, in particular: the definition of a wetland; the limitations in the use of the wetland evaluation method; and a description of how the Water Authority of Western Australia's recent work on wetland mapping relates to this Bulletin. A brief discussion of the rationale for protecting and managing wetlands is presented which includes a list and description of wetland "functions".

Section 3 gives a description of the philosophy behind the wetland evaluation method and the details of the five wetland management categories.

Section 4 contains background information regarding the questionnaire and details how to use it to carry out the evaluation.

Section 5 contains the questionnaire.

Section 2. Background information

2.1 Definition of wetlands

For the purposes of this document, a wetland is defined as an area of permanent, seasonal or intermittent inundation, whether natural or otherwise; fresh, brackish or saline; static or flowing. This paper focuses on static (lentic) wetlands which typically include lakes, swamps, marshes and dams.

Excluded from this definition are areas which typically do not support water-dependent plant and animal life such as flooded playing fields or roadways.

It should be noted that the above definition includes areas of land which are intermittently waterlogged and where surface water may or may not be present. These areas are commonly known as damplands and palusplains and are of ecological importance in supporting vegetation and habitats which differ from other wetland types.

2.2 Terminology — wetland functions, attributes and value

Wetlands are valuable assets because they carry out a number of important processes, either ecological (biological and chemical), hydrological or social (see Section 2.4 for the full list). These processes can be called wetland "functions". Wetlands are valued because of their functions.

Wetlands can be described using certain characteristics or "attributes", for example habitat diversity and extent of open water. It is possible to quantify these attributes, for example, number of species and percent of open water, so as to produce a measure of a wetland's value. The questionnaire in Section 5 of this Bulletin describes how the attributes of a wetland can be quantified to allocate the wetland into a management category.

The term "value" is used here to mean "worth" in its broadest sense, and is not restricted to monetary value only[1].

[1] There is often confusion over the use of the words function, attributes and value. A comparison to a car might be helpful. A wetland (car) has certain functions or processes, for example, food web (transport to and from work). A wetland's attributes are its descriptive characteristics, for example, habitat diversity (fuel efficiency). A wetland (car) is valued because it carries out these functions. The attributes can be used as a measure of that value, for example, the number of species (good fuel efficiency).

2.3 Limitations in the use of the wetland evaluation method

2.3.1 Geographic limitations

The wetland evaluation method applies 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 questionnaire was designed specifically for this region and should not be used elsewhere. However it may be possible in some circumstances to adapt the questionnaire for use in other areas, and the Environmental Protection Authority can provide advice on this issue.

The questionnaire does not work in the following situations:

- Wetlands above the foot of the Darling Scarp.
- Streams, channels and drains, but it may be applied to associated wide floodplains.
- Farm dams and similar structures or pits (eg gravel pits) without emergent vegetation.

2.3.2 Applicability to rural settings

One of the criticisms of early versions of the wetland evaluation method is that is does not work well for wetlands on private land in rural settings. The evaluation method works well in identifying public human-use values but less well in defining private human-use value. From a management perspective, it is important to identify privately owned wetlands valued by the land owners for private human-use purposes which are also valued for their natural attributes so that appropriate management strategies are put in place to deal with the potential conflict in values.

The revised evaluation method presented in this Bulletin addresses this issue, in particular, refer to Section 4.3

2.3.3 Limitations of the evaluation method

The allocation of management categories through this questionnaire should be perceived as a first cut, broad brush evaluation.

The information provided by the questionnaire provides only a 'snapshot' of the wetland's current condition. Active management, rehabilitation or lack of management can change the evaluation and hence the management category of a wetland.

2.4 Wetland functions

Wetlands are valuable assets because they carry out a number of important processes, either ecological (biological and chemical), hydrological or social. These processes can be called wetland "functions". These functions are as follows.

Ecological

- the food webs that include plants and animals and mico-organisms;
- drought refuges for waterbirds;
- provision of summer feeding areas for trans-equatorial migratory wading birds which are the subject to international agreement (to achieve this a range of wetland types needs to be protected and controls placed on surrounding land uses);

- habitats for plants, animals or communities considered to be rare or of restricted occurrence or distribution;
- limited capacity to assimilate loads of nutrients, other pollutants, sediment and litter; and
- index of environmental quality
  * changes in water levels;
  * nutrient enrichment
  * changes in wetland vegetation.

Hydrological

- Wetlands act as compensating or retention basins during storms and hence have a flood control function. The vegetation fringing lakes and wetlands act, to a certain extent, as filters which assimilate nutrients, sediments and pollutants in surface runoff from adjoining land.

Social

- historical/archaeological
- recreation
- nature study
- education
- access to wildlife, and
- aesthetic considerations

2.5 The relationship between the Water Authority's wetland work and the EPA's wetland evaluation method

Bulletin 227 and the wetland evaluation method were developed in the absence of a comprehensive inventory of the wetland resource of the Swan Coastal Plain. Recently, the wetlands on the coastal plain have been comprehensively mapped by the V & C Semeniuk Research Group, Water Authority and Department of Land Administration, using a wetland classification system designed by C. A. Semeniuk (Semeniuk, 1987). This mapping, for the most part, shows the existing wetland resource of the Swan Coastal Plain. However, some problems have arisen in the application of the Environmental Protection Authority's wetland evaluation method for the "extensive" wetland areas found mainly on the east of the coastal plain.

The wetlands of this eastern area - the Bassendean Dune system and the Pinjarra Plain - can be very large, covering tens of square kilometres. The Pinjarra Plain is arguably one large wetland covering hundreds of square kilometres. These extensive wetlands are damplands, palusplains and floodplains, although it should be noted that these types of wetlands occur elsewhere on the coastal plain and can be quite small.

There are sections of many of these extensive wetlands which have been severely degraded, through a combination of clearing of native vegetation and draining to allow for agricultural activities. These degraded areas have few, if any, wetland ecological or social functions, although they may have some hydrological function in that water may be present at or near the surface for some of the year.

The application the Environmental Protection Authority's wetland evaluation method to these extensive wetlands has not been as successful as its application to the well defined wetlands. Caution needs to be used in interpreting the allocated management category (refer to Section 3) to these extensive wetlands. Where development is proposed in these areas, additional work should be carried out to determine appropriate management objectives for these wetlands taking into account that some areas only have hydrological functions.

The part of the questionnaire used to evaluate these extensive wetlands has been revised in this Bulletin.

Section 3. The wetland evaluation method

3.1 Valuing wetlands using the two types of attributes

Wetland have value for two reasons:

- they are important to wildlife as "natural" ecosystems; and
- they are important to people for human-use purposes.

Natural and human-use "attributes" can be defined and used to describe the wetland and act as a measure of the wetland's value: for example, habitat diversity and drought refuge (natural attributes) and aesthetics and recreation (human-use attributes).

Clearly, different wetlands will be important for different reasons. Some wetlands will be important to wildlife (with many natural attributes) and some wetlands important to humans (with many human-use attributes). Similarly, other wetlands will be important for both natural and human-use reasons, while others will have little importance on either.

A wetland's management priorities should be determined, to a large extent, by its importance on these two attributes types.

3.2 The five management categories

Based on this approach, it is possible to identify five different management categories in which to place wetlands, each with specific management objectives. These categories are described below in terms of:

- the attributes;
- management objectives; and
- well known examples.

i) High conservation (Category H)

Attributes

These wetlands possess a high degree of naturalness and there is a high level of interest in using the wetlands for various human purposes.

Management objectives

Active management to maintain and enhance the wetland attributes, particularly natural attributes. Where there is no active management at present it should be put in place as a matter of highest priority.

Active management requires that a detailed management plan is prepared and implemented, with sufficient resources to maintain or improve the wetland's current condition.

This category is recognised as having the highest priority for establishment and implementation as regional park wetlands.

Examples

Loch McNess, Cooloongup, Thomsons Lake.

ii) Conservation (Category C)

Attributes

These wetlands possess a high degree of naturalness.

Management objectives

To maintain and enhance natural attributes and functions.

Examples

Forrestdale Lake, Gnangara Lake, Star Swamp.

iii) Conservation and recreation (Category O — for open space)

Attributes

These wetlands have been modified (they have moderate degrees of naturalness) but are considered to play important roles in their urban and/or rural settings (they have a high degree of human interest, either public or private).

