

Local Government BIODIVERSITY PLANNING Guidelines

for the Perth Metropolitan Region

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June 2004

Addendum for the South West Biodiversity Project Area

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Foreword

Local Governments in the South West Biodiversity Project Area directly manage more than 5,600 hectares of native vegetation, wetlands and waterways. Furthermore, they are required to make land use planning decisions over more than 970,500 ha. These decisions have the potential to significantly impact on biodiversity.

To assist Local Governments to take a more strategic approach to the retention, protection and management of bushland, wetlands and other natural areas, the Australian Government's Natural Heritage Trust 1 provided over \$1 million to the Western Australian Local Government Association's Perth Biodiversity Project in 2002. The project assisted Local Governments through a variety of on-ground and capacity building activities and in June 2004 published the 'Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region' ('the Guidelines'). The Guidelines promote a strategic planning framework to provide Local Governments with an understanding of the values of biodiversity in the Perth Metropolitan Region and a methodology for preparing and implementing Local Biodiversity Strategies.

In 2005 the Western Australian Local Government Association initiated the South West Biodiversity Project to engage 12 Local Governments in the South West NRM Region to follow a similar approach to strategically plan for biodiversity conservation.

This Addendum is designed to complement the Guidelines by providing additional ecological data and planning principles specific to the South West project region. The South West Biodiversity Project aims to facilitate Local Governments in the South West to develop a Local Biodiversity Strategy, provide technical and financial assistance (through targeted grants funding) and improve Local Government capacity to conserve biodiversity. The project is a strategic initiative of the South West Catchments Council funded by the Natural Heritage Trust (NHT) and the National Action Plan for Salinity and Water Quality (NAP), joint programs of the State and Australian Governments.

We hope that this Addendum to the Guidelines will significantly help Local Government staff and councillors, the community, consultants and State Government staff, by leading to greater protection and management of the South West's world-class biodiversity. The Guidelines and this Addendum are significant resources developed to assist Local Governments to strategically conserve their biodiversity assets.



Cr Bill Mitchell
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South West Catchments Council



Acronyms

CITES	The Convention on International Trade in Endangered Species
DAFWA	Department of Agriculture and Food Western Australia
DEC	Department of Environment and Conservation
DLI	Department of Land Information
DRF	Declared Rare Flora
EP Act	Environment Protection Act 1986
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPP Lake	Lakes defined in the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992
GBRS	Greater Bunbury Region Scheme
GIS	Geographic Information System
IBRA	Interim Bioregionalisation of Australia
JF	Jarrah Forest IBRA Region
LNA	Local Natural Area
LPP	Local Planning Policy
LPS	Local Planning Scheme
LSNA	Locally Significant Natural Area
NAC	Natural Area Condition target
NAIA	Natural Area Initial Assessment
NHT	Natural Heritage Trust
NRM	Natural Resource Management
NVIS	National Vegetation Information System
PFI	Priorities for Further Investigation of Local Natural Areas
PLSNA	Potentially Locally Significant Natural Area
PMR	Perth Metropolitan Region
PRS	Peel Region Scheme
RFA	Regional Forest Agreement
SCP	Swan Coastal Plain
SPP	State Planning Policy
SWBPA	South West Biodiversity Project Area (see Figure 3)
TEC	Threatened Ecological Community
WAPC	Western Australian Planning Commission
WAR	Warren IBRA Region

Key technical terms used in this manual are defined in the Glossary in the Guidelines.

Executive summary

"The South West of Western Australia is a significant biological asset which has world recognition for the diversity of species and the number of species found only here and no where else on the planet. We are privileged to have our beautiful forests, beaches and wetlands but with that privilege comes a responsibility to protect them against threats and conserve them for future generations.

One of the most urgent threats at this time is the demand for urban development to cater for the booming economy and the rapidly growing population of our State. Unfortunately it is the undeveloped remnant vegetation which provides the cheapest land to meet that required supply, and so it is these precious natural areas which are most at threat from urban growth. The key to providing sustainable growth, which considers the quadruple bottom line of economic, environmental, social issues and cultural issues, is careful strategic planning. The aim is not to constrain or impede economic prosperity to protect the environment, but rather to undertake growth and development in a way which not only preserves and sustains our environment but also enhances it.

The amount of solid data available for much of the South West is relatively limited. This Addendum provides the most up to date ecological criteria, statistics and information specific to the South West Biodiversity Project Area. A number of the tables split up the data into Shires and so provide a direct reference for 13 Local Governments to assist in target setting, natural area assessments and prioritisation for both conservation and management into the future.

The funding through the South West Catchments Council for the publishing of this Addendum represents delivery of a valuable tool to Local Governments and paves the way for better biodiversity conservation outcomes."

Tony Brun, Chairman, South West Catchments Council

Background

The South West of Western Australia is internationally recognised as one of the world's 'biodiversity hotspots' (Myers *et al.* 2000). The region is a global priority for conservation because of its great richness in endemic plants, animals and the ecological communities of which they are part. However these valuable biological assets are facing a range of threats, the most pressing of which is the habitat loss caused by clearing of native vegetation for urban development. The urbanisation of the South West is now occurring so rapidly that it is often in advance of recognition and protection of the region's unique biological heritage.

Local Governments have an important role to play in influencing the management of natural areas. In the South West Biodiversity Project Area (SWBPA) they are responsible for the direct management of 5,636 ha of native vegetation. Yet, the greater potential to change biodiversity outcomes is by land use planning and decision making. These decisions may be made over more than 970,531 ha of vegetation (68% of what remains) (Department of Agriculture and Food Western Australia 2006). Further, Local Governments are in the position to engage with the community, fostering appreciation of the region's natural features and encouraging management for conservation by private landholders.

The South West Biodiversity Project was created in 2005 to assist Local Governments in this important work. The increasing pressure on natural areas caused by development concentrated on the Swan Coastal Plain made this area a priority. Provision of assistance to Local Governments in strategically planning for biodiversity conservation was made a key task. As the South West Biodiversity Project was modelled on the successful Perth Biodiversity Project, it adopted the framework

created in the 'Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Area' ('the Guidelines'), published by the Western Australian Local Government Association in June 2004. The Guidelines introduce a four-phase local biodiversity planning process culminating in the preparation and implementation of a Local Biodiversity Strategy.

Local biodiversity planning process

The local biodiversity planning process promoted in the Guidelines assists Local Government to:

- ▶ determine the protection status of all Locally Significant Natural Areas (areas that meet one or more Local Significance Criteria)
- ▶ formalise policies and processes to ensure biodiversity considerations are integrated into their assessment of development proposals and construction activities
- ▶ develop and provide incentives to encourage private land conservation
- ▶ plan for the management of local reserves and other Local Government lands to conserve biodiversity.

The local biodiversity planning process consists of four phases: scoping, preparation of a Discussion Paper, preparation of a Strategy and implementation of the Strategy. Associated with the process are milestones that recognise the achievements of Local Government.

Using this Addendum

A part of the Guidelines has been adapted in this Addendum to address more specifically the ecological issues pertaining to the South West rather than the Perth Metropolitan Region, particularly within the Local Government areas that comprise the South West Biodiversity Project Area (SWBPA) (Figure 1).

The SWBPA is determined by Local Government boundaries rather than biogeographical or catchment boundaries. Local Governments currently subscribing to the project are the Cities of Mandurah and Bunbury and the Shires of Serpentine-Jarrahdale, Murray, Waroona, Harvey, Dardanup, Donnybrook-Balingup, Bridgetown-Greenbushes, Busselton, Augusta-Margaret River and Manjimup. Statistics for the Shires of Capel and Nannup have also been included in this Addendum for completeness.

It should be noted that in defining the SWBPA, the Shire of Serpentine-Jarrahdale has not been included. The Shire of Serpentine-Jarrahdale is a member of the SWBP and part of the South West NRM region administered by the South West Catchments Council. However, the Shire is also within the Perth Metropolitan Region and accordingly the planning policy issues relating to the Metropolitan Region Scheme and Bush Forever are applicable. Thus the Guidelines adequately provide a framework and ecological criteria for the Shire of Serpentine-Jarrahdale.

This Addendum modifies Chapters 3, 4, 5, 6, 12 and 16 and Section 10.7 of the Guidelines and entirely substitutes those parts of the Guidelines with this Addendum. There is some duplication of text from the Guidelines to avoid the need for the reader to refer to the Guidelines for these substituted chapters.

All material cited in this Addendum is provided in a list of references independent from that in the Guidelines. To maintain order in the Addendum, citations in some situations will not match those in the Guidelines. For instance "Government of Western Australia 2003c" in the Guidelines has become "Government of Western Australia 2003a" in the Addendum.

An overview of the contents of the Addendum, to be read in conjunction with the Guidelines, is provided overleaf.



PART A – SETTING THE SCENE

Part A provides important background information on the biodiversity of the South West Biodiversity Project Area and defines the ecological criteria relevant for recognising the biodiversity values of Local Natural Areas.

Chapter 3 clarifies the roles and responsibilities of Local Governments for protection and management of biodiversity as defined by key Federal, State and local legislation and policy.

Chapter 4 has been modified to refer specifically to biodiversity assets and threats in the South West region, and more particularly in the SWBPA.

Chapter 5 now includes, amongst other amendments, essential and desirable criteria for the SWBPA which will assist Local Governments to identify and prioritise Locally Significant and Potentially Locally Significant Natural Areas.

Chapter 6 discusses ecological criteria used to assess viability and considers local ecological linkages for the SWBPA.

It is important that Chapters 1 and 2 of the Guidelines and Chapters 3, 4, 5 and 6 of this Addendum are read and understood before embarking on local biodiversity planning as Part A provides the principles and criteria that underpin the local biodiversity planning process outlined in Part B.



PART B – LOCAL BIODIVERSITY PLANNING PROCESS

Part B of the Guidelines aims to guide Local Government through the four-phase local biodiversity planning process that includes scoping, preparation of discussion paper, preparation of the Local Biodiversity Strategy and implementation of the Local Biodiversity Strategy.

Section 10.7 has been adapted to provide direction for Local Governments in the SWBPA to prioritise Locally Significant Natural Areas and modified tables have been substituted for Tables 10 to 13.



PART C – IMPORTANT INFORMATION TO HELP IN DEVELOPING A LOCAL BIODIVERSITY STRATEGY

Part C provides information and templates to assist Local Governments in completing the four phases of the local biodiversity planning process. Information specific to each Local Government within the SWBPA is provided in Chapter 12 along with templates for Natural Area Initial Assessment (NAIA) and a recently developed NAIA summary sheet which incorporates the ecological criteria specific to the SWBPA. Chapter 16 provides tables of statistics for each of the Local Governments within the SWBPA. Sections in the Guidelines that refer solely to Bush Forever or the Metropolitan Regional Scheme have been omitted in this Addendum and do not have corresponding sections.

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Figure 1: South West Biodiversity Project Area showing Local Government Boundaries and Native Vegetation Extent by Administrative Planning Category

Part A - Setting the scene

3. Legislation and policies

There are numerous international arrangements, as well as Federal, State and Local laws and policies that are linked to biodiversity conservation. Local biodiversity planning will assist Local Governments to meet their responsibilities under these laws and policies as well as achieve sustainable development and Natural Resource Management (NRM) objectives. Legislation and policy is subject to ongoing revision and replacement. Relationships between State and Commonwealth legislation and development processes are also evolving. New opportunities for biodiversity conservation may arise with increased use of market-based instruments. These are likely to be accompanied by new regulation.

Current legislative requirements and policy should be checked for updates. Unofficial copies of Commonwealth legislation can be found on the Attorney General's Department website 'ComLaw' <http://www.comlaw.gov.au/> while unofficial copies of Western Australian legislation can be found on the State Law Publisher website at <http://www.slp.wa.gov.au/legislation/statutes.nsf/default.html>.

Legislation and policies particularly significant for the preparation of Local Biodiversity Strategies are discussed in more detail below.

3.1A International agreements and treaties

Australia is party to various international agreements that are relevant to biodiversity conservation issues. The agreement currently placing most responsibility on all levels of Government is the United Nations Convention on Biological Diversity. Other significant international agreements include the Convention on International Trade in Endangered Species (CITES), the World Heritage Convention and Convention on Migratory Species of Wild Animals ('The Bonn Convention') as well as other agreements regarding migratory species. These international agreements are interpreted in policy and enacted in Federal and State law. For instance, the Environment Protection and Biodiversity Conservation 1999 Act (EPBC Act) refers to internationally significant wetland sites recognised under the Ramsar Convention and species identified in the Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment (CAMBA) (Department of the Environment and Water Resources 2007a).

Convention on Biological Diversity

Objectives of the Convention on Biological Diversity are conservation and sustainable use of biological diversity, and fair and equitable sharing of benefits from genetic resources. Parties undertake to:

- ▶ develop national strategies;
- ▶ identify and monitor components of biodiversity and adverse processes;
- ▶ establish protected areas;
- ▶ undertake sound management of biological resources outside reserves;
- ▶ integrate conservation and sustainable use into national decision making;
- ▶ protect and encourage customary use of biological resources; and
- ▶ provide incentives for conservation and sustainable use of biological diversity.

See <http://www.cbd.int> for more information.

Convention on International Trade in Endangered Species

The CITES convention seeks cooperation among nations to regulate international trade in wildlife. Species are categorised by schedules based on level of threat posed by their trade. These are species threatened with extinction, which are or may be affected by trade; species which, although not necessarily currently threatened, may become so unless trade is strictly regulated; and species that any party identifies as being subject to regulation within its jurisdiction to prevent or restrict exploitation. See <http://www.cites.org/> for more information.