Management objectives

To provide for human uses whilst maintaining and enhancing the existing natural attributes.

Examples

Lake Carine, Lake Claremont, Lake Gwelup.

iv) Resource enhancement (Category R)

Attributes

These wetlands have been modified and do not have clearly recognised human-uses in their urban or rural settings (they have moderate degrees of naturalness and human interest). Some of the wetlands in this category will be the focus for controversy if uncontrolled developments begin to impinge upon them.

Management objectives

To maintain and enhance the existing ecological functions.

The term 'resource enhancement' has been used to indicate that opportunities may exist for commercial developments to enhance the conservation values of wetlands (ie the wetland resource) in this management category.

Examples

Hazelmere Lakes, Mariginiup Lakes, Tamworth Hill Swamp.

v) Multiple use (Category M)

Attributes

Wetlands in this category are significantly degraded, possessing few natural attributes and limited human-use interest. Despite this, wetlands in this category can be a focus for controversy if developments impinge upon them. For example, attempts to alter Jackadder Lake, which falls into this category, would be closely scrutinised by the surrounding residents. Despite having few natural attributes, some of these wetlands may provide valuable waterbird habitat.

Management objectives

Objectives should be considered in the context of catchment and land use planning (especially drainage, nutrient enrichment, surface and groundwater pollution), in terms of the current value of the wetland and the potential value to the community if rehabilitated.

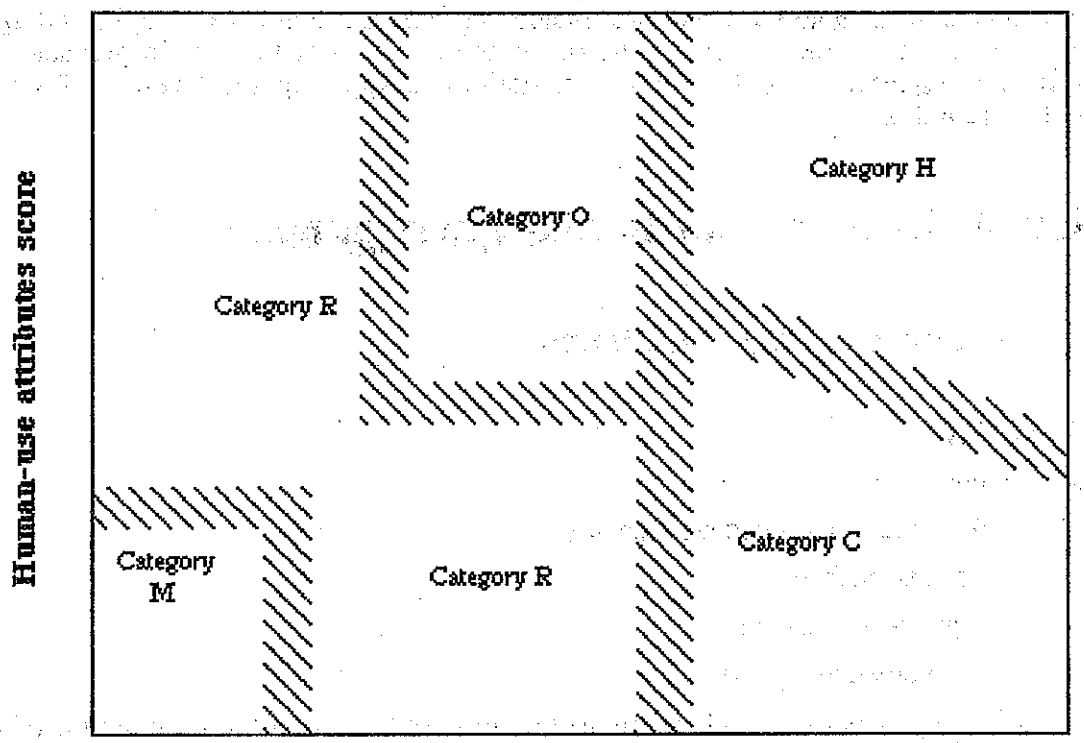
Sections of extensive wetlands that fall into this category may only have a hydrological function. Development and management within these areas should address the key issues of water management and off-site impacts.

Examples

Jackadder Lake, Queens Gardens, Wright Lake.

It is possible to represent these management categories using a two dimensional graph with the two attributes types (natural and human-use) as the axes. This is shown in Figure 1.

Figure 1: Conceptual representation of the five management categories using the natural and human-use attributes scores.



NOTE: The boundaries between the management categories are deliberately broad. It is not possible to define a clear cut-off point. Where scores fall into these areas, supplementary questions are used to determine the appropriate management category.

3.3 Protecting wetlands where development is planned to proceed

3.3.1 Overview

The Authority's Lakes and Wetland Strategy gives clear guidance in deciding the environmental acceptability of proposed developments likely to impact wetlands. As a generality, wetlands within categories R and M are most likely to be threatened by development.

Other than where lakes protected under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 are involved, developments impacting category R and M wetlands could be recommended for approval provided:

a the wetland function is retained within the development; or

b a wetland is constructed or rehabilitated to fulfil equivalent functions.

It is important to understand that all wetlands are of value regardless of the purpose for which they are managed.

3.3.2 Wetland function

The notion of conserving wetland function where development is to proceed is a relatively new concept in Western Australia. Some initial work has been carried out in applying this principle, for example, the Kwinana Freeway extension to Thomas Road.

This and subsequent work will establish specific criteria so that the broad definitions of wetland functions can be translated into wetland rehabilitation and construction work. It is likely that the Authority will, in the future, report on the outcome of this work to provide planners, the community and developers with practical guidelines is applying the "wetland function conservation" principle.

Section 4. Background to the questionnaire

4.1 The structure of the questionnaire

4.1.1 Overview

The questionnaire consists of four parts:

Part I	Presence of Gazetted rare species
Part II	Natural attributes
Part III	Human-use attributes
Part IV	Supplementary questions

Part I is a filtering question which needs to be answered prior to the completion of the remaining Parts. It relates to the identification of Gazetted rare flora and fauna.

Parts II and III are made up of a series of questions that relate to specific attributes. The answers to each question will enable a score to be given for each attribute. The total score in each part represents the value of that wetland for each attribute type. The scores for each Part will enable each wetland to be allocated a management category (refer to Section 4.2).

The role of the supplementary questions in Part IV is to allocate an appropriate management category in special circumstances.

A more detailed explanation of the questionnaire is provided below.

4.1.2 Part I - Presence of rare species

In recognition of the importance of Gazetted rare species, any wetland which is a habitat for a declared rare species is automatically allocated to management category H. The remaining Parts should still be answered to provide valuable management information. However, the scores obtained on Parts II and III will not alter the allocated management category.

4.1.3 Part II - The Natural attributes

The natural attributes score provides an indication of the current 'naturalness' of the wetland. This Part is divided into two broad sections in recognition of the diverse nature of Perth's wetlands.

The first sub-section (Part IIA) is for permanent and seasonal wetlands with well defined boundaries. The second (Part IIB) is for seasonal and episodic wetlands with poorly defined boundaries.

Seasonal and episodic wetlands with poorly defined boundaries are common on the eastern regions of the Coastal Plain (the Bassendean Dunes), the broad floodplains of the major rivers and on the Pinjarra Plain, as discussed in Section 2.3.

4.1.4 Part III - The Human-use attributes

The human-use part of the questionnaire scores the number of human uses for which the wetland area is perceived as important. This gives an indication of the degree of management that may be necessary in determining the future of the wetland. Therefore the score for human-use includes beneficial, conflicting and detrimental human-uses. It measures public rather than private human-use value.

4.1.5 Part IV - Supplementary questions

The supplementary questions apply to two types of wetlands:

- those where the scores from the questionnaire place them on the boundary between two management categories; or
- those located on private land with high private human-use value.

For the first type of wetland, questions i, ii and iii are answered to decide the most appropriate management category in which to place the wetland.

Question iv is used to determine the level of private human-use value for those wetlands. A change in management category will only occur where:

- the wetland has a demonstrated existing private human-use; and
- it is a category R wetland based on Parts I to III of the questionnaire.

It is possible to complete the questionnaire with a single visit to the site in conjunction with information from air photos, maps and council records.

4.2 How to use Parts I, II and III of the questionnaire

Step 1 - collecting resources

Obtain aerial photographs and maps. Aerial photographs should be at a scale of 1:20,000 or better. The Metropolitan Road Guide colour aerial photographs are suitable and are available from the Central Mapping Agency, Cathedral Avenue, Perth. If the wetland has poorly defined boundaries, stereoscopic coverage is useful. Maps should show property boundaries, roads, service corridors and land tenure. Refer to the Water Authority wetland maps.

Step 2 - preparation for the field visit

Read the whole questionnaire and make notes about the information to be collected during the field visit. The management notes associated with each question give hints about what you need to look for. Make a copy of the field survey sheet and use this to record data.

Step 3 - determine the wetland's "boundary" type

Using the information in Section 4.1.3 determine which of the two Natural Attributes Parts to apply.

For wetlands with well defined boundaries go to step 4. For wetlands with poorly defined boundaries go to step 5

Step 4 - determining boundaries for well defined wetlands

Determine the boundaries of the wetland being assessed using maps and aerial photographs in combination. The local hydrology and vegetation is generally used to delineate the wetland from surrounding areas. The Water Authority mapping would normally give accurate boundaries for these wetlands.

Go to step 7

Step 5 - determining boundaries for poorly defined wetlands

This task is often difficult in the case of seasonal and episodic wetlands. In some cases it is almost impossible to determine wetland boundaries once the vegetation has been cleared. Caution is required when using aerial photography as it is easy to mistake a piece of remnant vegetation in a cleared area for a distinct wetland.

To overcome this problem the following approach is recommended:

- Using aerial photography and the Water Authority mapping, divide the wetland into homogeneous units based on vegetation cover - for example, relatively pristine, some disturbance, and mostly cleared.
- Where property boundaries approximate the vegetation boundaries, use property boundaries to define unit.
- Treat each unit as a separate area.
- Determine the functions of each unit (step 6).

Step 6 - determine which units have ecologically and socially functions

Using the list of wetland functions in Section 3.3, identify which functions if any is appropriate for each unit. NOTE: the ecological function relating to food web refers to wetland related species.

Where a function other than hydrological cannot be identified, do not apply the questionnaire, but note it as "severely degraded". Note also any hydrological function. Apply the questionnaire to the remaining wetland units.

Step 7 - desk work

Answer as much as you can from the aerial photographs and maps for the relevant natural attributes questionnaire part (IIA or IIB) and the human-use questionnaire part (III) using the field sheet provided as Appendix X. Answer the Supplementary questions if possible.

It should be noted that the format and wording of some questions in the field sheet has been altered to simplify the collection of data, and to enable the entire questionnaire to be condensed on to a single double-sided sheet. Users should therefore be familiar with the substance of the text prior to using the field sheet.

Step 8 - field work

Undertake the field investigation(s) and visit the local government authority or relevant government department making sure you know what you are going to look for before you get there (Refer back to Step 2 and unanswered questions from Step 7). Check with land owners before visiting wetlands on private land.

Step 9 - allocating management categories

Reassess all your answers after the field visit and tally up the scores for each section[2] . Use the appropriate graph from Appendix 2 to determine the management category for your wetland. If you used the Natural Attributes questionnaire IIA refer to graph A, and use graph B if you used questionnaire IIB to determine your management categories.

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[2] Although it can be argued that it is best to consider the score for each subsection of the questionnaire rather than the final score, the system for using the final score was found to provide satisfactory results for determining management categories.

Step 10 - final note

It is important to present sufficient information to enable others to understand how the wetland's management category was determined. Information should be provided on the boundaries used in the assessment as well as the individual scores for the Natural Attributes, Human-use and Supplementary questions. If the Supplementary questions are used to determine the final outcome, the letter **S** should be written and circled adjacent to the wetlands name on the field sheet. Additional information which may be of use during the formulation of management plans should also be recorded.

4.3 How to use Part IV of the questionnaire — Supplementary questions

4.3.1 Wetlands with scores in the "transition" zone of the graphs

As noted earlier, where the final score falls in the "transition" zone in the graphs, supplementary questions i, ii and iii (or further consideration of local issues) should be used to decide the appropriate wetland category. More extensive field work or research is required to answer these questions.

Allocate management categories as described below.

1. If the answer is YES in question i (species rarity) the wetland should be moved to the management category to the right. If NO, move to left.
2. If the answer to either ii or iii (effect on land values and human use) is YES, move upwards; if NO move downwards.

4.3.2 Wetlands on private property

For wetlands on private land, signs of private use should be looked for: for example, grazing by stock, a house overlooking the wetland or evidence of private recreational use. Where there is evidence of these uses, interview the owner and ask supplementary question iv.

If the answer to the question is yes, then:

- if the wetland is in category R based on Parts I, II and III questions, the wetland is allocated management category O unless Part I applies; or
- if wetland is in any other category based on Parts I, II and III questions, do not change the category but make a note for future reference.

NOTE: The change in management category only applies to category R wetlands with demonstrated existing high private human-use value, and represents an "upgrading" of management category.

It is inappropriate to change wetlands in other management categories (M, C, O and H) with high private human-use value because their natural attributes value is either too high of too low for category O. As discussed in Section 3.2, category O and R wetlands have moderate degrees of naturalness (with category O wetlands having a high degree of human interest and category R wetlands having a moderate degree of human interest). Category C or H wetlands have a high degree of naturalness and category M wetlands have few natural attributes.

Clearly, changing a C or H wetland to category O would "downgrade" its natural attributes value. Changing an M wetland to O would effectively "downgrade" other O wetlands.

Section 5. The questionnaire

Part I - presence of rare species

Is the wetland a habitat for Gazetted rare species of flora or fauna?

Yes/No

If "yes" wetland automatically is allocated management category H. If "no" proceed with Parts II and III to determine management category.

Part II The natural attributes questionnaire

Part IIA: Permanent and seasonal wetlands with well defined boundaries

For wetlands with poorly defined boundaries go to Part IIB

i Environmental geology classification

Does the wetland occur on the Quindalup Dunes or on a geological unit confined to a river/estuary floodplain?

YES	Score	5
NO	Score	1

Score [ ]

Source: Refer to 1:50,000 Environmental Geology Series (see Gozzard 1982).

Management Notes: Geological origin is one of the basis for wetland classification systems. In the metropolitan area wetlands within these geological units are rare.

ii Adjacent wetlands

Are there wetlands within a 2km radius?

YES			*go to question iii*
NO	Score	3	*go to question (iv)*

Score [ ]

Source : Aerial photos.

Management Notes: Refer to question (iii).

iii Habitat diversity

Is the composition and structure of the vegetation significantly different to that found at nearby wetlands?

YES	Score	3
NO	Score	1

Score [ ]

Source: Refer to question (vi) for a listing of habitat types. Use aerial photos and field visits.

Management Notes: A high diversity of habitats is desirable from an ecological perspective. In some cases this diversity is not expressed in an individual wetland, but in a series of adjacent wetlands.

iv Drought refuge

What is the importance of the wetland as a drought refuge for birds?

Major importance	Score	5
Minor importance	Score	2
No importance	Score	0

Score [ ]

Source: Refer to Appendix 7 and local branch of RAOU.

Management Notes: Although waterbirds can move long distances to find suitable habitat when lakes dry out, it has been shown that Perth's natural and artificial wetlands provide a valuable drought refuge during the summer. Verify with local government authority.

v Area of wetland

Estimate the area of the wetland and score as follows:

Area	Score
>100ha	5
50-100ha	4
25-50ha	3
10-25ha	2
<10ha	1

Score [ ]

Source: Map of appropriate scale in conjunction with a grid overlay. The edge of the inundated area (often indicated by fringing vegetation or summer grass) should be used as the wetland perimeter for this calculation.