Ramsar Convention

The Ramsar Convention (The Convention on Wetlands of International Importance especially as Waterfowl Habitat) establishes criteria for recognition of internationally significant wetlands. Wetlands that meet the following criteria may be added to the Ramsar list:

- ▶ are representative, rare or unique;
- ▶ support vulnerable or endangered species;
- ▶ maintain biological diversity of a region;
- ▶ provide essential refugia;
- ▶ support more than 20,000 waterbirds or more than 1% of the population of a waterbird species;
- ▶ have a significant proportion of indigenous fish species, thereby contributing to maintenance of global biodiversity; and
- ▶ provide important feeding, spawning or nursery grounds or migration paths for fish.

Parties undertake to protect the values that led to their listing. The Ramsar Convention is of particular interest in regard to wildlife management, in that it also seeks to provide guidelines for wise use of wetlands. The generality of the language used in the convention has spawned a great deal of debate about methods for making the principles of wise use operational. It is probable that greatest progress will be made by establishing and thoroughly documenting case studies that show the principles in action. See <http://www.ramsar.org/> for more information.

3.1 Federal Government legislation and policies relating to biodiversity

3.1.1 Federal Government legislation

The most significant Federal Government legislation relating to biodiversity is the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Subsequent legislation with the effect of amending this Act includes the Environment Protection and Biodiversity Conservation Amendment (Wildlife Protection) Act 2001 and the Environment and Heritage Legislation Amendment Act 2003. Other legislation with relevance to biodiversity planning includes the Regional Forest Agreements Act 2002 (RFA).

Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides for the assessment of actions, which, if implemented, may significantly impact on a matter of national environmental significance. There are seven matters of national environmental significance that are triggers for Commonwealth assessment and approval.

These are:

- ▶ World Heritage properties;

- ▶ National Heritage places;
- ▶ wetlands that are listed as Ramsar wetlands of international importance;
- ▶ nationally threatened species and communities that are listed under the EPBC Act (note that these species may not be the same as those listed under State legislation);
- ▶ migratory species that are listed under the EPBC Act (these are migratory species protected under international agreements);
- ▶ nuclear actions, including uranium mining; and
- ▶ the Commonwealth marine environment (which is generally Australian waters beyond the three nautical mile limit of State waters).

Under the EPBC Act a person must not take an action that is likely to have a significant impact on any of these matters of national environmental significance without approval from the Commonwealth Environment Minister. There are penalties for taking such an action without approval (Department of the Environment and Water Resources 2007b). Any need for Commonwealth approval does not diminish the need for Local and State Government approvals. Responsibility for ensuring that all necessary approval for a development has been achieved lies with the developer. However, Local Governments are encouraged to inform developers if they are likely to require approval under the EPBC Act. A protected matters search tool is located at <http://www.environment.gov.au/erin/ert/epbc/index.html>. Searches can be made by entering coordinates, defining an area on a map or by Local Government Area.

Listings of Threatened Ecological Communities under the EPBC Act are presently about two years out of date with current State listings. In addition, only those ecological communities in Western Australia identified by the State as 'critically endangered' are identified under the Act. The communities within the SWBPA currently listed under the EPBC Act are presented in Section 16.2 of this Addendum.

The EPBC Act is accompanied by regulations: Environment Protection and Biodiversity Conservation Regulations 2000. These regulations have been progressively amended. Relevant matters addressed by the regulations include matters of national environmental significance, referral of proposals, assessing impacts, species and communities.

There is legislation subsequent to the EPBC Act that has the effect of amending this Act. The Environment Protection and Biodiversity Conservation Amendment (Wildlife Protection) Act 2001 codifies the CITES Convention and replaces earlier legislation related to wildlife collection and use. It has relevance to scientific collection and breeding programs for native species. The Environment and Heritage Legislation Amendment Act 2003 amends the EPBC Act provisions on places of heritage significance. The Act identifies and protects places of national heritage significance, provides for their management and establishes a process for their listing. The regulations associated with this act are the Environment Protection and Biodiversity Conservation Amendment Regulations 2003.

3.1.2 Federal Government policies

Federal level biodiversity conservation policy includes:

- ▶ policies accompanying the EPBC Act. There are several types of policy designed to guide the application of this Act: Significant Impact Guidelines, Industry Guidelines, Nationally Threatened Species and Ecological Communities Guidelines and Practice Guidelines. See <http://www.environment.gov.au/epbc/policy/#guidelines> for the current status of these documents. Significant Impact Guidelines provide general advice on whether activities are likely to have biodiversity impacts considered 'significant' under the Act. Significant impact guidelines exist for matters of national environmental significance (Department of the Environment and Heritage, 2006a) and for actions on, or impacting upon, Commonwealth land and actions by Commonwealth agencies (Department of the Environment and Heritage, 2006b);

- ▶ **Industry Guidelines.** These provide guidance to particular industries. There are no current guidelines of relevance to Local Natural Areas in the South West. Four documents with potential relevance are in preparation: wind farms, agriculture, urban development and Local Government;
- ▶ **Nationally Threatened Species and Ecological Community Guidelines.** These address individual species or communities and clarify the activities and locations considered to be of likely significance. No South West species or communities are addressed by current guidelines but documents are in preparation for Carnaby's and Baudin's Black Cockatoos on the Southern Swan Coastal Plain, the Vasse-Wonnerup Ramsar-listed wetlands, the Western Ringtail Possum and Threatened Plant and Ecological Communities of the Southern Swan Coastal Plain;
- ▶ **Practice Guides.** These documents guide interpretation of some sections of the Act. Practice Guide 1 - Prior authorisation and continuing use exemptions - Sections 43A and 43B Department of the Environment and Heritage (2005);
- ▶ **The National Strategy for the Conservation of Australia's Biological Diversity (Commonwealth of Australia 1996)** produced as part of the Commonwealth/State/Territory intergovernmental agreement on the environment;
- ▶ **Natural Heritage Trust (NHT) Partnership Agreement (Commonwealth of Australia and State of Western Australia 1997);**
- ▶ **National Local Government Biodiversity Strategy (Berwick and Thorman 1999);**
- ▶ **National Framework for the Management and Monitoring of Australia's Native Vegetation (Australian and New Zealand Environment and Conservation Council (ANZECC) 2000a);**
- ▶ **National Objectives and Targets for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001a)** produced as part of the Review of the National Strategy for the Conservation of Australia's Biological Diversity (ANZECC 2000b) and signed by the Commonwealth and five State and Territory Governments, including Western Australia. The National Objectives and Targets for Biodiversity Conservation 2001–2005 recognises that the retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected. This level of recognition is in keeping with the targets set by ANZECC (2000b);
- ▶ **The National Weeds Strategy: A Strategic Approach to Weed Problems of National Significance (Agriculture and Resource Management Council of Australia and New Zealand, Australian and ANZECC and Forestry Ministers 1997;**
- ▶ **National biodiversity and climate change action plan 2004 – 2007 (Department of the Environment and Heritage, 2004); and**
- ▶ **Guidelines for indigenous participation in natural resource management (Australian Government, 2004).**

The Federal Government has also supported the preparation of a Local Government Biodiversity Toolbox, which provides advice for all Local Governments on biodiversity conservation, especially those in rural and regional Australia. The Toolbox promotes eight key outcomes for Local Governments that are reflected in the Guidelines. The Toolbox can be found on the Department of the Environment and Heritage's website <http://www.deh.gov.au/biodiversity/toolbox/index.html>.

3.2 State Government legislation and policies relating to biodiversity

3.2.1 State Government legislation

Wildlife Conservation Act 1950

The Wildlife Conservation Act 1950 is the primary State legislation directly protecting native flora and fauna in Western Australia. The Act contains general controls for

the protection of all native species, with specific measures designed to protect rare or threatened species. The legislation does not provide protection for Threatened Ecological Communities (TECs) or recognise threatening processes. It is anticipated that the proposed Biodiversity Conservation Act may replace this legislation (Government of Western Australia 2002a).

Conservation and Land Management Act 1984

The Conservation and Land Management Act 1984 makes provision for 'the use, protection and management of public lands and waters and the flora and fauna thereof'. The Act applies to State forest, timber reserves, national parks, conservation parks, nature reserves, marine nature reserves, parks and management areas and other land vested in the Lands and Forests Commission created under this Act. The Act defines the allowed uses and management responsibility for these areas. Under this Act the Land Administration Minister may compulsorily acquire land. Alternatively, the Department for Environment and Conservation (DEC) may enter into an agreement with the owner, lessee or licensee of any land thereby allowing the DEC to manage that land as a State forest or reserve or for some other purpose under the Act. Any such agreement will occur with the knowledge of the relevant Local Government, which has the opportunity to make written submissions on the matter.

The Act also allows for the establishment of statutory authorities such as the Department of Conservation and Land Management (now part of DEC), the Conservation Commission, the Marine Parks and Reserves Authority, and the Forest Products Commission. Under this Act, a body controlling a reserve must develop and implement a management plan for the reserve. This plan must specify the purpose of the reserve, define the policies and guidelines to be followed and summarise operations to be undertaken. Under the Act, land may be classified as a wilderness area, a limited (or prohibited) access area, a temporary control area, or a recreational use area. Licenses and permits for actions undertaken on these lands are issued under the Act.

Environmental Protection Act 1986

There are various ways in which the Environmental Protection Act 1986 (EP Act) protects biodiversity. Primarily, the EP Act enables Environmental Impact Assessment and refusal or modification of all proposals that are likely to have significant environmental impacts.

Section 38 of the EP Act deals with the referral and assessment of proposals that are likely to have a significant impact on the environment. Any decision-making authority, such as a Local Government, must refer such proposals to the Environmental Protection Authority (EPA) (Clement *et al.* 2001).

The Planning and Development Act 2005 requires Planning Schemes to be referred to the EPA. The EPA will decide whether or not the scheme requires environmental assessment. This provides the opportunity for a strategic assessment of significant environmental impacts identified on land affected by the Planning Scheme. Part IV (sections 48A – 48F inclusive) of the EP Act contains the procedure for this assessment. The relevant authority (the Local Government, in the case of a Local Planning Scheme) may be required to conduct an environmental review of the Scheme.

The EP Act also gives the State power to develop Environmental Protection Policies to prevent, control or abate pollution or to protect any portion of the environment. The Act also regulates industries and activities likely to pollute the environment.

The EPA, through the powers given to it under the EP Act can provide advice and guidelines to assist proponents, and the public generally, on environmental matters. This is provided in the form of Guidance Statements, Position Statements or advice under section 16 of the EP Act (see EPA policy and guidance for assessing planning schemes below).

Amendments to the EP Act introduced comprehensive clearing controls to Western Australia. These clearing controls replace the previous process under the Soil and

Land Conservation Act 1945. Clearing of native vegetation is primarily covered in Section 51 of the Act. These amendments came into force in 2004 and introduced the requirement to obtain a clearing permit before any clearing can take place, unless exempted under the Act.

As the DEC assesses applications for clearing permits it requires the relevant Local Government to provide comment. Local Biodiversity Strategies should enable Local Governments to more easily meet this requirement and provide well informed and comprehensive advice. An application to clear vegetation may be refused by DEC if the proposed clearing does not comply with the principles defined in the Act. Exemptions from the need to obtain a permit are listed both in Schedule 6 to the Act as well as the 'prescribed clearing' activities listed in Regulation 5 of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. These regulations also define Environmentally Sensitive Areas, where exemptions to the need for a permit do not apply. Amongst these Environmentally Sensitive Areas are defined wetlands and their 50 m buffers, Bush Forever sites and Threatened Ecological Communities determined by the Minister.

The regulations and their application are more comprehensively explained in documents such as A Guide for Local Government Clearing Native Vegetation under the Environmental Protection Act 1986 (Department of Environment 2005) located online at http://portal.environment.wa.gov.au/portal/page?_pageid=53,3217882&_dad=portal&_schema=PORTAL.

Planning and Development Act 2005

The Planning and Development Act 2005 consolidated and replaced several pieces of State legislation relating to planning: Western Australian Planning Commission Act 1985, the Metropolitan Region Town Planning Scheme Act 1959, and the Town Planning and Development Act 1928. In addition to increasing certainty regarding planning and development procedures the new Act was promoted as encouraging sustainability and expanding the role of the Western Australian Planning Commission (WAPC) in providing advice on development (Western Australian Planning Commission, 2006a).

The Act covers topics including:

- ▶ the establishment, functions and powers of the WAPC;
- ▶ preparation of State Planning Policies, Region Planning Schemes and Local Planning Schemes;
- ▶ declaration of Special Control Areas;
- ▶ the relationship between region planning schemes, local planning schemes, planning control provisions and written laws;
- ▶ subdivision and development control;
- ▶ compensation and acquisition;
- ▶ financial provisions; and
- ▶ enforcement and legal proceedings.

Under the Act, former 'Town Planning Schemes' are replaced by 'Local Planning Schemes'. New or amended Local Planning Schemes are referred to the EPA, which will determine if the Scheme must be assessed for environmental impacts (according to the EP Act s.48). If the Scheme is to be assessed, the relevant Local Government must provide to the EPA all public submissions regarding environmental matters. Furthermore, under the EP Act, as part of an assessment, the EPA may require a Local Government to conduct an environmental review of the Scheme. Sections 82 and 83 of the Planning and Development Act provide guidance on conducting this review. The Act also requires that upon creation of a Scheme, a Local Planning Strategy is also created. Local Planning Strategies must be advertised and subject to public comment before endorsement by the WAPC.

For further information on the changes introduced by the Act see 'Planning Bulletin 76 Planning and Development Act 2005 and Related Legislation' (Western Australian Planning Commission 2006a).

A layperson's description of the land planning system is included in Section 14 of the Guidelines to show the sequence of plans and decisions that ultimately lead to development and clearing or retention and protection of natural areas.

Aboriginal Heritage Act 1972 and the Commonwealth Native Title Act 1993

Many natural areas may constitute an Aboriginal site as described in Section 5 of the Aboriginal Heritage Act 1972. Anyone planning to develop land in a way that might disturb an Aboriginal site should be aware of their legal obligations and all reasonable efforts must be made to find out if any sites exist in the development area. Under the Aboriginal Heritage Act 1972, it is an offence to disturb any Aboriginal site without consent from the Minister for Aboriginal Affairs. The Aboriginal Heritage Act 1972 applies to:

- ▶ places of importance and significance where persons of Aboriginal descent have, or appear to have left any object, natural or artificial, used for, or made or adapted for use for, any purpose connected with the traditional cultural life of Aboriginal people, past or present;
- ▶ any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent;
- ▶ any place which, in the opinion of the Registrar, is or was associated with Aboriginal people and which is of historical, anthropological, archaeological or ethnographic interest and should be preserved because of its importance and significance to the cultural heritage of the State; and
- ▶ any place where objects to which the Act applies are traditionally stored, or to which, under the provisions of this Act, such objects have been taken or removed.

In Western Australia, information regarding the consultation process with the Indigenous community for Aboriginal sites can be obtained from the Department of Indigenous Affairs. The process requires wide consultation with all Indigenous communities/groups that may have an interest in the natural area.

A separate consultation process and social impact assessment may be required under the Commonwealth Native Title Act 1993, by which proponents should consult with the claimants of Native Title. The Native Title Act 1993 protects Aboriginal heritage to some extent by allowing claimants certain consultation rights depending on the nature of the development on the land (Aboriginal and Torres Strait Islander Commission, 1999). Further information on this process in the south west of Western Australia can be obtained from the South West Catchments Council's Indigenous Facilitator or from the South West Aboriginal Land and Sea Council.

Proposed Biodiversity Conservation Act

A consultation paper (Government of Western Australia 2002a) prepared by the State Government proposes that a new Biodiversity Conservation Act be introduced to protect all listed rare or threatened species and ecological communities and incorporate listing of threatening processes so that threat abatement plans can be developed.

The consultation paper also provides that the Minister for Environment may approve or recognise bioregional plans. An approved or recognised bioregional plan would need to be taken into consideration in making relevant decisions under the proposed Act (Government of Western Australia 2002a). A State Biodiversity Strategy is also proposed.

3.2.2 State Government policies

There is an expectation that the Local Governments within the SWBPA can and will reinterpret regional policy and apply it to their local situations. This becomes challenging given the range of regional strategies and policies and the reality of achieving multiple objectives (environmental, social, and economic) on-ground at the local level. The EPA releases Position Statements and Guidance Statements for various environmental issues and the WAPC prepares Statements of Planning Policy to guide land use planning. State policies also exist for regional areas, for example, the Swan Coastal Plain (SCP). Most existing regional policy deals with specific components of biodiversity such as bushland, wetlands or forest. Future policy (for example policy associated with the proposed Biodiversity Conservation Act) is likely to be more comprehensive in its treatment of biodiversity issues.

Local Governments should be aware of the following State policies when preparing Local Biodiversity Strategies:

- ▶ Environmental Protection (Peel Inlet - Harvey Estuary) Policy 1992 (Government of Western Australia 1992a);
- ▶ Environmental Protection (South West Agriculture Zone Wetlands) Policy 1998 (Government of Western Australia 1998a);
- ▶ Environmental Protection (Swan Coastal Plain Lakes) Policy (EPP Lakes) (Government of Western Australia 1992b);
- ▶ Environmental Protection Authority Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia (Environmental Protection Authority 2000a);
- ▶ Environmental Protection Authority Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (Environmental Protection Authority 2002);
- ▶ Environmental Protection Authority Position Statement No. 4: Environmental Protection of Wetlands (Environmental Protection Authority 2004a);
- ▶ Environmental Protection Authority Position Statement No. 5: Environmental Protection and Ecological Sustainability of the Rangelands in Western Australia (Environmental Protection Authority 2004b);
- ▶ Environmental Protection Authority Position Statement 7: Principles of Environmental Protection (Environmental Protection Authority 2004c);
- ▶ Environmental Protection Authority Position Statement No. 8: Environmental Protection In Natural Resource Management (Environmental Protection Authority 2005a);
- ▶ Environmental Protection Authority Position Statement No. 9: Environmental Offsets (Environmental Protection Authority 2006a);
- ▶ Environmental Protection Authority Guidance Statement No. 10: Guidance for the Assessment of Environmental Factors – Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1 region (Environmental Protection Authority 2006b);
- ▶ Environmental Protection Authority Guidance Statement No. 28: Guidance for the Assessment of Environmental Factors – Protection of the Lake Clifton Catchment (Environmental Protection Authority 1998);
- ▶ Environmental Protection Authority Guidance Statement No. 51: Guidance for the Assessment of Environmental Factors – Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia. (Environmental Protection Authority 2003a);
- ▶ Environmental Protection Authority Guidance Statement No. 56: Guidance for the Assessment of Environmental Factors – Terrestrial fauna surveys for environmental impact assessment in Western Australia. (Environment Protection Authority 2003b);

- ▶ Environmental Protection Authority Guidance Statement No. 33: (Draft): Environmental Guidance for Planning and Development (Environmental Protection Authority 2005b);
- ▶ Environmental Protection Authority Guidance Statement No. 6: Guidance for the Assessment of Environmental Factors – Rehabilitation of Terrestrial Ecosystems (Environment Protection Authority 2006c);
- ▶ Environmental Protection Authority Guidance Statement No. 19: (Draft) Guidance for the Assessment of Environmental Factors – Environmental Offsets (Environment Protection Authority 2007a);
- ▶ Western Australian Planning Commission Statement of Planning Policy No. 2.1: The Peel-Harvey Coastal Plain Catchment (Government of Western Australia 1992d);
- ▶ Western Australian Planning Commission Statement of Planning Policy No. 2.5: Agricultural and Rural Land Use Planning (Government of Western Australia 2002b);
- ▶ Western Australian Planning Commission Statement of Planning Policy No. 2.6: State Coastal Planning Policy (Government of Western Australia 2003a) (Amended 2006);
- ▶ Western Australian Planning Commission Statement of Planning Policy No. 2: Environment and Natural Resources Policy (Government of Western Australia 2003b);
- ▶ Western Australian Planning Commission Statement of Planning Policy No. 2.7: Public Drinking Water Source Policy (Government of Western Australia 2003c);
- ▶ Western Australian Planning Commission Statement of Planning Policy No. 6.1: Leeuwin-Naturaliste Ridge (Government of Western Australia 1998b) (Amended 2003);
- ▶ Western Australian Planning Commission Statement of Planning Policy No. 2.9: Water Resources (Government of Western Australia 2006a);
- ▶ Western Australian Planning Commission Statement of Planning Policy No. 1: State Planning Framework Policy (Variation No 2) (Government of Western Australia 2006b);
- ▶ Western Australian Planning Commission Development Control Planning Policy 6.1: Country Coastal Planning Policy, (Government of Western Australia 1999);
- ▶ Western Australian Planning Commission Development Control Policy No. 2.3: Public Open Space in Residential Areas Government of Western Australia (2002c);
- ▶ System 6 report (Department of Conservation and Environment 1983) and the System 6 Update program (Department of Environmental Protection unpub. 1996);
- ▶ Wetlands Conservation Policy for Western Australia (Government of Western Australia 1997);
- ▶ Position Statement: Wetlands (Water and Rivers Commission 2001);
- ▶ Western Australia's State Weed Plan (State Weed Plan Steering Group 2001);
- ▶ Wildlife Conservation (Rare Flora) Notice 2001 (Government of Western Australia 2001a);
- ▶ Wildlife Conservation (Specially Protected Fauna) Notice 2001 (Government of Western Australia 2001b);
- ▶ Forest Management Plan 2004 – 2013 (Conservation Commission 2003);
- ▶ Western Australian Greenhouse Strategy (Western Australian Greenhouse Taskforce 2004);
- ▶ Draft - A 100-year Biodiversity Conservation Strategy for Western Australia. Phase One: Blueprint to the Bicentenary in 2029 (Department of Environment and Conservation 2006);
- ▶ State Water Plan 2007 (Department of Premier and Cabinet 2007); and
- ▶ Making decisions for the future: Climate Change; The Premier's Climate Change Action Statement (Government of Western Australia 2007).

Most of these State policies are reflected in regional level policy described below.

Wetlands, waterways and catchments

Wetlands, including swamps, damplands, rivers and estuaries, have been given special consideration in the SWBPA due to their special values and the high impacts of development they have suffered in both urban and rural areas. The Wetlands Conservation Policy for Western Australia (Government of Western Australia 1997) identified the need to protect wetlands of international (Ramsar listed), national and regional conservation value. The challenge now for Local Governments is to link wetland biodiversity to the protection of upland native vegetation.

Specified open water wetlands on the coastal plain are currently protected by the Environmental Protection (Swan Coastal Plain Lakes) Policy ('EPP Lakes') (Government of Western Australia 1992b). The policy has the force of law and makes it an offence to fill, excavate, mine, deposit effluent into, or construct or alter any drainage works associated with any lakes to which the policy applies (Government of Western Australia 1992b).

In the SWBPA, a preliminary assessment of wetland values has been conducted and wetlands have been placed in one of three management categories according to their values, namely Conservation, Resource Enhancement or Multiple Use. A Position Statement has been developed outlining how wetlands in these categories should be addressed where development is proposed (Environmental Protection Authority 2004a). There is also a basic assumption that all new development around wetlands will meet water sensitive urban design principles (Water and Rivers Commission 2003).

Forests

Local Governments in the eastern portion of the SWBPA also need to be aware of the Forest Management Plan 2004 – 2013 (Conservation Commission 2003). The Forest Management Plan 2004 – 2013 makes recommendations for the use and management of forest ecosystems and has led to changes to land tenure and vestings.

EPA Policy and guidance for assessing Planning Schemes

Guidance Statement 33

In 1997 the EPA released draft Guidance Statement No. 33, Environmental Guidance for Planning and Development (Environmental Protection Authority 1997). This Guidance Statement was issued to assist Local and State Government planning agencies in the environmental impact assessment process defined for planning schemes under Section 48 of the Environmental Protection Act 1986 (Environmental Protection Authority 1997). Guidance Statement No. 33 identifies the areas of highest conservation value of interest to the EPA and provides policy advice on the management of environmental impacts of proposals that could have a significant impact on the environment.

A final version of these guidelines was not released and the 1997 draft is still a key document informing planning agencies of the expectations of the EPA with regard to management of environmental impacts. However, a substantially reviewed Guidance Statement No. 33 will significantly update the information available to Local and State Government planning agencies with regard to environmental planning. This document is planned for release by the end of 2007.

Guidance Statement 10

Guidance Statement 10 was prepared by the EPA in 2003 to provide guidance to proponents planning and designing proposals potentially impacting on regionally significant natural areas, threatened communities or species within the System 6 region and the Swan Coastal Plain portion of the System 1 region (Environmental Protection Authority 2006b). Guidance is provided on the criteria that must be met for a natural area to be recognised as regionally significant. Proponents are encouraged to

revise, redesign or manage proposals to avoid impacts on regionally significant natural areas and where these impacts cannot be resolved the proposal should be referred to the EPA.

Locally Significant Natural Areas (LSNA) are outside the scope of Guidance Statement 10 but the EPA expects that proposals impacting on LSNAs throughout System 6 and the Swan Coastal Plain portion of System 1 will be dealt with in a manner that is consistent with the intent of these guidelines regarding locally significant bushland (Environmental Protection Authority 2006b). It is important to note that the ecological criteria developed for these Guidelines (to identify LSNAs) also include the regional significance criteria summarised in Guidance Statement 10. Consequently there will be some LSNAs that will be subject to the requirements and process outlined in Guidance Statement 10.

3.3 Regional Natural Resource Management Strategies

The Commonwealth Government established the Natural Heritage Trust (NHT) in 1996 to help fund environmental activities at the National, State, Regional and Local levels. Regional NRM Strategies and their associated Investment Strategies are now the principle delivery mechanism for the NHT. Strategies have been prepared in accordance with Commonwealth and State Government agreements for each of Australia's 56 NRM regions according to a set of national objectives. Following consultation with a range of stakeholders the strategies have been endorsed by the Commonwealth (Commonwealth of Australia 2007). The documents are subject to an ongoing process of review and evolution. Local Government thus have the opportunity to influence the priorities for future NRM works and bid for future public environmental funding. In the case of the SWBPA, the relevant regional body is the South West Catchments Council (SWCC).

3.4 Other formal protection mechanisms for the South West's natural areas

In addition to general legislative mechanisms requiring biodiversity and natural area protection, some natural areas are formally recognised and protected by one or more of the following:

- ▶ DEC Managed Estate;
- ▶ Regional Parks;
- ▶ Local Government reserves and other public reserves;
- ▶ conservation covenanted and conservation zoned lands; and
- ▶ System 6 areas.

DEC Managed Estate

The DEC Managed Estate includes State Forest, Nature Reserves, National Parks, Conservation Parks and a variety of other land purpose categories. DEC manages these lands on behalf of the Conservation Commission of Western Australia and the public. The management of Nature Reserves and National Parks is guided by specific management plans and State Forest management is directed under a 10-year Forest Management Plan (e.g. 2004 – 2013 Forest Management Plan). All management plans provide opportunities for the public and Local Government to contribute to the management of these areas.

Regional Parks

Regional Parks are areas of Regional Open Space that are identified as having outstanding conservation, landscape and recreation values. Regional parks provide the opportunity for coordination in planning and management strategies by different land management agencies and private landowners. There are currently eight regional parks in the Perth Metropolitan Region. Although there are currently no regional parks

in the SWBPA, an 'Ocean to Preston River Regional Park' has been proposed for the Bunbury area while the Peel Regional Park is also under development.