Management Notes: As a general rule large wetlands are capable of supporting a larger variety of species and have a greater capacity to absorb the detrimental impacts of nearby land uses than small wetlands. Where a wetland chain is severed by urban development, species diversity within individual lakes often declines due to a reduction in habitat diversity (see management notes Question (vi).

vi Habitat type

Using the list below score 1 for each habitat type represented.

a).Must cover 0.1 ha (1000m^2) in area (not necessarily in one stand)

- large paperbarks (> 2.5m tall) in dense clumps [ ]
- low thickets (ie < 2.5m tall). These are often *Melaleuca, Astartea* or *Kunzea* spp [ ]
- paperbark fringe [ ]
- fringing rushes and sedges (often *Baumea* and *Juncea* spp.) [ ]
- fringing *Typha* (bullrush) [ ]
- samphire or saltmarsh [ ]
- extensive inlake beds of sedges [ ]
- extensive inlake beds of *Typha* or other rushes [ ]
- scattered dense clumps of rushes or sedges [ ]

b) Other habitats

- flooded grassland in winter/spring [ ]
- mud flats or seasonally dry open water [ ]
- islands — natural or human made [ ]
- fringing woodland or heath (eg eucalyptus nodes or non-wetland species) [ ]
- permanent **shallow** open water < 50cm deep [ ]
- permanent **deep** open water > 50cm deep [ ]

Score 1/2 point for:

- scattered paperbarks [ ]
- scattered rushes [ ]

Score [ ]

Source: Field visit and aerial photos.

Management Notes: The composition, density and structure of the vegetation around a wetland has a major influence on the size and diversity of bird and other animal populations. The more complex the vegetation associations, the greater the habitat diversity.

vii Emergent vegetation

Calculate how much of the wetland is covered with emergent wetland vegetation and score as follows:

Percentage emergent vegetation	Score
40-60%	5
30-40% or 60-70%	4
20-30% or 70-80%	3
10-20% or 80-90%	2
<10% or >90%	1

Score [ ]

Source: Aerial photos and field visit.

Management Notes: A wetland which provides both open water and emergent vegetation is likely to fulfil the biological requirements of a greater range of species. For example, waterbirds need emergent vegetation for breeding and open water areas for feeding.

viii Adverse water quality

Has adverse water quality been reported in the last two years or observed on the current inspection? For example the presence of oil slicks, algal blooms or botulism in waterbirds. Score according to the following table.

Number of aspects observed or reported	Score
0	5
1	2
2	1
3 or more	0

Score [ ]

Source: Field survey, Waterbird Conservation Group, discussion with local residents, and local government authority.

Management Notes:

1 Water quality varies significantly throughout the year with problems most evident in summer and often undetectable during winter.

2 The presence of macroalgae and/or large numbers of epiphytes is often an indication of poor water quality. An epiphyte is a non parasitic plant that relies on other plants for physical support.

3 Good water quality is important, particularly for invertebrates. If there is evidence of pollution (from heavy metals, pesticides and nutrients etc) measures should be taken to alleviate the problem.

ix Drainage

This question deals with drains into or out of the wetland. Four scenarios are possible:

- no drains;
- drains into wetland only;
- drains out of wetlands only; and
- drains into or out of wetlands.

First determine which category is applicable, and then proceed to the relevant sub-section below.

a) No drains present

NO DRAINS Score 5 *go to question (x).*

b) Drain(s) into wetland only

Drain(s) into a wetland will likely cause two problems: a deterioration in water quality and a rise in water level. Drains can be categoriseed as one of three types, as listed below. Note the presence of each.

- off-road stormwater drains;
- open drains carrying excess groundwater from nearby urban land; and
- open drains carrying excess groundwater from rural land.

Note the types of drains present and score as follows:

Number of drain types observed	Score
1	3
2	1
3	0

Score [ ]

c) Drain(s) out of wetland only

Outlet drains are constructed to either:

- maintain water levels in the lake or to support wetland vegetation; or
- dry out the wetland.

Score as follows:

Maintain water levels Score 3

Dry out the wetland Score 0

d) Drains into and out of wetland

The inlet drains will likely (a) carry unwanted pollutants and (b) raise water levels in the wetland. An outlet drain could manage the water level changes by controlling maximum levels. A deterioration in water quality would still be expected.

Score as follows.

Is the outlet drain(s) constructed to maintain water levels in the lake or to support wetland vegetation?

Maintain water levels	Score	1
Other reasons	Score	0

Source: Field inspection and visit to local government authority.

Management Notes: Surface water run-off entering wetlands via drains is often polluted. Nutrient inputs from this source should ideally be monitored for several years before determining the most appropriate means of managing algal and insect problems.

x Adjacent nutrient sources

a) Presence of nutrient sources

Are there adjacent nutrient sources that could affect the water quality in the wetland? For example:

- rubbish tips or landfill;
- lawns and/or grazing property fertilised on a seasonal basis;
- septic tanks within 100m of the wetland; and
- agricultural development with high nutrient output such as feedlots and sheep holding yards nearby.

YES			*go to (b) and (c)*
NO	Score	5	*go to question (xi)*

b) Nutrient sources present

Note the number of nutrient sources and score as follows:

Number of nutrient sources observed	Score
1	2
more than 1	0

Score [ ]

Source: Field inspection and visit to the local government authority.

Management Notes: Recent research has demonstrated that large quantities of nutrients enter wetlands via surface water drains.

xi Area of wetland modified

What proportion of the wetland, within boundaries taken as 50m from the edge of the inundated area, has been modified by landfill, paving, cultivated gardens/playing fields, irrigated agriculture, grazing, weed invasion, mining etc?

Percentage modified	Score
0 - 10 %	5
11 - 20%	4
21 - 30 %	3
31 - 40%	2
> 40%	1

Score [ ]

Source: Aerial photos and maps.

Management Notes: See question (xiii)

xii Reserve area

Is the size of the (potential) reserve containing the wetland large enough to ensure that conservation values can be protected from the impacts of surrounding land uses. To determine this divide the area of the wetland by the area of the reserve surrounding the wetland. Score according to the following table:

ratio or wetland to "reserve"	Score
< 0.1	5
0.1 - 0.25	4
0.25 - 0.5	3
0.5 - 0.75	2
0.75 - 1.0	1

Score [ ]

Source: Aerial photos and maps — If there are not formal boundaries around the wetland use fence lines, roads or natural features of the landscape for the calculation (see management notes below).

Management Notes: Wetlands with large buffer zones are less likely to be degraded by the impact of surrounding land uses than those with small buffer zones. The size of buffer zones should be determined according to the physical and ecological properties of the individual wetland and the purpose for which it is being managed. Property or reserve boundaries used in the above computation should be at least 50m from the wetland edge. If less than 50m make a note in the report.

xiii Native vegetation buffer

Calculate the percentage of the wetland perimeter with a buffer of native vegetation 50m or wider along it. Score as follows:

% wetland perimeter with 50m buffer	Score
100 - 90%	10
89 - 80%	8
79 - 70%	6
69 - 60%	4
59 - 50%	2
<50%	1

Score [ ]

Source: Aerial photos.

Management Notes: Native vegetation has a beneficial effect on water quality and aesthetics and is essential for wetland fauna. A clear management objective for all wetlands should be to ensure there is vegetation cover where it would normally occur. Limited clearing may be acceptable at some sites if management procedures ensure that weed invasion is controlled and applied nutrients are prevented from leaching into the ground water or reaching the wetland through surface flow.

TOTAL SCORE [ ]

Part IIB: Seasonal and episodic wetlands with poorly defined boundaries

Introduction - "zoning" the wetlands

As described in Section 2.4, these "extensive" wetlands cannot be treated as single units. Zone the wetland as described in Section 4.2, Step 6. Each section should be the subject of a separate assessment using the following questionnaire. Where the word "wetland" is used it should be interpreted to mean "wetland section".

i Environmental geology classification

Does the wetland occur on the Quindalup Dunes or on a geological unit confined to a river/estuary floodplain?

YES	Score	5
NO	Score	1

Score [ ]

Source: Refer to 1:50,000 Environmental Geology Series (see Gozzard 1982).

Management Notes: Geological origin is one of the bases for wetland classification systems. In the metropolitan area, wetlands within these geological units are rare.

ii Adjacent wetlands

Are there wetlands within a 2km radius?

YES			*go to question iii*
NO	Score	3	*go to question (iv)*

Score [ ]

Source : Aerial photos.

Management Notes: Refer to question (iii).

iii Habitat diversity

Is the composition and structure of the vegetation significantly different to that found at nearby wetlands?

YES	Score	3
NO	Score	1

Score [ ]

Source: Refer to question (iv) for a list of habitat types. Use aerial photos and field visits.

iv Habitat type

Using the list below score one for each habitat type represented (maximum score 10).

a) Vegetation over 0.1 hectare (1000m^2) in area.