Regional Parks may comprise of Crown land vested in State Government agencies and Local Governments as well as private lands if the agreement of the landowner has been obtained. Thus, regional parks could include a variety of tenures and reserve purposes that are drawn together for coordination of management by DEC. In addition to this overall coordination of management, DEC is also responsible for management of those areas of Regional Parks that are vested in the Conservation Commission of WA and land vested or owned by the WAPC. Responsibility for and funding of management of other Local Government vested areas in a Regional Park is unchanged. Community involvement in the ongoing management of regional park lands is important and encouraged.

Local Government Reserves

There are approximately 5,636 ha of native vegetation in Local Government reserves in the SWBPA. Local Governments are given responsibility to manage reserves by Management Orders issued by the Department of Land Information (DLI). The purpose for which the reserve is to be managed is specified in the Management Order and includes purposes such as drainage, protection of indigenous flora and fauna or recreation. The purpose of the reserve can be altered with the approval of DLI and can include any reasonable objective of the reserve, such as stream-course protection or protection of native fauna habitat.

The specified purpose of the reserve does not necessarily restrict management of the reserve to that use or value. Under the Land Administration Act 1997, Local Governments can manage a reserve for other values that are "ancillary or beneficial" to the formal purpose (Section 46(1)). However, the formal recognition of the purpose of a reserve is a clear indication to land managers, surrounding landholders and the community of why the reserve is valued and how it can be used.

Local Governments are strongly encouraged to reflect biodiversity values in the formal purpose of reserves where it is the Local Government's intention to conserve biodiversity. Failure to formally recognise biodiversity values and ecosystem services in reserve purposes will provide a barrier to public investment for biodiversity conservation in these reserves. This is discussed in more detail in Section 10.4 of the Guidelines.

Conservation covenanted lands

Covenants can provide formal protection of natural areas. There are three covenanting programs available to public and private land managers in Western Australia operated by:

- ▶ the National Trust;
- ▶ DEC;
- ▶ Department of Agriculture and Food Western Australia (DAFWA).

All these covenants are voluntary agreements between the landholder and the covenanting organisation. Stewardship and expert management advice are provided with covenants with the National Trust and DEC. When a conservation covenant is applied, the land should be zoned consistent with the conditions of the covenant because determinations relating to inconsistencies between the Local Planning Scheme and a covenant will rule in favour of the Local Planning Scheme.

While covenants pass with the property title to subsequent owners other schemes such as 'Land for Wildlife' allow a more informal commitment to landholders who wish to retain the high biodiversity values of their land without creating legal obligations (Department of Environment and Conservation undated a).

Local Planning Scheme zoning provisions to protect biodiversity

Local Governments can use their Local Planning Scheme to recognise and protect natural areas. Schemes may recognise natural areas by zoning (for example,

conservation zoning) or by overlays (for example, landscape protection overlays or special control areas). For lands that are subject to conservation covenants Local Governments should aim to formally recognise the commitment between the landholder and the covenanting body through the Scheme.

Schemes can also contain general provisions for the protection of natural assets, such as those applying to special rural areas or trees. However, these provisions have limited value given the difficulty of enforcement and the fact that they only apply to a small part of the landscape or vegetation. See Section 15 of the Guidelines for more detail on protection mechanisms for Locally Significant Natural Areas (LSNAs).

3.5 Local Government legislation and policies

Before a Local Government produces a Local Biodiversity Strategy, it will be important for the Local Government to identify its own laws and policies that may already be delivering some aspects of biodiversity protection. Examples of such legislative mechanisms include:

- ▶ Local Planning Scheme Zonings – conservation zones, conservation living zones, rural landscape protection zones, subdivision for conservation;
- ▶ Local Planning Scheme provisions – vegetation protection areas, prohibition of grazing, tree preservation clauses; and
- ▶ local laws, for example, for the control of cats; or the listing of pest plants for which the Local Government has the power to require land owners to control or eradicate (Clement *et al.* 2001).

Examples of Local Government policies that support biodiversity conservation include:

- ▶ greening or wildlife corridors plans;
- ▶ Local Government Environmental Plans or Strategies;
- ▶ Reserve management plans;
- ▶ policies for environmental assessment of development;
- ▶ local weed strategies; and
- ▶ Local Planning Policies.

The effectiveness of these measures in securing local biodiversity values for the long term will be enhanced by preparation of a comprehensive strategy based on scientifically derived biodiversity conservation objectives and Natural Area Condition (NAC) targets. For successful implementation of their Biodiversity Strategies, Local Governments will need to have sound ecological assessment integrated with their land planning systems and decision-making processes. This is what Local Biodiversity Strategies are designed to achieve.

4. The South West Biodiversity Project Area

4.1 Overview

4.1.1 Geography

The SWBPA falls within the South West Botanical Province of Western Australia. This is recognised as one of the world's top 25 biodiversity hotspots due to the large number of flora and fauna species, the extent to which they are restricted to the region and the significant threats they face (Myers *et al.* 2000). This botanical province covers south-western Western Australia from Shark Bay in the north to east of Esperance in the south. It supports an estimated 8000 taxa (species, subspecies and varieties) of vascular plants, approximately two-thirds of the estimated plant taxa in Western Australia (Hopper *et al.* 1996; Beard *et al.* 2000). Over 80% of the plant taxa are endemic to the South West Botanical Province (that is, they occur nowhere else in the world) (Beard *et al.* 2000).

The SWBPA intersects three major natural regions, namely the Swan Coastal Plain, the Darling Plateau and its associated escarpment, the Darling Scarp and the Blackwood Plateau. The Interim Biogeographical Regionalisation of Australia (IBRA) regions in this area are the 'Swan Coastal Plain' (SCP), the 'Jarrah Forest' (JF) and the 'Warren' (WAR) (Thackway and Cresswell 1995; Commonwealth of Australia 2001b).

A brief description of the SWBPA IBRA regions follows:

- ▶ The Swan Coastal Plain is a low lying area where marine dunes have developed in three phases. The plain is largely covered with woodlands. On sandy soils there are Banksia or tuarts (*Eucalyptus gomphocephala*); on outwash plains, mainly in the south, sheoaks (*Casuarina obesa*) dominate while paperbark shrublands (*Melaleuca spp.*) are found in swampy areas. On the eastern side of the plain, there are hardened Mesozoic sediments which are dominated by jarrah (*Eucalyptus marginata*) woodland.
- ▶ Jarrah Forest is a part of the Yilgarn Craton where weathering has led to the development of a hardened layer of sediments on a plateau. The vegetation comprises jarrah-marri (*Corymbia calophylla*) forest on areas of laterite gravels while clayey soils in the eastern part are dominated by wandoo (*Eucalyptus wandoo*)-marri woodlands. Sediments derived from weathering and carried by water have allowed the development of *Agonis* shrublands. Jarrah forests also occur interspersed with species-rich shrublands on sediments of Mesozoic age.
- ▶ Warren overlies several geological formations which have been dissected to form an undulating landscape. Karri (*Eucalyptus diversicolor*) is found on loamy soils and jarrah-marri forest is found on laterites. Peppermint (*Agonis flexuosa*) and *Banksia* woodlands and heaths are found on marine dunes of Holocene age. Low jarrah woodlands as well as paperbark and sedge swamps are found in leached sandy soils in depressions and plains (May and McKenzie 2004).

For the purposes of this Addendum, the South West Biodiversity Project Area (SWBPA) is defined as referring to those Local Government areas with current, or proposed, participation in the South West Biodiversity Project (see Figure 3).

4.1.2 Climate

The climate of the south-west of Western Australia is mediterranean in nature. As such it is characterised by cool, wet winters and hot, dry summers. Annual rainfall ranges from 800-900 mm in coastal areas to approximately 1,400 mm in the karri and tingle forests of the Warren region. The wettest period of the year is from May to September, with prolonged dry periods being common in the hotter months. Occasionally, widespread heavy rain may occur during the hotter months, usually as a consequence of the southward passage of cyclones from the State's north (South West Catchments Council 2005).

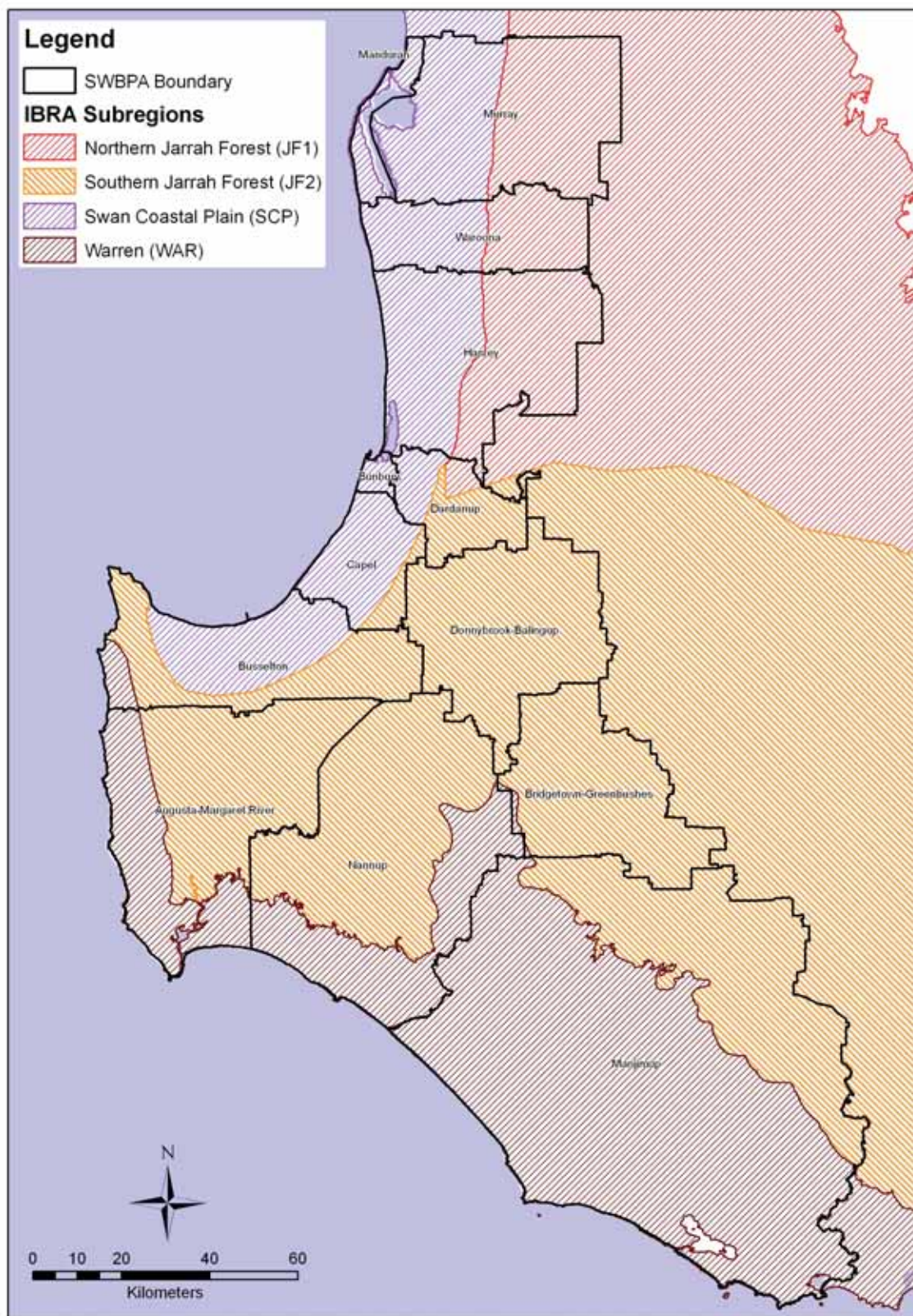


Figure 3: South West Biodiversity Project Area including Local Government boundaries and IBRA boundaries.

4.1.3 Vegetation

Within the SWBPA there are 21 vegetation complexes represented in the SCP portion and 320 vegetation complexes represented in the Regional Forest Agreement (RFA) study area (Jarrah Forest and Warren) portion. Fifteen vegetation complexes have 10% or less of their pre-European extent remaining within the SWBPA and are therefore considered to be threatened. A further 63 vegetation complexes within the SWBPA have between 10% and 30% of their pre-European extent remaining.

Only 22% of the original extent of native vegetation on the SCP portion of the SWBPA remains, compared with 77% for the RFA (Jarrah Forest and Warren) area. This supports the observation that the vegetation of the SCP area is significantly more fragmented than that of the RFA (Jarrah Forest and Warren) areas of the SWBPA.

The reduction in extent of native vegetation in the SWBPA and its associated fragmentation and degradation by other processes has contributed to a number of flora species and ecological communities being listed by the DEC as being rare or threatened. There are approximately 576 Declared Rare and Priority floristic taxa and 29 different Threatened Ecological Communities (TECs) currently listed within the SWBPA. These figures are likely to increase as the amount of bushland continues to decline, the region's flora is further studied, and more ecological communities are assessed for listing as TECs (Table 25 in Section 16.2 of this Addendum).

4.1.4 Vegetation Extent Within the SWBPA

The SWBPA comprises a total area of 2,204,849 ha containing 348,915 ha on the SCP and 1,156,702 ha of the Jarrah Forest and 699,233 ha of the Warren IBRA regions. Maps produced from aerial photographs circa 2005 indicate that only 1,507,095 ha (68% of original extent) of native vegetation remained within the SWBPA. Of this, 536,563 ha (24% of the original total area) is currently protected in formal reserves and 970,531 ha (44% of the original total area) is currently without protection (see Table 2 below).

Table 2. The extent of native vegetation within the Swan Coastal Plain, Jarrah Forest and Warren region portions of the South West Biodiversity Project Area (Department of Agriculture and Food 2006).

SWBPA	ha	Native Vegetation Remaining (ha)	%	Native Vegetation 'Protected' (ha)	%	Native Vegetation 'Unprotected' (ha)	%
Swan Coastal Plain	348915	76943	22	14042	4	62902	18
Jarrah Forest	1156702	855785	74	191354	17	664431	57
Warren	699233	574366	82	331168	47	243198	35
TOTAL	2204849	1507095	68	536563	24	970531	44

Key to Table 2

'Protected' includes formal reserves (Department of Environment and Conservation National Parks, Nature Reserves and Conservation Parks).

'Unprotected' includes Department of Environment and Conservation State Forest and Timber Reserves, Section 5(1)(g) and (h) Reserves, Miscellaneous Reserves and Executive Director Freehold land and Local Natural Areas.

4.1.5 Wetlands

Very little information is currently available about the spatial extent of WA wetlands and even less is available on their condition as no systematic survey has been made (Environmental Protection Authority 2007b). Most available information pertains to wetlands on the SCP. This is the most populated region in Western Australia and is under significant urban development and growth pressures. Previous estimates

indicate that of the original 362,000 ha of wetlands on the SCP 70-80% of these have been cleared, drained or filled since European settlement (Hill *et al.* 1996). The ecological function of many remaining wetlands has been so significantly altered that they now bear little resemblance to their original state. Furthermore between 1996 and 2004 a further 4% of the remaining wetland vegetation was lost or became severely degraded (Environmental Protection Authority 2007b).

4.1.6 Terrestrial Fauna

The reduction in extent of native vegetation in the SWBPA and its associated fragmentation has also contributed to a number of fauna taxa being listed by the DEC as being rare or threatened (Priority fauna). The list of Rare and Priority native fauna taxa within the SWBPA currently includes 11 mammals, 19 birds, 13 reptiles, 4 frogs, 3 fish, 15 insects, 8 crustaceans, 3 snails, 3 spiders, and 1 native shellfish (South West Biodiversity Project 2007a).



The Western Ringtail Possum (Pseudocheirus occidentalis) is listed as Threatened under the WA Wildlife Conservation Act and Threatened (Vulnerable) under the Federal EPBC Act. The major factors contributing to decline include habitat loss and fragmentation, predation by foxes and changing fire regimes. Although once widespread throughout South Western Australia, most populations are now restricted to near coastal areas of peppermint (Agonis flexuosa) woodland and peppermint/tuart associations. Photo: Greg Harewood

4.2 Threats to Biodiversity within the South West Biodiversity Project Area

4.2.1 Land Clearing

Historically, widespread clearing occurred for development of intensive agriculture and grazing in the SWBPA. In particular farming of sheep and wheat has been practised over a wide area. Since the 1980s, agricultural expansion has slowed and clearing controls have been enforced, although recent expansion of the wine and plantation industries has renewed clearing activity in small pockets of the region.

Population increases in Western Australia have resulted in increased housing demand, and consumption patterns show that Western Australians have a preference for larger houses and fewer people per household in comparison with other parts of the world (Environmental Protection Authority 2007b). Urban areas have expanded rapidly around Perth and the major coastal regional centres of the SWBPA require large land areas to accommodate urban centres and consequential clearing of native vegetation. The land clearing and fragmentation of remaining areas is leading to a loss of species and ecological assemblages.

4.2.2 Salinity

The clearing of native vegetation for agriculture has been the major cause of rising water tables and associated dryland salinity. This threat is manifested through water-logging of soils, increased inundation and erosion, and the inability of many species and ecological systems to cope with moderate to extremely high concentrations of salt. Fauna populations are consequently threatened due to changes in both habitat and resources (Environmental Protection Authority 2007b).

4.2.3 Water eutrophication

Eutrophication refers to a raised concentration of nutrients in water. This may stimulate blooms of algae. Although eutrophication is a natural process, human activities can augment eutrophication by increasing the rate at which nutrients enter aquatic ecosystems and by changing flow regimes. Agricultural runoff, urban runoff, leaking septic systems, eroded banks, and similar sources can increase the flow of nutrients into aquatic systems. Excessive algal growth can interfere with the health and diversity of other flora and fauna. This occurs as the algae blocks the penetration of light to other aquatic plants, subsequently reducing availability of food to fauna. Furthermore, the dissolved oxygen available to other organisms is decreased and in some cases the algae themselves are toxic (Environmental Protection Authority 2007b).

4.2.4 Soil acidification

Most Western Australian soils are naturally acidic. However, this acidity can be increased as a result of high nitrogen inputs from agriculture. This can occur either due to incorrect or excessive fertiliser application, or crops being planted under repeated legume rotations. The acidic groundwater produced releases heavy metals from the soil which may reach toxic concentrations. This affected groundwater represents an obvious threat to stands of remnant vegetation. While the impacts are often mistaken for salinity, revegetation of these sites with salt tolerant plants is not successful and there are significant obstacles to engineered solutions.

In near coastal locations, such as some of the Local Government areas on the SCP the disturbance of acid sulfate soils is a particular problem for several reasons, including the threat posed to biodiversity. Acid sulfate soils occur naturally and are not usually a problem until disturbed (for example by drainage or excavation), leading to the development of sulfuric acid. In addition to the low pH, release of metals such as lead and arsenic may occur. This change in quality of ground and surface water is a problem for biodiversity conservation particularly in wetland areas. (Department of Environment and Conservation undated b; Queensland Department of Natural Resources and Water 2007).

4.2.5 Pest species

The Australian biota has suffered enormously through the introduction of exotic species. Many plants introduced intentionally for agriculture, forestry, horticulture, and amenity purposes, and others introduced accidentally, have become significant environmental weeds. Other species already in the SWBPA but not currently significant environmental weeds have the potential to cause future damage. In the absence of their natural consumers, competitors and pathogens, exotic species often have distinct advantages when in competition with native flora.

Weeds compete with native plants for light, space, water and nutrients. As a result of this, weeds often replace local native plant species, thereby diminishing inherent biodiversity values within stands of remnant vegetation. Furthermore, the replacement of native vegetation can endanger fauna by reducing the available habitat and food resources. Weeds tend to proliferate in areas subject to regular disturbance through fire, grazing, hydrological change, agricultural practice, traffic and the clearing of native vegetation.

Similarly, many animals that have been introduced, either intentionally or accidentally have proven to be serious environmental threats. Feral predators such as foxes (*Vulpes*

vulpes) and cats (*Felis catus*) eat native species, causing some regional extinctions and seriously threatening the survival of other species. Rabbits (*Oryctolagus cuniculus*) and pigs (*Sus scrofa*) consume vegetation and damage its structure. Introduced rodents compete with native mammals for food resources. Introduced bees invade tree hollows denying habitat to native birds and mammals (Low 2001).

In some cases, species native to Australia and even to the region may become pests. The increased availability of food and water and the creation of large open spaces have resulted in the populations of some species rising to the point that they now pose threats to biodiversity in their own right. Foremost amongst these species are the Western Grey Kangaroo (*Macropus fuliginosus*), Euro (*Macropus robustus*), Twenty Eight parrot (Australian Ringneck) (*Barnardius zonarius semitorquatus*), Galah (*Cacatua roseicapilla*), and Western Corella (*Cacatua pastinator*). These species not only cause substantial damage to agriculture, they use habitat and resources required by other native species and subject remnant vegetation to significant pressure from heavy grazing and destructive behaviour, such as the stripping of bark and leaves by large numbers of parrots.

The aim of native pest animal management is to limit damage and to maintain populations at a biologically sound level. This is not always a simple task. For example, sometimes a population may be of a high density (and may be causing considerable damage) but also be one of few populations, or be of high conservation priority. In such a case determining what is a biologically sustainable level, may prove to be a complex task requiring the consideration of many potential outcomes and scenarios (Wallace, Beecham and Bone 2003).

4.2.6 Grazing of remnant vegetation by stock

Grazing of remnant vegetation by stock presents a major problem. Stock graze out understorey species, damage and kill canopy species, compact soils, change vegetation structure and prevent regeneration by the destruction of seedlings. Further, they encourage the proliferation of weeds. Protracted grazing by stock has the potential to totally clear remnant vegetation, and as such, has been historically used as a means of intentional clearing. Grazing stock also incur similar impacts on revegetation sites (Loney and Hobbs 1991).

4.2.7 Pathogens

There are many pathogens currently affecting remnant vegetation within the SWBPA. Most of these are natural features of native vegetation. As such, their impacts normally contribute to the natural processes occurring within stands of remnant vegetation. When remnant vegetation is disturbed or stressed these diseases have the potential to have greater impacts. However, these diseases and their impacts are generally poorly understood.

Dieback or *Phytophthora cinnamomi* is an introduced water mould that is a major threat as it kills a wide range of plant species within the SWBPA. *Phytophthora* dieback poses such a threat to biodiversity in the region that it has been listed as a key threatening process under the Environment Protection and Biodiversity Conservation Act 1999. The extent of the spread of the disease is not currently mapped but it is conservatively estimated that 15 to 20% of the Jarrah Forest throughout the northern and southern parts has been infested. This figure may be significantly higher in the wetter, north western part of the forest (Dieback.org.au 2005). *Phytophthora cinnamomi* is widespread in areas with > 400 mm rainfall but its distribution and impacts are greatest in the > 600mm rainfall zone. The disease has the capacity to infect and ultimately kill approximately 40% of the native plant species in the SWBPA and to prevent them from effectively re-colonising infested sites. The worst case scenario resulting from the uncontrolled spread of the disease may be a collapse of ecosystems and significant interruption of ecological processes (Department of Conservation and Land Management 2004a).

Highly susceptible families are Proteaceae (including banksias, dryandras and hakeas), Epacridaceae (heaths), Papilionaceae (peas) and Myrtaceae (including



eucalypts) (Department of Environment and Conservation undated c). In addition to native species, *Phytophthora* dieback also affects many commercial plants such as stone fruit, avocados, grapevines and plantation pines. *Phytophthora* dieback requires moist conditions to survive and can be spread through the movement of surface and subsurface water, and the movement of infected soil either directly or from soil and mud on vehicles, animals or footwear.

Refer to Section 12.9 of this Addendum for further information on indicator species.

Ben Deeley of the City of Bunbury treats a Phytophthora cinnamomi affected Jarrah tree with phosphite injections into the trunk. Phosphite is a biodegradable fungicide which temporarily reduces the susceptibility of vulnerable plant species to damage by Phytophthora. Treatment must be repeated every few years; there is no known cure for infection. (Dieback.org.au). Photo: Jodie Wood

Another serious pathogen in Western Australia is the honey fungus *Armillaria luteobubalina*. This fungus can also attack a wide range of plant species, and is active in the SWBPA. As yet no substantial surveys have been undertaken to assess the distribution or impact of *Armillaria*. Research so far shows that many areas are at risk including wandoo woodlands, karri forest and coastal shrubland communities.

Mundulla Yellows is another pathogen affecting native flora within the SWBPA. The disease was first reported in the late 1970s in South Australia and is thought to be caused by a virus or viroid. It has proven fatal to many taxa including numerous species of *Eucalyptus*, *Casuarina*, *Acacia*, *Dryandra*, *Hakea* and *Banksia*. This disease has been documented in tuart and *Banksia* woodlands of the SCP (Hanold *et al.* 2006). The suspected agents for spreading of this disease are sap sucking insects, nematodes, fungi, pollen as well as sap on tools. For these reasons Mundulla Yellows represents a potential threat to native vegetation in the SWBPA.

4.2.8 Altered fire regimes

Fire has been a major influencing factor in the evolution of Australian flora and fauna. Indigenous people have been using fire to manage vegetation for many thousands of years. Foresters and land managers continue to do so. However, remnant vegetation is often threatened by the changed fire regimes which may involve fires of either greatly increased frequency or greater intensity and changes in seasonality.

Many plant species require fire to reproduce but when fire reoccurs before plants have matured and set seed, that species may be lost from the patch. Given the isolation of most vegetation remnants within the SWBPA, it is likely that the loss will be permanent. Meanwhile, frequent fires encourage the proliferation of species that can regenerate and set seed quickly. This factor, combined with the removal of leaf litter, means that an increased frequency in fire often encourages weeds to proliferate within stands of remnant vegetation. High weed burdens within remnant vegetation increase fuel loads and are relatively easy to ignite. This in turn helps to bring about more frequent fires and fires that are hotter than those that would normally occur.

Land managers should understand that the presence of dead wood in bushland is a valuable ecological resource. For example, the Stone Curlew (*Burhinus grallarius*) is dependent on fallen wood to make its camouflage effective, echidnas (*Tachyglossus aculeatus*) and numbats (*Myrmecobius fasciatus*) are dependant on eating termites that feed on wood. They are also dependent on fallen timber for protection, shelter and other resources, as are bandicoots (quenda) (*Isodon obesulus*), juvenile birds, many small marsupial, reptile and native rodent species as well as a large (as yet undetermined) number of invertebrate species (Attiwell and Wilson 2003).

4.2.9 Severe weather events

Severe weather events such as cyclones and tropical storms are usually confined to the tropical and subtropical regions of the State and rarely descend into the SWBPA. Periodically they do affect the SWBPA, such as the 1978 Tropical Cyclone Alby (Australian Bureau of Meteorology 2007). When major storms occur the main impact on biodiversity is by flooding. These floods cause significant erosion problems (especially on denuded creek and drainage lines) and contribute to rising water tables, dryland salinity, siltation and eutrophication. Additionally, small animals are lost; small and immature plants are drowned, washed away or buried under silt; leaf litter can be lost (resulting in potential weed problems) and trees and other larger plants can be pushed over, broken or have their roots exposed. Conversely, floods also have positive effects on biodiversity. They can bring about major rejuvenation in remnant vegetation through the large scale germination of the soil's natural seed bank. It has been argued that periodic flooding is necessary for the persistence and rejuvenation of some ecological assemblages within the SWBPA. The effects of climate change may bring about changes in the frequency and intensity of flood events in the SWBPA. The long term ramifications of this are as yet undetermined (CSIRO and Australian Bureau of Meteorology 2007).