- large paperbarks (>2.5m tall) in dense clumps [ ]
- low thickets (ie <2.5m tall). These are often *Melaleuca, Astartea* or *Kunzea* spp [ ]
- paperbark fringe [ ]
- fringing rushes and sedges (often *Baumea, Juncea* spp) [ ]
- fringing *Typha* (bullrush) [ ]
- samphire or saltmarsh [ ]
- extensive inlake beds of *Typha* or other rushes [ ]
- scattered dense clumps of rushes or sedges [ ]

b) Other habitats

- flooded grassland in winter/spring [ ]
- mud flats or seasonally dry open water [ ]
- islands — natural or human made [ ]
- fringing woodland or heath (eg eucalyptus nodes or non-wetland species) [ ]
- permanent shallow open water < 50cm deep [ ]
- permanent deep open water > 50cm deep [ ]

Score ½ point for

- scattered paperbarks [ ]
- scattered rushes [ ]

Score [ ]

Source: Field visit and aerial photos.

Management Notes: The composition, density and structure of the vegetation around a wetland has a major influence on the size and diversity of bird and other animal populations.The more complex the vegetation associations, the greater the habitat diversity.

v Drainage

Are there drains directing water into or out of the wetland?

YES	Score	0
NO	Score	5

Score [ ]

Source: Field inspection and visit to local government authority.

Management Notes: Surface water run-off entering wetlands via drains is often polluted. Nutrient inputs from this source should ideally be monitored for several years before determining the most appropriate means of managing algal and insect problems.

vi Area of wetland modified

What proportion of the wetland has been modified by clearing of vegetation (including undergrowth) landfill, paving, cultivated gardens/playing fields, irrigated agriculture, grazing, weed invasion, mining etc?

Percentage modified	Score
0 - 10 %	5
11 - 20%	4
21 - 30 %	3
31 - 40%	2
> 40%	1

Score [ ]

Source: Aerial photos and maps.

Management Notes: See question (vii)

vii wetland size

Estimate wetland size and score as follows:

Area	Score
>100ha	5
50-100ha	4
25-50ha	3
10-25ha	2
<10ha	1

Score [ ]

Source: Map of appropriate scale in conjunction with a grid overlay. The edge of the inundated area (often indicated by fringing vegetation or summer grass) should be used as the wetland perimeter for this calculation.

Management Notes: As a general rule large wetlands are capable of supporting a larger variety of species and have a greater capacity to absorb the detrimental impacts of nearby land uses than small wetlands. Where a wetland chain is severed by urban development, species diversity within individual lakes often declines due to a reduction in habitat diversity (see management notes Question (vi).

TOTAL SCORE [ ]

Part III - Human-use questionnaire

i Aesthetics

Does the wetland possess any of the following attributes? (score appropriately and add score at the end)

Little, if any, artificial noise	Score	2	[ ]
Understorey mostly intact	Score	2	[ ]
Few, or no, roads or buildings obvious from wetland	Score	2	[ ]
Steep ridge visible as part of the scenery	Score	1	[ ]
Ridge accessible giving view of wetland	Score	1	[ ]
Wetland is a lake and open water easy to view	Score	1	[ ]
A section of wetland exists where few people visit	Score	1	[ ]

Score [ ]

Source: Field survey.

Management Notes: A management plan should try to ensure that these attributes are preserved or enhanced by proposed developments.

ii Historical and archaeological features

Does the wetland have any of the following historical or archaeological features?

- registered Aboriginal relics or sacred sites[3] .
- pioneer relics/operations
- National Estate/Trust listings

Score according to the following table:

Number of historical archaeological features	Score
2 or more	5
one	3
0	0

Score [ ]

[3] This information may not be made available by the Aboriginal Sites Department in some circumstances. In these situations it should be assumed that a site is present and scored appropriately.

Source: Field survey, local government authorities, National Trust, WA Museum — Department of Aboriginal Sites.

Management Notes: Strategies for the protection and/or preservation of historical and archaeological features should be clearly defined in the management plan for the wetland.

iii Security of wetland

What is the current vesting of the land containing the wetland ? Score according to the following table.

Vesting/ownership of wetland	Score
A Class Reserve for conservation and recreation or Metropolitan Region Scheme reserve for Parks and Recreation owned by the Department of Planning and Urban Development or local government authority.	5
Other class of reserve — vested System Six recommendation unvested or on private property	3
Other class of reserve — unvested	2
Other (eg private or vacant Crown land)	1

Score [ ]

iv Protection groups

Does the wetland have active community protection groups?

One or more Score 5

No groups Score 0

Score [ ]

v Passive recreation

Is the wetland used for any of the following passive recreation activities?

If yes, score 1 for each

- nature study/bird watching [ ]
- education (school or other educational interest within 500m) [ ]
- picnic and /or barbecue facilities [ ]
- conservation of flora (refer to maps) [ ]
- conservation of fauna (refer to maps) [ ]
- protection and preservation of other attributes [ ]
- recognised research site
  - — biological
  - — archaeological

— other [ ]

- recognised tourist venue [ ]

Score [ ]

Source: Field surveys, maps, road directories, State and local government department and residents.

Management Notes: Damage such as trampling, erosion and destruction of vegetation should be noted during the field visit.

vi Active recreation

Is the wetland used for any of the following active recreational activities? If yes, score 1 for each.

- walking/jogging or cycling [ ]
- horse riding [ ]
- trail bike riding [ ]
- playground [ ]
- sports grounds [ ]
- model boats [ ]
- golf course [ ]
- canoeing/rowing [ ]
- power boating/skiing [ ]
- swimming [ ]

Score [ ]

Source: State and local government recreation departments.

Management Notes: Damage from current activities should be recorded during the field survey and reported to the appropriate authority/s.

vii Other human-uses

Is the wetland used for any of the following purposes? (Score 1 for each)

- agricultural activities (grazing, horticulture etc) [ ]
- mining (check for mining leases) [ ]
- existing/proposed service corridors (SECWA, roads, etc) [ ]
- water supply [ ]
- proposed urban/housing use [ ]
- private purposes other than described above [ ]

Score [ ]

Source: Field survey, maps and State and local government departments.

Management Notes: The compatibility of the above activities with conservation values should be considered during the formulation of a management plan. It may not be practical to achieve all management objectives, and land use priorities will have to be decided.

TOTAL SCORE [ ]

Part IV - Supplementary questions

These questions are to be used to

- determine the most appropriate management category for a wetland where the natural attributes and human-use score falls in the "transition zones" in the graph in Appendix 2;
- determining the most appropriate management category for wetlands on private land with high private human-use value.

Instructions

1. If the answer is YES in question i (below) the wetland should be moved to the management category to the right.

   If NO, move to left.
2. If the answer to either ii or iii is YES, move upwards; if NO move downwards.
3. If the answer to iv is yes, then:
   - if the wetland is in Category R, the wetland is allocated management category O unless Part I applies; or
   - if wetland is in any other category, do not change the category but make a note for future reference.

i Species rarity

Are rare (and not gazetted) species of animals or plants present or are there communities represented which have a limited distribution?

Source: Department of Conservation and Land Management, local government authorities, conservation groups, literature searches.

Management Notes: Wetlands supporting rare and endangered species should be given priority when allocating resources for the formulation of management plans and implementation of field works.

YES/NO

ii Effect on land values

Does the wetland significantly enhance real estate values and land rates around it? ie, does the wetland add more than 10% to the value of nearby houses?

Source: local government authorities, estate agents.

Management Notes: The enhancement of real estate values is a legitimate reason for increased expenditure on the active management of a wetland.

YES/NO

iii Human use

Do more than 100 people visit the wetland each week?

Source: Extended field surveys, State and local government recreation departments.

Management Notes: This question provides a good measure of the need for human-use management.

YES/NO

iv) private human-use value

Where there is evidence of private use of the wetland (stock grazing, views of wetland from house or private recreation) ask owner how important the wetland is as a private resource. Does the owner rate it highly?

Source: evidence from field trip and interview with owner.