4.2.10 Drought

Drought is a natural phenomenon regularly affecting biodiversity in the SWBPA. As such the flora and fauna have evolved a wide variety of behavioural and physical traits to enable their survival under drought conditions. Unfortunately, this capacity for survival can be compromised when:

- ▶ stands of remnant vegetation are isolated, thereby restricting the movement of fauna species that would otherwise relocate in search of new resources, and preventing the natural reintroduction of flora species;
- ▶ species have been lost from the remnant, thereby compromising the capacity of the remnant to regenerate naturally, and reducing resources available to fauna;
- ▶ native species are under pressure from competition with exotics;
- ▶ native fauna populations are forced into areas of high population density encouraging increased pressure from native and exotic predators, and pathogens; and
- ▶ large numbers of herbivores move, or are moved, into small stands of remnant vegetation thereby increasing grazing pressure (Bennett 2003).

4.2.11 Climate change

Climate change, as a probable consequence of increased levels of CO₂ and other 'greenhouse gasses' emitted into the atmosphere as a result of human activity, has the potential to have serious impacts on biodiversity both locally and globally. In their most recent report on climate change, the CSIRO and the Australian Bureau of Meteorology (2007) state that by 2030 temperatures will almost certainly rise by about 1°C across Australia. Temperature rises later in the century will depend on the future extent of greenhouse gas emissions but a rise of 2.5°C is likely by 2070 with a rise of up to 5°C possible. This report also predicts (for South West Western Australia) a continuing rise in sea level, a decrease in rainfall of 10% or more by 2070 (with a probable change in rainfall seasonality) and more days of extreme temperatures. It also predicts an increase in the frequency and intensity of bushfires, droughts, floods and severe storms.

Climate and disturbances such as fire events are critically important in defining many of the SWBPA's ecosystems. If the forecasted changes in climate eventuate, profound impacts on the biodiversity of the SWBPA's fragmented landscape are likely. These impacts to the area's biodiversity should be considered in planning biodiversity conservation projects, especially with regard to ecological linkages.

4.2.12 Impacts of competing land uses

When an area is set aside for biodiversity conservation it is often also used for other purposes, either legally or illegally. These land uses and uses in neighbouring sites may prove detrimental to the intended conservation objectives. Housing, industrial development recreation, agriculture, consumptive uses (wildflower cutting, timber cutting, etc.), illegal activities, mines and quarries, can all occur within remnant vegetation. Pollution is a common land use related threat in any urban, industrial or agricultural landscape. Pollution impacts directly on flora and fauna on contact, and has indirect impacts through contamination of resources such as food, water and habitat.

While all of the listed activities have the capacity for detrimental impacts on biodiversity this may not occur in every situation. In each case the potential impacts of the additional land use should be thoroughly examined with an emphasis on the biodiversity values of the site, the potential benefits of the land use, the values and priorities of the land manager or the relevant community, the availability of practical and effective threat management actions, and the capacity of the land manager or community to enact, enforce, monitor and review those management actions (Wallace, Beecham and Bone 2003).

4.2.13 Lack of understanding of biodiversity values

Successful and sustainable biodiversity conservation requires the support of both land managers and the general community. Support of this type can only be achieved when there is a general understanding of biodiversity conservation values and principles, and their contribution to human quality of life.

5. Ecological criteria to identify Locally Significant Natural Areas

One of the most important parts of local biodiversity planning is to establish the ecological criteria for assessing the biodiversity conservation value of natural areas. These criteria identify the natural areas that are of greatest value for biodiversity conservation.

While all natural areas have some value in conserving biodiversity, determining these values and assessing the condition and viability of each area is the best way to determine the most strategic investment of resources on public and private land. Although setting priorities for the retention, protection and management of natural areas must be based on socio-economic criteria and other environmental criteria as well as ecological criteria, it is important to first establish a clear picture of the biodiversity resource. This will allow a transparent, accountable and defensible position on decisions affecting natural areas. It is also important to establish a vision, objectives and targets for biodiversity retention, protection and management.

Natural Area Condition (NAC) targets allow Local Governments to formalise the ecological criteria for determining which natural areas are locally significant. The NAC targets should be developed and reviewed with close community consultation to ensure the process remains transparent as well as ensuring the community fully understands the objectives and targets set. The setting of a vision, objectives and NAC targets is discussed in more detail in Part B (Section 9.2) and ideas for community consultation are discussed in more detail in Part C (Chapter 18) of the Guidelines.

Once NAC targets are established Local Governments can implement the necessary framework and processes required to retain and protect natural areas to meet these targets. The ecological criteria provided in this Addendum have been designated a level of priority as either 'Essential' or 'Desirable' (see Section 5.2 of this Addendum) according to existing legislation and policies. This allows an initial prioritisation of Local Natural Areas (LNAs) before further considering social and economic constraints. In some Local Government areas a prioritisation process (based initially on ecological factors) of all Locally Significant Natural Areas (LSNAs) may have to occur to ensure the NAC targets being set are achievable where significant socio-economic constraints (such as urban or industrial zoning) exist. The Guidelines promote the development of a range of NAC targets. In each Local Government Area these should be based on the ecological criteria discussed in this Addendum. Community consultation will be important in this process to determine the most suitable level of biodiversity target to be adopted in a Local Biodiversity Strategy.

5.1 Ecological criteria

The intent and rationale of the ecological criteria must be understood as widely as possible during the preparation of the Local Biodiversity Strategy and explained during public consultation. Setting standard ecological criteria for use by all Local Governments ensures that the natural areas required to maintain biodiversity within each Local Government area (as well across the region) are retained, and where possible, protected and appropriately managed.

Local Government boundaries are administrative and do not relate to the biological processes and factors that affect the distribution of native species and communities. Therefore, standard criteria must be used by each Local Government to contribute to regional biodiversity conservation.

The ecological criteria to identify LSNAs in the South West Biodiversity Project Area (SWBPA) are an adaptation of the Bush Forever ecological criteria combined with the original local significance criteria proposed in the Urban Bushland Strategy (Government of Western Australia 1995).

The standard ecological criteria for local biodiversity planning are grouped under the following themes:

- ▶ representation of ecological communities;
- ▶ diversity;
- ▶ rarity;
- ▶ maintaining ecological processes or natural systems; and
- ▶ protecting wetland, streamline and estuarine fringing vegetation and coastal vegetation.

Two other potential key criteria groupings have not been included in both the Guidelines and this Addendum as they will be addressed through the evaluation and assessment process:

- ▶ scientific or evolutionary importance; and
- ▶ criteria not relevant to determination of regional significance, but which may be applied when evaluating areas having similar values.

Many of the criteria discussed below use the term 'ecological community'. In the SWBPA the most common way to interpret ecological communities for quantitative targets based on area is by vegetation complexes (and their groupings into major landform elements) as defined and mapped by Heddlé *et al.* (1980) for the Swan Coastal Plain (SCP) IBRA region, and Mattiske and Havel (1998) for the Jarrah Forest (JF) and Warren (WAR) IBRA regions. In the SWBPA, ecological communities are also defined as:

- ▶ Floristic Community Types (Gibson *et al.* 1994, Department of Environmental Protection unpub. 1996) developed for the SCP;
- ▶ Floristic Community Types (Markey 1997) developed for the Northern Darling Scarp;
- ▶ Ecological Vegetation Communities (Havel and Mattiske 2000) developed for the JF and WAR areas; and
- ▶ Threatened Ecological Communities (English and Blyth 1997, 1999) where applicable.

However, unlike vegetation complexes, these community types have not been mapped in a way that allows them to be used for quantitative targets based on area. The criteria in this document are therefore based on using vegetation complexes as a means of measuring the broad scale patterning of ecological communities. Local Governments are encouraged to use more detailed and appropriate information to interpret ecological communities where this is available.

5.1.1 Representation of ecological communities

Any LNA confirmed as meeting one or more of the following criteria is referred to as a Locally Significant Natural Area (LSNA).

Criterion 1a. Regional representation

Criterion 1a) i). The area is of recognised International, National, State or Regional value but not already protected and/or managed for conservation (Essential).

These areas are identified in the following documents and databases:

- ▶ areas protected under or containing species protected under the EPBC Act as well as threatened flora, threatened fauna and Threatened Ecological Communities, including areas such as Ramsar listed wetlands and areas supporting populations of migratory birds protected under international agreements (for example, Japan Australia Migratory Bird Agreement (JAMBA) and China Australia Migratory Bird Agreement (CAMBA)). The Department of Environment and Water Resources has

an online Protected Matters Search Tool to generate a list of relevant matters by Local Government Area, geographic coordinates or for an area selected on a map (Department of Environment and Water Resources 2007a);

- ▶ System 6 recommendation areas outside of DEC Managed Estate (Department of Conservation and Environment, 1983). In the Jarrah Forest some natural areas outside the DEC Managed Estate are recognised for their regional conservation value as System 6 areas (these sites include both public and private land);
- ▶ other regionally significant natural areas yet to be formally recognised through the System 6/part System 1 Update program (Environmental Protection Authority 2003c). Contact the Department of Environment and Conservation for current information;
- ▶ wetlands in the Directory of Important Wetlands in Australia (Environment Australia 2001a) as well as the online Australian Wetlands Database which gives site-specific information for wetlands (Environment Australia 2001b); and
- ▶ additions to the Conservation Estate through the Forest Management Plan 2004 – 2013 (Conservation Commission 2003).

This criterion ensures all areas with regional or greater conservation value are identified within each Local Government area and any natural areas not already protected by the State or Federal Government can be afforded protection through Local Government planning and conservation initiatives. There are unlikely to be many LNAs that meet this criterion as these areas should already be adequately protected. In some cases Local Government may already be involved in partnerships with State or Federal Government and the community for management of these areas.



Regional representation of Guildford complex, (Melaleuca woodland on palusplain) in very good condition, on a 10 ha reserve just east of the Bussell Highway near Stratham, Shire of Capel. Only 4% of the pre-European extent of Guildford complex remains.

Much of the vegetation on the Swan Coastal Plain has been cleared for agriculture or urban development. This site is on the opposite side of the road on the same palusplain, which has been cleared for agricultural purposes.

Photos: Shaun Molloy



Criterion 1a) ii). The area is of an ecological community with only 1500 ha or 30% or less (whichever is greater) of its pre-European extent remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions (Essential).

This criterion is based directly on the National Targets and Objectives for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001a). It aims to retain the minimum amount of native vegetation cover needed to prevent exponential loss of species and failure of ecosystem processes across the landscape.

Vegetation complexes that meet this criterion are listed in Table 3 in this Addendum (for JF and WAR regions) and Table 4 (for SCP region). These tables are based on statistical information on the percentage of ecological communities remaining or protected (reserved) within the SWBPA. This statistical information is derived from broad scale mapping of ecological communities (1:250,000 for most of the SCP (Heddl *et al.* 1980) and 1:50,000 for the Southwest Forest Region (Mattiske and Havel 1998)). It should be noted that the datasets used to calculate these statistics have a number of limitations (see Section 16.1 of this Addendum). It is very important to bear these limitations in mind when the statistics for percentage of the vegetation complexes remaining are approaching target figures set for Local Significance Criteria.

Table 3. Vegetation Complexes occurring in the South West Forest Region portion of the Jarrah Forest and Warren IBRA regions that currently meet criteria 1 a) ii), 1 a) iv), 1 a) v) and 3 i) based on Table 2 of Department of Environment and Conservation (2007) using 2000- 2004 native vegetation extent mapping (Department of Agriculture and Food Western Australia, 2006).

RFA Code	RFA Vegetation Complex (Mattiske and Havel 1998)	Is criterion 1a ii) potentially met?	Is Criterion 1a iv) potentially met?	Is Criterion 1a v) potentially met?	Is Criterion 3 i) potentially met?
A	Angove	No	No	No	No
B	Blackwood	No	Yes	Yes	No
Ba	Barlee	Yes	Yes	Yes	Yes
BD	Bidella	No	No	No	No
Bd	Blackwood	Yes	Yes	Yes	Yes
BE1	Bevan	No	No*	No*	No
BE2	Bevan	No	No	No	No
BEb	Bevan	No	No	No	No
BEs	Bevan	Yes	Yes	Yes	Yes
BEy1	Bevan	No	No	No	No
BEy2	Bevan	No*	No*	Yes	No
Bf	Blackwood	Yes	Yes	Yes	Yes
BK	Blackwood	No	No	No	No
BL	Balingup	No*	Yes	Yes	No
BLf	Balingup	Yes	Yes	Yes	Yes
BN	Bentley	Yes	Yes	Yes	Yes
BO	Boonarie	No	Yes	Yes	No
BT	Bridgetown	Yes	Yes	Yes	No
BTf	Bridgetown	Yes	Yes	Yes	Yes
BU	Burnett	No	No	No	No
BW	Blackwater	Yes	Yes	Yes	Yes
Bw	Blackwood	No	Yes	Yes	No
BWp	Blackwater	No	No	No	No

RFA Code	RFA Vegetation Complex (Mattiske and Havel 1998)	Is criterion 1a ii) potentially met?	Is Criterion 1a iv) potentially met?	Is Criterion 1a v) potentially met?	Is Criterion 3 i) potentially met?
Bwy	Blackwood	Yes	Yes	Yes	Yes
C1	Cowaramup	No*	No*	Yes	No
C2	Cowaramup	No*	Yes	Yes	No
CA	Caldyanup	No	No	No	No
CB	Carbanup	No	No	No	No
CC1	Catterick	No	No*	No*	No
CC2	Catterick	No	No	No	No
Cd	Cowaramup	No	Yes	Yes	No
CE	Coate	No	No	No	No
Ce	Cooke	No	No	No	No
CL1	Corbalup	No	Yes	No	No
CL2	Corbalup	No	No	No	No
CM	Camballup	No	No	No	No
CO1	Collis	No	Yes	Yes	No
CO2	Collis	No	Yes	Yes	No
COb	Collis	No	No	No	No
COd	Collis	No	Yes	Yes	No
COy1	Collis	No	No	No	No
COy2	Collis	No	No	No	No
CP	Cattaminup	No	No	No	No
Cr	Cowaramup	Yes	Yes	Yes	Yes
CRb	Crowea	No	No	No	No
CRd	Crowea	No	Yes	Yes	No
CRy	Crowea	No	No	No	No
CSs	Cartis	Yes	Yes	Yes	Yes
CT	Cormint	No	Yes	No	No
CV	Cleave	No	Yes	Yes	No
Cw1	Cowaramup	Yes	Yes	Yes	No
Cw2	Cowaramup	Yes	Yes	Yes	No
D	D'Entrecasteaux	Yes	Yes	Yes	Yes
D1	Dwellingup	No	Yes	Yes	No
D2	Dwellingup	No	No	No	No
D5	D'Entrecasteaux	No	Yes	Yes	No
DB3	Donnybrook	Yes	Yes	Yes	Yes
Dd	D'Entrecasteaux	No	No	No	No
Dd5	D'Entrecasteaux	No	No	No	No
DE5	D'Entrecasteaux	No	No	No	No
DM1	Dalmore	Yes	Yes	Yes	No
DMg	Dalmore	Yes	Yes	Yes	Yes
DO	Donnelly	No	No	No	No
DP	Darradup	No	No	No	No
Dr	D'Entrecasteaux	Yes	Yes	Yes	Yes
Drd	D'Entrecasteaux	Yes	Yes	Yes	Yes

RFA Code	RFA Vegetation Complex (Mattiske and Havel 1998)	Is criterion 1a ii) potentially met?	Is Criterion 1a iv) potentially met?	Is Criterion 1a v) potentially met?	Is Criterion 3 i) potentially met?
DS1	Darling scarp	Yes	Yes	Yes	Yes
DS2	Darling scarp	No*	Yes	Yes	No
E	D'Entrecasteaux	Yes	Yes	Yes	Yes
FH1	Frankland Hills	No	No	No*	No
FH2	Frankland Hills	No*	No	No*	No
FH3	Frankland Hills	No	No	No	No
FH4	Frankland Hills	Yes	Yes	Yes	Yes
FH5	Frankland Hills	No	No	No*	No
Fo	Forrestfield	Yes	Yes	Yes	Yes
G	Goonaping	No	No	No	No
G2	Gracetown	No	No	No	No
G3	Gracetown	No	No	No	No
GA	Gale	Yes	Yes	Yes	Yes
Ge	Gracetown	No	No	No	No
GE	Gracetown	No	No	No	No
Gg	Gardner	Yes	Yes	Yes	Yes
Gk	Gracetown Karst	Yes	Yes	Yes	Yes
GR	Grimwade	No	Yes	No*	No
Gv	Gracetown	Yes	Yes	Yes	Yes
H	Glenarty Hills	No*	Yes	Yes	No
HA	Hazelvale	No	Yes	Yes	No
Hd	Glenarty Hills	Yes	Yes	Yes	Yes
He1	Helena	No	No	No	No
HK	Hawk	No	No	No	No
HR	Hester	No	No	No	No
Hw	Glenarty Hills	Yes	Yes	Yes	Yes
JA	Jasper	Yes	Yes	Yes	Yes
JL	Jalbaragup	No	No*	No	No
JN	Jangardup	No	No	No	No
Kb	Keystone	No	No	No	No
KB	Kilcarnup	Yes	Yes	Yes	Yes
KbE	Kilcarnup	Yes	Yes	Yes	Yes
KE	Kilcarnup	No	No	No	No
KEf	Kilcarnup	Yes	Yes	Yes	Yes
Kf	Kilcarnup	Yes	Yes	Yes	Yes
Kg	Keystone	Yes	Yes	Yes	Yes
KI	Kingia	No	No	No	No
KO	Kordabup	Yes	Yes	Yes	Yes
KP	Kapalarup	Yes	Yes	Yes	Yes
Kr	Kilcarnup	No	No	No	No
KR	Kirup	No	Yes	Yes	No
Ks	Keystone	Yes	Yes	Yes	Yes
Ky	Keystone	No	No	No	No

RFA Code	RFA Vegetation Complex (Mattiske and Havel 1998)	Is criterion 1a ii) potentially met?	Is Criterion 1a iv) potentially met?	Is Criterion 1a v) potentially met?	Is Criterion 3 i) potentially met?
L	Lakes and open water	Yes	No*	Yes	No*
LF	Lefroy	No	No	No	No
Lg	Lindesay	Yes	Yes	Yes	Yes
LK1	Lukin	Yes	Yes	Yes	Yes
Lo	Lowdon	No	No*	Yes	No
Lp	Lindesay	No	No	No	No
LY	Layman	Yes	Yes	Yes	Yes
M	Metricup	Yes	Yes	Yes	Yes
Mc	Meerup	No	No	No	No
Mf	Meerup	No	No	No	No
ML	Mumballup	Yes	Yes	Yes	Yes
Mp	Meerup	No	No	No	No
MP	Milyeanup	No	Yes	Yes	No
Mr	Meerup	Yes	Yes	Yes	Yes
Ms	Meerup	No	No	No	No
MT1	Mattaband	No	Yes	Yes	No
MT2	Mattaband	No	Yes	Yes	No
MTb	Mattaband	No	No	No	No
Mty1	Mattaband	No	No	No	No
Mu	Meerup	No	No	No	No
Mv	Metricup	Yes	Yes	Yes	Yes
My	Meerup	Yes	Yes	Yes	Yes
My1	Murray	No	No	No	No
N	Nillup	No	No	No	No
Nd	Nillup	No	Yes	Yes	No
Nw	Nillup	No	No	No	No
NW1	Newgalup 1	Yes	Yes	Yes	Yes
NW2	Newgalup 2	Yes	No*	Yes	No
NWf1	Newgalup 1	Yes	Yes	Yes	Yes
NWf2	Newgalup 2	Yes	Yes	Yes	Yes
NWg1	Newgalup 1	Yes	Yes	Yes	No*
OW	Owingup	No	No	No	No
Pi	Pingerup	No	No	No	No
PM1	Pemberton	No	Yes	No	No
PM2	Pemberton	No	Yes	Yes	No
Pn	Pindalup	No	No	No	No
PR	Preston	No	Yes	No	No
Q	Quagering	No	No	No	No
QN	Quindabellup	No	No	No	No
QP	Quininup	Yes	Yes	Yes	Yes
QT	Quartzite hills	Yes	Yes	Yes	Yes
QW	Queenwood	Yes	Yes	Yes	Yes

RFA Code	RFA Vegetation Complex (Mattiske and Havel 1998)	Is criterion 1a ii) potentially met?	Is Criterion 1a iv) potentially met?	Is Criterion 1a v) potentially met?	Is Criterion 3 i) potentially met?
QWf	Queenwood	Yes	Yes	Yes	Yes
RO	Rosa	No	No*	No	No
S	Swamp	No	No	No	No
S1	Granite Valleys	No	No	No	No
S2	Granite Valleys	No	No	No	No
S3	Shallow Valleys	No	No	No	No
S4	Broad Swamps	Yes	Yes	Yes	Yes
SC	Sidcup	Yes	Yes	Yes	Yes
Sd	Scott	No	No	No	No
Sd2	Scott	Yes	Yes	Yes	Yes
SP	Southampton	Yes	Yes	Yes	Yes
SS	Scott scarp	Yes	Yes	Yes	Yes
ST	Stratton	No	Yes	Yes	No
Sw	Scott	Yes	Yes	Yes	Yes
Swd	Scott	No	No	No	No
Swi	Scott	Yes	Yes	Yes	Yes
T	Treeton	No	Yes	Yes	No
t	Valley Terrace	No	No	No	No
Td	Treeton	Yes	Yes	Yes	Yes
TL	Telerah	No	No	No	No
TP	Toponup	Yes	Yes	Yes	Yes
TR1	Trent	No	No	No	No
Tw	Treeton	No*	Yes	Yes	No
UC1	Unicup	No	Yes	Yes	No
UC2	Unicup	No	No	No	No
UC3	Unicup	Yes	Yes	Yes	Yes
UC4	Unicup	No	No	No	No
V1	Granite Valleys	No	Yes	No	No
V4	Granite Valleys	No	No	No	No
Va2	Granite Valleys	No	No	No	No
Va3	Granite Valleys	No	No	No	No
Vh2	Granite Valleys	No	No	No	No
Vh3	Granite Valleys	No	No	No	No
W1	Wilyabrup	No	No	No	No
W2	Wilyabrup	Yes	Yes	Yes	Yes
WA	Warren	No	No	No	No
WC	Whicher Scarp	No	Yes	Yes	No
WCv	Whicher Scarp	Yes	Yes	Yes	Yes
Wd	Wilyabrup	Yes	Yes	Yes	Yes
We	Wilyabrup	Yes	Yes	Yes	Yes
WE	Wilyabrup	Yes	Yes	Yes	Yes
WEw	Wilyabrup	Yes	Yes	Yes	Yes
WG	Wilga	No	No	No	No

RFA Code	RFA Vegetation Complex (Mattiske and Havel 1998)	Is criterion 1a ii) potentially met?	Is Criterion 1a iv) potentially met?	Is Criterion 1a v) potentially met?	Is Criterion 3 i) potentially met?
WH1	Wheatley	No	No*	No	No
WH2	Wheatley	No	Yes	Yes	No
WH3	Wheatley	No	Yes	No	No
WL	Wilgarup	No	Yes	No	No
Wp	Walpole	Yes	Yes	Yes	Yes
Wr	Wilyabrup	Yes	Yes	Yes	Yes
WS2	Wishart	No	Yes	Yes	No
WSv	Wishart	Yes	Yes	Yes	Yes
Ww1	Wilyabrup	Yes	Yes	Yes	Yes
Ww2	Wilyabrup	Yes	Yes	Yes	Yes
Y	Yelverton	No*	Yes	Yes	No
Yd	Yelverton	Yes	Yes	Yes	Yes
YE	Yerraminnup	No	No	No	No
YEf	Yerraminnup	Yes	Yes	Yes	Yes
Yf	Yelverton	Yes	Yes	Yes	Yes
Yg1	Yarragil 1	No	No*	No	No
Yg2	Yarragil 2	No	No*	No	No
YN1	Yanmah	No	No	No	No
YN2	Yanmah	No	Yes	No	No
YR	Yornup	No	No*	No	No
Yw	Yelverton	Yes	Yes	Yes	Yes

* Complex is close to the criterion target threshold therefore we recommend that a 10% margin for error be applied to Criterion 1a ii) and 5% to criteria 1a iv), 1a v) and 3 i).

Table 4: Vegetation Complexes occurring in the South West NRM Region portion of the Swan Coastal Plain that currently meet criteria 1 a) ii), 1 a) iv), 1 a) v) and 3 i) based on Table 2 (Department of Environment and Conservation, 2007) using 2000-2004 native vegetation extent mapping (Department of Agriculture and Food Western Australia, 2006).

Interim Swan Coastal Plain Vegetation Complexes (Hedde <i>et al.</i> 1980)	Is criterion 1a ii) potentially met?	Is Criterion 1a iv) potentially met?	Is Criterion 1a v) potentially met?	Is Criterion 3 i) potentially met?
Abba Complex	Yes	Yes	Yes	Yes
Bassendean Complex-Central & South	No*	NA	NA	No
Beermullah Complex	Yes	Yes	Yes	Yes
Cannington Complex	Yes	NA	NA	Yes
Cartis Complex	Yes	Yes	Yes	Yes
Cottesloe Complex-Central & South	No	NA	NA	No
Dardanup Complex	Yes	Yes	Yes	Yes
Darling Scarp Complex	Yes	Yes	Yes	Yes
Forrestfield Complex	Yes	NA	NA	Yes
Guildford Complex	Yes	NA	NA	Yes
Herdsmen Complex	Yes	NA	NA	Yes

Interim Swan Coastal Plain Vegetation Complexes (Hedde <i>et al.</i> 1980)	Is criterion 1a ii) potentially met?	Is Criterion 1a iv) potentially met?	Is Criterion 1a v) potentially met?	Is Criterion 3 i) potentially met?
Jarrahwood Complex	Yes	Yes	Yes	Yes
Karrakatta Complex-Central & South	No	NA	NA	No
Kingia Complex	Yes	Yes	Yes	Yes
Ludlow Complex	Yes	NA	NA	No
Mungardup Complex	Yes	Yes	Yes	Yes
Preston Complex	Yes	Yes	Yes	Yes
Quindalup Complex	No	NA	NA	No
Serpentine River Complex	Yes	NA	NA	No*
Southern River Complex	Yes	NA	NA	No
Swan Complex	Yes	NA	NA	Yes
Vasse Complex	No*	NA	NA	No
Yoongarillup Complex	No	NA	NA	No

NA Indicates that this criterion relates to protection in the Jarrah Forest and Warren IBRA regions but the vegetation complex only occurs on the Swan Coastal Plain

* Complex is close to the criteria target threshold therefore we recommend that a 10% margin for error be applied to Criterion 1a ii and 5% to criteria 1a iv, 1a v and 3 i.

Criterion 1a) iii). The area is a large (greater than 20 ha), viable natural area in good or better condition of an ecological community with over 30% remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions (Desirable).

Where more than 30% of an ecological community remains, there is an opportunity to retain and protect a network of natural areas that are large, viable and in good or better condition and provide the conditions necessary to maintain biodiversity. The 30% threshold is a generalisation based on the range of studies conducted to date and may not be adequate to prevent the exponential loss of species for all ecological communities (see Section 1.6 and Chapter 17 of the Guidelines). Even at the 30% threshold there will already have been a moderate decline in the diversity of species that are sensitive to fragmentation.