YES/NO

References

Environmental Protection Authority (1986). *Draft Guidelines for Wetland Conservation in the Perth Metropolitan Area.* Department of Conservation and Environment, Perth, Western Australia. Bulletin 227

Environmental Protection Authority (1990). *A guide to wetland management in Perth.* , Perth, Western Australia. Bulletin 374

Gozzard, J R (1982). Perth Sheet 2034 11 and part 2034 111 and 2134 111 Perth Metropolitan Region Environmental Geology Series. Geological Survey of Western Australia.

Semeniuk, C. A. (1987). Wetlands of the Darling System - A geomorphic approach to habitat classification. *J. Roy. Soc. W.A.*, **69**, 95-112.

Glossary of terms

The definitions given here are as they relate to wetlands and their useage in this Bulletin.

Term/word	definition
Attribute	Characteristic used to describe a wetland - eg size, diversity and depth of water.
Dampland	A basin wetland where the soil is seasonally waterlogged.
Episodic wetlands	Wetland with surface water for a period of time but not every year.
Extensive wetland	Large seasonally waterlogged wetlands found on the east of the Swan Coastal Plain, found typically on the Pinjarra Plain and the Bassendean Dunal system.
Function	Ecological (biological and chemical), hydrological or social process carried out by a wetland - eg food web and flood control.
Gazetted rare species	Species Gazetted Endangered under the Wildlife Conservation Act.
Hydrological function	Wetland processes that are related to water only - flood control, and drainage
Lake (as used in EPA Bulletin 227)	A wetland dominated by open water (rather than emergent vegetation), whether permanent, seasonal or ephemeral.
Lake (Semeniuk, 1987)	A basin wetland permanently inundated irrespective of vegetation cover.
Lentic wetland	Wetland where the water is stationary - a lake or swamp.
Lotic wetland	Wetland where the water is moving - streams and rivers.

Palusplain	A wetland typically flat rather than in a basin where the soil is seasonally waterlogged - typical of the Pinjarra Plain.
Pinjarra Plain	Poorly drained flat area stretching from the foot of the Scarp to the Bassendean dunes consisting of clay sediments mixed with sand.
Policy/EPP lake	A Swan Coastal Plain wetland with surface water of at least 1 000 square metres at the first of December 1991 (the first day of summer) protected by the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992.
Rare species	Species not gazetted under the Wildlife Conservation Act, but listed on the Department of Conservation and Land Management's Reserve List.
Seasonal wetlands	Wetland with surface water for only part of the year.
Sumpland	A basin wetland seasonally inundated irrespective of vegetation cover.
Swamp	A wetland dominated by emergent vegetation (rather than open water), whether permanent, seasonal or ephemeral.
Value	The importance of a wetland as expressed in terms of its functions.
Wetland	An area of permanent, seasonal or intermittent inundation, whether natural or otherwise; fresh, brackish or saline; static or flowing.

Appendix 1

Field survey sheet

Field survey sheet

The field sheet has been designed to simplify the collection and processing of the field information.The majority of questions are contained within single and double boxes. The questions within the **single** boxes can be answered by referring to maps, aerial photography, the System 6 Red book or local government information, without the need for field checking.

Questions within **double** boxes are best answered after the completion of the field investigations. Question 2b (habitat diversity) should not be attempted until the relevant field data has been collected for nearby wetlands. Question 14 (historical and archaeological features) is best answered after considering the wetland system as a whole.

The questionnaire can be used for wetlands with or without well defined boundaries. If the wetland has a well defined boundary **all** questions should be answered. If the boundary is poorly defined, answer only those questions marked with a @

Do not fill out the scoring section until all the data has been collected for the wetlands in the study area and has been entered on the sheets. The additional information collected (eg geology, soil type, System 6 recommendation number etc) will be used during the formulation of management plans or a regional wetland policy. Provision is also made for miscellaneous comments at the end of the questionnaire.

FIELD AND SCORE SHEET

A. RESOURCE DATA

WETLAND NAME _____

IS THE BOUNDARY WELL DEFINED OR POORLY DEFINED? (Underline correct response)

LOCATION (nearest road or junction) _____

DATE(S) VISITED _____ FIELD WORKER _____

LOCAL GOVERNMENT AUTHORITY _____

MAP REFERENCE _____

AERIAL PHOTOGRAPH RUN _____ NUMBER _____

B. NATURAL ATTRIBUTES — SCORE

@1 Environmental geology classification

Geology _____ Soil type _____ Distribution restricted? Yes/No

@2 ADJACENT WETLANDS

Are there wetlands within a 2 km radius? Yes/No

3 HABITAT DIVERSITY

Is the composition and structure of the vegetation significantly different to that found at nearby wetlands? (refer to Q5) YES/NO

4. DROUGHT REFUGE

Is the wetland important as a drought refuge for water birds? (Tick appropriate box) Major [ ] Minor [ ] None [ ]

@5. AREA OF WETLAND (or wetland unit for Part IIB wetlands)

Estimate the diameter of the wetland [m], and/or its length [m] and breadth [m],

or calculate the area of the wetland. and tick the appropriate box.

0-10ha [ ] 10-25ha [ ] 25-50ha [ ] 50-100ha [ ] >100ha [ ]

@6. HABITAT TYPE

No. of habitat types visible from the aerial photo _____

Tick the appropriate boxes for habitat types present.

a. Vegetation over one hectare in area.

Large paperbarks (>2.5m tall) in dense clumps	[ ]
Low thickets of *Melaleuca, Kunzea* or *Astartea* spp.	[ ]
Paperbark fringe	[ ]
Typha	[ ]
Extensive inlake beds of sedges	[ ]
Extensive beds of *Typha* or rushes	[ ]
Scattered 'clumps' of rushes or sedges	[ ]
Fringing rushes and sedges	[ ]
Samphire or saltmarsh	[ ]

b. Other habitats

Flooded grasslands in winter/spring	[ ]
Mud flats or seasonally dry open water	[ ]
Islands — natural or human made	[ ]
Fringing woodland or heath	[ ]
Permanent shallow open water (<0.5m deep)	[ ]
Permanent deep open water (>0.5m deep)	[ ]
Scattered paperbarks	[ ]

SCORE

7. EMERGENT VEGETATION

How much of the wetland is covered with emergent vegetation?

Calculate AREA OF EMERGENT VEGETATION x 100 / AREA OF WETLAND

Tick the appropriate box

40-60%	[ ]	30-40% or 60-70%	[ ]		
20-30% or 70-80%	[ ]	10-20% or 80-90%	[ ]	<10% or >90%	[ ]

8. ADVERSE WATER QUALITY

Have any of the following been observed/recorded by fieldworkers or locals?

Algal blooms (free-floating)	[ ]	Algal mats (filamentous)	[ ]		
High nutrient levels	[ ]	Pollution slicks	[ ]	Botulism	[ ]

@9. DRAINAGE

Are there any drains coming in or out? (circle correct response)

Drains in drains out No drains

If drains come into the wetland circle type(s) of drains present

off-road stormwater drains open drains from urban/industrial land open drain from rural land

10. ADJACENT NUTRIENT SOURCES

Note the presence of any of the following:

Septic tanks within 100m	[ ]	Seasonally fertilised lawns or grazing areas	[ ]
Unbunded rubbish tips/landfill	[ ]	Agriculture with high nutrient output	[ ]

@11. AREA OF WETLAND MODIFIED (or wetland unit for Part IIB)

What percentage of the wetland and buffer has been modified within the boundaries you have chosen? To determine this you may need to calculate as follows. Tick the appropriate box after calculation.

TOTAL AREA MODIFIED x 100 / AREA OF WETLAND + BUFFER

NOTE: Ignore buffer size for Part IIB wetlands

0-10%	[ ]	11-20%	[ ]	21-30%	[ ]
31-40%	[ ]	>40%	[ ]		

12. RESERVE AREA

Wetland area (refer to question 10) _____

Calculate the area of reserved land containing the wetland, AND/OR area of private land allocated to the wetland by the landowner(s) _____

(Show calculation in margin)

@13. NATIVE VEGETATION BUFFER

What is the total perimeter of the wetland? _____ m

What percentage of the property boundary chosen is at least 50m from the wetland edge and is covered with native vegetation?

100-90%	[ ]	79-70%	[ ]	59-50%	[ ]
89-80%	[ ]	69-60%	[ ]	50%	[ ]

C. HUMAN USE — SCORE

@1. AESTHETICS

Record any of the following aspects related to aesthetics:

Little if any artificial noise	[ ]
Steep ridge visible as part of scenery	[ ]
Ridge accessible giving view of wetland	[ ]
Wetland is a lake & open water easy to view	[ ]
Understorey mostly intact	[ ]
Few or no roads or buildings obvious from wetland	[ ]
A section of wetland exists where few people visit	[ ]

@2. HISTORICAL/ARCHAEOLOGICAL FEATURES

Note the presence of any of the following:

Aboriginal site	[ ]	Pioneer relics	[ ]
National Trust site	[ ]	National Estate listing	[ ]

@3. SECURITY OF WETLAND

Total No. of owners _____

Using the codes below list the owner types

PO - private; LA - local authority; VA - vested res or DPUD land;

CL - vacant Crown land

Owner 1 _____ Owner 2 _____ Owner 3 _____

Major owner _____

Reserve class and number _____

Reserve purpose:

a In full

b Summary: tick the appropriate box.

A Class Reserve for conservation/recreation	[ ]
MRS owned by local authority or government department	[ ]
other vested reserve	[ ]
other (eg private or vacant Crown land)	[ ]

System 6 Recommendation No. _____ MRS Zone _____ (use codes below)

PAR - parks & recreation; PUB - public purposes; RRL - rural; SF- State Forest; IND - industry & special industry:

TRS - transport (road and rail); URB - urban, urban deferred, civic and cultural

@4. PROTECTION GROUPS

Are there active protection groups for this wetland? Yes/No

If yes give the details below.

NAME(S) _____

CONTACT PERSON(S) _____

_____

ADDRESS(ES) _____

_____

_____

PHONE NUMBER(S) _____

@5. PASSIVE RECREATION — SCORE

Is the wetland used or has it facilities for the following — tick the appropriate box(es)?

nature study/bird watching	[ ]	education (school < 500m)	[ ]
picnic/barbecue facilities	[ ]	recognised tourist venue	[ ]
conservation of flora	[ ]	conservation of fauna	[ ]
recognised research site	[ ]	protection/preservation of other attributes	[ ]

@6. ACTIVE RECREATION

Is the wetland used or has it facilities for any of the following active recreational pursuits:

walking, jogging or cycling [ ] horse riding [ ] trail bikes [ ]

playground [ ] oval [ ] other [ ]

@7. OTHER HUMAN USES

Is the wetland used for any of the following? - tick box(es)

agriculture	[ ]
mining (check for mining leases)	[ ]
water supply	[ ]
existing/proposed service corridors (roads, SEC)	[ ]
proposed urban/housing	[ ]
private purpose other than above	[ ]

@E. **Presence of rare species.** List here rare species (gazetted and other priority) known at the site. Note 1. species name, priority number, and source of information

_____

_____

_____

@F. **Private human uses.** Note here any evidence of private use for wetlands on private land. Also note comments of land owner.

_____

_____

_____

@ G MAKE A ROUGH SKETCH OF THE AREA, BELOW OR ATTACHED, INCLUDING IF YOU CAN THE BOUNDARIES YOU CHOSE, DIMENSIONS, NORTH DIRECTION, RESERVES, WATERBODY, VEGETATION ZONES, TRACKS, ROADS, FENCES, ETC.

MISCELLANEOUS COMMENTS

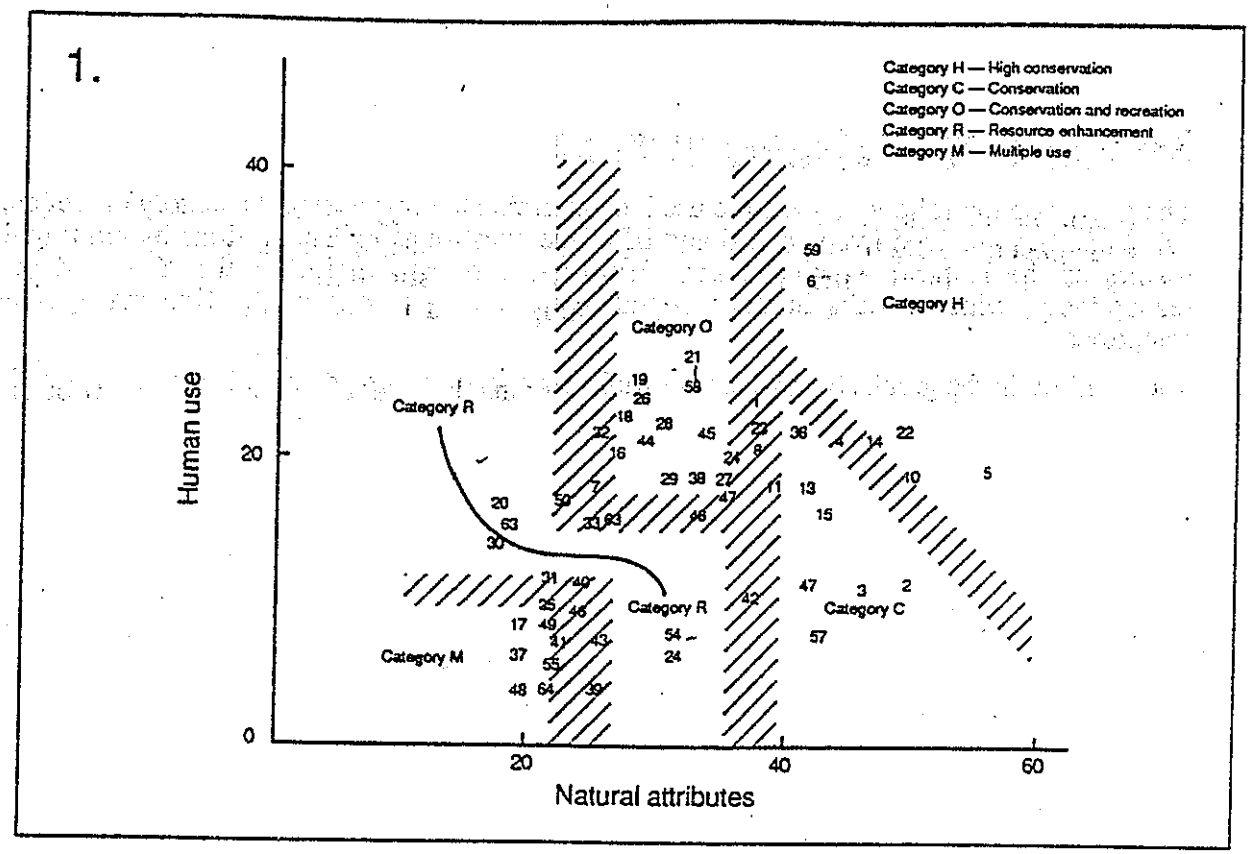
Appendix 2

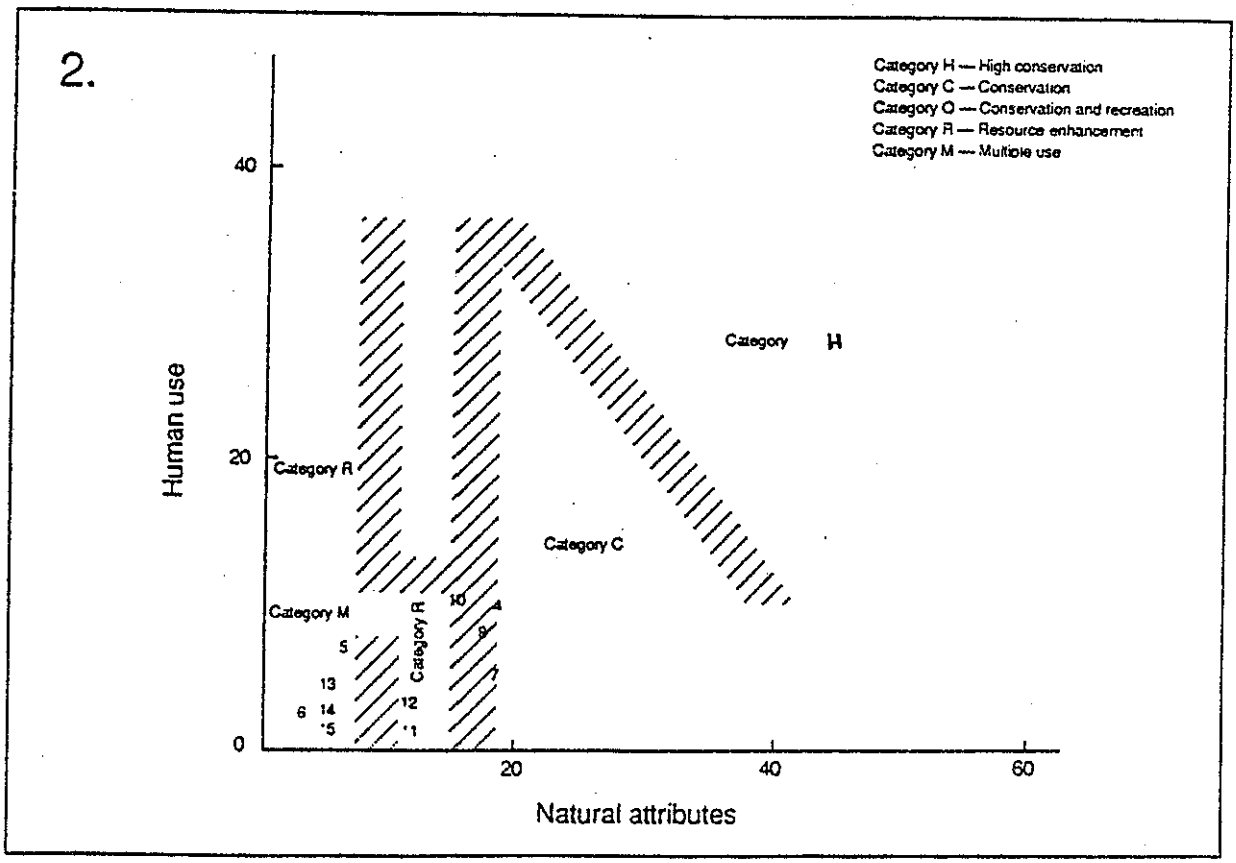
Management category graphs

Management category graphs

The graphs on the following page are used to determine the management category of wetlands using the data obtained from parts II and III of the questionnaire. This is done by plotting the results of the Natural Attributes and Human-use questionnaire on the Y and X axes respectively, which results in the wetland being placed in one of the five management categories.

The numbers in the graphs below identify wetlands already assessed using Bulletin 227 or 374.





Graph 1 : Management categories for permanent and seasonal wetlands with well defined boundaries.
Graph 2: Management categories for seasonal and episodic wetlands with poorly defined boundaries

Appendix 3

Summer drought refuge index

Summer drought refuge index

The table below provides information on the relative importance of metropolitan wetlands as drought refuges for waterbirds and water depths during summer. The table is based on the records of the Water Authority of Western Australia (1982-89) and the Royal Australasian Ornithologists Union's waterbird project. As the majority of Perth's wetlands dry out during the summer, wetlands which do not appear on the list below probably do not contain any water at this time of year.

Wetland	Permanent Open Water <50cm deep	Permanent Open Water >50cm deep	Drought refuse importance
Adams	x		None
Beonaddy	x		Minor
Bibra	x		Major
Blue Gum			Minor
Bollard Bullrush	x		Minor
Booragoon		x	Major
Canning River	x	x	Minor
Carabooda	x		Minor
Careniup	x		Minor
Carine	x		Minor
Claremont			Minor
Coogee	x		Minor
Coogee Spring	x		Major
Cooloongup	x		Minor
Forrestdale			Minor
Goollelal	x		Minor
Gwelup	x		Major
Hazelmere	x		Minor
Herdsman	x	x	Major
Heirisson Island	x	x	None
Interchange	x		Minor
Jackadder	x		Minor
Jandabup			Minor
Joondalup	x		Major
Loch McNess	x	x	Major
Mariginiup	x		Minor
Mary Carroll	x		Minor
McDougall Park	x		Minor
Mongers		x	Major
Neerabup	x		Minor
North	x		Major
Nowergup	x	x	Major

Wetland	Permanent Open Water <50cm deep	Permanent Open Water >50cm deep	Drought refuse importance
Perry Lakes			Minor
Pipidinny	x		Minor
Queen's Gardens	x	x	Minor
Richmond		x	Major
Shenton Park	x		Minor
Spectacles	x		Minor
Thomsons			Minor
Tomato	x		Minor
Yangebup	x		Major
Yonderup	x		Major

Appendix 4

History behind this Bulletin

Appendix 4 - History behind this Bulletin

In 1986, the Environmental Protection Authority received a proposal from the Water Authority of Western Australia to abstract large volumes of water from the Gnangara Mound. As this proposal had the potential to adversely affect wetlands by lowering the water table it was necessary to place controls over the level of water abstraction. The controls imposed a limit to the volume of water that could be abstracted from the mound through constraints to the levels to which lakes would be allowed to fall as a result of the water abstraction.

Consequently, it was necessary to examine the wetlands on the mound and to determine the purpose for which individual wetlands should be managed.

The Environmental Protection Authority developed a procedure for evaluating individual wetlands and placing them into one of five management categories according to their biological, geological and/or social attributes. As the management objectives for each category are defined, it is then possible to set appropriate management criteria.

The approach also had the advantage of resolving conflict between government authorities, community groups and individuals about the 'value' of individual wetlands by making it possible to decide objectively the purpose for which they should be managed.

During the formulation of the assessment process for the Gnangara Mound, it was recognised that the basic principle of evaluating wetlands and assigning them to management categories could be used elsewhere in the State. In 1986, the Environmental Protection Authority produced Bulletin 227 "Draft Guidelines for Wetland Conservation in the Perth Metropolitan Area" and released the document for public comment. This Bulletin contains a wetland evaluation questionnaire formulated for the Swan Coastal Plain along with supportive text.

Over the following months submissions suggesting improvements to the document were received from community groups, wetland researchers, local and State government administrators and private individuals. Changes were required to enhance the practical application of the questionnaire, to meet the objectives of the recently completed State Conservation Strategy and to provide more information to the user about wetland management.

In response to those submissions and experienced gained in the application of the questionnaire, Bulletin 227 was revised as Bulletin 374. The revised questionnaire was extensively field tested in the Shires of Serpentine-Jarrahdale and Gingin by the Water Authority of Western Australia and staff and students of Murdoch University.

The Environmental Protection Authority has intensively promoted the use of the wetland evaluation method (through Bulletin 374) by metropolitan local authorities in particular so that they may make use of it planning and management of wetlands in their area, and to assist them in considering development proposals affecting wetlands. Encouragement of its use has also been made to State Government instrumentalities whose operations may affect wetlands, as well as developers and their consultants in the formulation of their development plans.

The Water Authority has been the most active agency applying the wetland evaluation method, and has been done in conjunction with its recent wetland mapping work. The Water Authority has recently mapped wetlands of the Perth region from Wedge Island to Dunsborough, and prepared a broadsheet showing the wetland resource in the near Perth region. The wetland mapping is available also in digital form from the Water Authority.

Preliminary management objectives for 2000 of Perth's remaining wetlands have been determined using the wetland evaluation method based on the Water Authority of Western Australia mapping. This has been co-ordinated by the Water Authority with advice from the Gnangara Mound Technical Advisory Group and the Western Australia Water Resources Council. Evaluations were carried out over four years by environmental science students at Murdoch University, Environmental Protection Authority staff and by consultants Joan Payne, Jan Rodda and Garry Middle.

The Environmental Protection Authority and the Water Authority are soon to publish a broadsheet which depicts the management categories for these 2000 wetlands as well as Swan Coastal Plain Policy lakes. The Water Authority also has the information on wetland management categories available in digital form.

To further assist local authorities and other agencies with an interest and role to play in looking after wetlands on the Swan Coastal Plain the Environmental Protection Authority and the Water Authority are preparing wetland 'atlases' showing the boundaries of environmental protection policy lakes, Bulletin 374 management categories, System 6 recommendation areas and the wetlands mapped by the Semeniuks. The atlases are to be distributed in 1993.

Since the publication of Bulletin 374, some minor modifications to the application of the questionnaire have been made. The Authority believes that it is timely that, with the release of the "Strategy for the Protection of Lakes and Wetlands of the Swan Coastal Plain", (EPA Bulletin 685), Bulletin 374 should be updated to reflect the principle in that Strategy and to make minor modifications in light of the experience since 1990.