It is also important to remember that current statistics on the extent of ecological communities in the SWBPA (measured using vegetation complexes) rely on data gathered remotely via satellite imagery or aerial photography. Therefore once a community is recorded as reaching the 30% threshold, the on-ground reality will inevitably be a much smaller extent of a community that is intact, viable and in good condition and thus able to maintain biodiversity. It is therefore essential to select the most viable areas in the best condition and with the greatest potential for connection to other areas in good condition to meet the 30% target.

In addition, higher thresholds for native vegetation cover may be required for objectives other than biodiversity conservation. The maintenance of natural hydrological cycles to prevent salinisation of land and water and to maintain ground and surface water quality and quantity depends heavily on native vegetation extent and condition. In some catchments a minimum of 70% native vegetation cover is required to prevent or begin to bring salinity under control (Government of Western Australia 1992c).

Setting criteria for the retention and protection of natural areas to maintain environmental services is beyond the scope of the Guidelines or this Addendum but needs to be considered as part of the assessment of the future of any natural area.

Criterion 1a) iv). The area is of an ecological community with only 1500 ha or 10% or less (whichever is greater) protected in formal reserves in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions (Essential).

To maintain the biodiversity of the SWBPA it is important to aim for at least a 10% protection target even if this is achieved through a combination of large regionally significant sites and smaller LSNAs protected by mechanisms put in place by Local Government. For the purposes of this Addendum we consider formal reserves to be those lands managed primarily for conservation purposes by the DEC (being National Parks, Nature Reserves, Conservation Parks and Regional Parks).

The "at least 10%" target is based on Munro and Holdgate (1991) guidelines originally intended to apply to constrained urban environments. It is now recognised that this target is inadequate to provide effective conservation of biodiversity (Environmental Protection Authority 2006b).

Vegetation complexes that meet this criterion are listed in Table 3 of this Addendum (for JF and WAR regions) and Table 4 (for SCP region).

Criterion 1a) v). The area is of an ecological community with only 1500 ha or 15% or less (whichever is greater) protected in formal plus informal reserves in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions (Essential).

While at least 30% of a given ecological community needs to be retained to conserve biodiversity, it is recognised that a certain proportion of this must occur in areas designated specifically for conservation. These areas are to be secured from future conflicting land uses and actively managed for conservation (i.e. they are protected).

Under the Regional Forest Agreement (RFA) process 1500 ha or 15% (whichever is the greater) of forest ecosystems was set as a minimum threshold for protection in secure tenure (ANZECC/Ministerial Council on Forests Fisheries and Aquaculture 1997). This precedent of aiming to protect 15% of each ecological community has since been adopted by the EPA and applied to vegetation complexes (Environmental Protection Authority 2006b). Vegetation complexes that meet this criterion are listed in Table 3 (for JF and WAR regions) and Table 4 (for SCP region) of this Addendum.

Criteria 1b. Local representation

Criterion 1b i). The area is of an ecological community with 10% or less remaining within the Local Government area (Essential).

The aim of this criterion is to conserve local biodiversity and a local sense of place at a bare minimum level. This criterion ensures that there is natural area retention in Local Government areas where there are few areas protected in DEC Managed Estate. Local Government should aim to ensure that all natural areas meeting this criterion are secured and protected for conservation. The South West Biodiversity Project has provided each Local Government with the information required to set NAC targets for this criterion.

Criterion 1b ii). The area is of an ecological community with 30% or less remaining within the Local Government area (Desirable).

This criterion directly addresses the need to conserve local biodiversity and local sense of place at an adequate level for biodiversity conservation within the Local Government area. It aims to ensure that the minimum amount of native vegetation cover needed to prevent exponential loss of species and failure of ecosystem processes across the Local Government area is retained.

Local Government should aim to ensure that a pre-determined proportion of the natural areas meeting this criterion is secured and protected for conservation using appropriate mechanisms. These areas need to be the best condition, most viable examples of each community available with the greatest potential for connection to other good or better condition areas.

The proportion protected needs to be determined in consultation with the local community but should not be less than 10% of an ecological community's extent across the Local Government area. This criterion ensures that there is a level of natural area retention and protection in Local Government areas where there are few areas protected in DEC Managed Estate. The South West Biodiversity Project has provided each Local Government with the information required to set NAC targets for this criterion.

Criterion 1b iii). The area is a large (greater than 10 ha), viable natural area in good or better condition of an ecological community with more than 30% remaining within the Local Government area (Desirable).

As explained under regional representation Criterion 1a iii), where more than 30% of an ecological community remains, the opportunity exists to retain and protect a network of natural areas that are large, viable and in good condition to provide the conditions necessary to maintain biodiversity. Also as discussed under Criterion 1a iii), higher thresholds may be required to provide other ecosystem services.



Patersonia occidentalis is a common species throughout the SWBPA. Common species (local representation) and not the rare and unusual, are the backbone of all natural areas. Protecting and managing these natural areas ensures we keep the common, common. Photo: K Savage

5.1.2 Diversity

This criterion relates to the diversity of ecological communities within a natural area.

Detailed criteria for diversity, and in particular species diversity, have not been included in the Guidelines or this Addendum due to the extensive ecological work that is required to document diversity in a way that allows comparisons between natural areas. Information exists on the diversity of flora and fauna for a number of natural areas in the SWBPA but considerable expertise would be needed to interpret this information.

Criterion 2 i). Natural areas in good or better condition that contain both upland and wetland structural plant communities (Essential).

Upland and wetland communities are quite different at an ecological level and contain ranges of species and habitats that are complementary. The transitional habitats between these communities are also particularly diverse. Therefore, any natural area still in good or better condition that contains both upland and wetland communities will have a high diversity of living organisms.

Local Governments are encouraged to seek professional advice in setting other diversity criteria relevant to their local area (where this advice is available and knowledge of diversity of their LNAs can be documented and interpreted for use).

This criterion has been developed to assist Local Governments to function within the State Government's land clearing permit system. The 'ten clearing principles' defined in Schedule 5 of the Environmental Protection Act 1986 are included as Appendix 5 of the Guidelines.

5.1.3 Rarity

Under these criteria, rarity refers to the scarcity or lack of abundance of ecological communities measured at the vegetation complex level or the floristic community level (e.g. TECs) or at the individual species level. All areas meeting rarity criteria are, at the very least, regionally significant in conservation value, except for small, less viable areas meeting only Criteria 3 iv) and v) below.

Criterion 3 i). The area is of an ecological community with only 1500 ha or 10% or less (whichever is the greater) of its pre-European extent remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions (Essential).

This criterion is also based directly on the National Targets and Objectives for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001a). It aims to retain the minimum amount of native vegetation cover needed to prevent exponential loss of species and failure of ecosystem processes across the regional landscape.

The meeting of this criterion is determined within the context of vegetation complexes. Vegetation complexes that meet this criterion are listed in Table 3 (for JF and WAR regions) and Table 4 (for SCP region) of this Addendum.

Criterion 3 iii). Natural areas containing Threatened Ecological Communities (TECs) (Essential).

There is currently an expectation in land use planning that TECs will be protected but at present there is only legislation in place to proactively protect the most severely threatened of these listed communities (the EPBC Act). The Biodiversity Conservation Act, currently being drafted for Western Australia, proposes statutory protection for all listed TECs. The Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (pursuant to the Environmental Protection Act 1986) prevent clearing of all listed TECs as their presence indicates an Environmentally Sensitive Area. The EP Act Schedule 5(d) also states that 'Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community' (See Appendix 5 to the Guidelines).

There is a list of TECs found within the SWBPA contained in Table 25 of this Addendum based on the 2004 list compiled by DEC. Lists of TECs are found at the website http://www.naturebase.net/component/option,com_docman/task,cat_view/gid,460/Itemid,1182/. While this list is updated regularly, for current information on TECs present locally contact the WA Threatened Species and Communities Unit (WATSCU) at DEC's Woodvale Research Centre for advice.

Criterion 3 iv). Natural areas containing Declared Rare Flora (DRF), Specially Protected Fauna (SPF), or significant habitat for Specially Protected Fauna (Essential).

Significant habitat is habitat that provides resources (breeding, resting, feeding), connectivity or habitat that is critical for a rare species' survival (Safstrom unpub. 2002). DRF and Specially Protected Fauna are protected under the State's Wildlife Conservation Act 1950. Lists of these protected species are regularly updated and published in the State Government Gazette. Most of these species are also listed for protection under the EPBC Act. The Biodiversity Conservation Act currently being drafted for Western Australia will update the statutory protection of these species. The Environmental Protection (Clearing of Native Vegetation) Regulations 2004

provide protection for rare flora by considering 50m around known locations to be an Environmentally Sensitive Area. No equivalent recognition is given to faunal habitat in these regulations. However, the EP Act Schedule 5b states that 'Native vegetation should not be cleared if it comprises the whole or a part of or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia'.

Criterion 3 v). Natural areas containing Priority or other significant flora or fauna or significant habitat for these fauna (Essential).

Priority flora are plant taxa that are under consideration as threatened flora but need further survey to adequately determine their status, or are adequately known but require monitoring to ensure that their status does not decline. Priority Flora and Fauna lists are maintained by DEC. The process of researching and listing species for statutory protection under the Wildlife Conservation Act 1950 and the Federal EPBC Act is a detailed and lengthy process and statutory lists do not necessarily reflect the current state of knowledge. A more serious problem is the lack of resources available to ensure adequate survey of natural areas to determine those species that are naturally rare or threatened. Where specialists identify Priority or other significant flora or fauna in LNAs and this is the only criterion the natural area meets, then the reason for concern over these species needs to be considered and advice sought, especially if the natural area is in poor condition and of low viability.

Lists of priority flora and fauna for this region have been compiled by the South West Biodiversity Project and provided to Local Governments (SWBP 2007a). Further information can be provided by DEC.



An example of a TEC located in the Shire of Serpentine-Jarrahdale, during spring flowering. The TEC is community type 8, Herb rich shrublands in clay pans of the Swan Coastal Plain. Photo: Val English

5.1.4 Maintaining ecological processes or natural systems – connectivity

Criteria can be set with the objective of maintaining ecological processes or natural systems. For the purposes of local biodiversity planning, one key issue is protecting and managing natural areas that are important for maintaining connectivity at the regional and local scale. This helps to ensure the viability of retained and protected areas and the continued survival of connectivity-sensitive species within these areas. It allows living organisms to move freely along environmental gradients in response to various threats, for example, wildfire and climate change.

The objective of ecological linkages is to connect natural areas, preferably with continuous corridors of native vegetation, to allow fauna and flora (pollen, seeds etc.) to move between these areas to access resources and suitable habitat for survival and reproduction. In highly fragmented landscapes, continuous corridors of vegetation rarely exist, except perhaps along rivers and creeklines and this vegetation is often in poor condition.

Research in the ACT/NSW region has shown that the connectivity of natural areas becomes a significant factor for the distribution of many woodland bird species where core habitat areas are less than 10 ha in size. In Freudenberger's study (Freudenberger 1999), for areas below 10 ha there was a direct relationship between distance from other natural areas and the probability of a given species being present. Generally, natural areas needed to be within 500 - 1000 m of one another to maintain the diversity of woodland bird species. The third significant factor was the structural complexity of the vegetation in the natural area, with degraded areas with only trees and few shrubs remaining being of limited value. It was concluded that stepping stones of good condition native vegetation at least 10 ha in size located no more than 500 - 1000 m from each other provided the best connectivity across the landscape for a range of woodland bird species.

Several studies have found that linear corridors of native vegetation need to be at least 25 - 50 m wide to function effectively as habitat links for a range of bird species (Freudenberger 1999; Barrett 2000). This width requirement is likely to suit a range of other animals as well as many plants, fungi and microorganisms. A width of 50 m is considered the minimum required for maintaining the viability of long, linear natural areas. For linear corridors of reconstructed habitat to be effective, they also need to consist of a mix of trees, shrubs, herbs, grasses and sedges/rushes similar to the natural areas being linked to recreate the structural complexity and floristic characteristics of habitat required by a wide range of species.

In some cases, while local habitat quality may be low, proximity to areas with higher quality habitat may support a richer suite of species. For instance, analysis of bird surveys in 121 reserves in the Perth region has suggested that only 11 species are able to persist within a variety of habitats in an urban context, but 54 (83%) of all species in the study are dependent upon native vegetation within a 2 km radius of the site at which they occur. Three groups were identified. One consisted of bushland-dependent species that were more common on the less-developed urban fringe. The tree group was dependent upon native eucalyptus species for survival as well as the presence of logs. A further group including wide-ranging and rare species was negatively associated with urbanisation (Davis *et al.* 2007).

The most effective way to provide connectivity across the landscape for as many species as possible is to protect existing natural areas as stepping stones within ecological linkages that connect the larger, more viable natural areas.

Criterion 4 i). The natural area acts as an ecological stepping stone within an existing "regional ecological linkage" which has been identified in a published report relevant to the study area (or part of the study area) (Note: published "regional ecological linkage" information will not be available for some areas) (Essential).

All existing LNAs partly or wholly contained within a designated Regional Ecological Linkage are considered to meet this criterion.

Criterion 4 ii). Natural areas acting as stepping stones within a Local Ecological Linkage determined by a Local Government (Essential).

All existing LNAs within 500m of a designated local ecological linkage are considered to meet this criterion. Each Local Government is encouraged to identify local ecological linkages as part of the local biodiversity planning process (see Section 6.2 of this Addendum for a guide to identification of locally significant ecological linkages).

5.1.5 Protecting wetland, streamline and estuarine fringing vegetation and coastal vegetation

Wetland categories have been defined by the Environmental Protection Authority (1993). Protecting good condition wetlands with an associated buffer, ideally of upland vegetation, is already expected under existing state and regional legislation and policy (Section 3.2 in this Addendum) for a number of reasons:

- ▶ a significant loss of wetlands has already occurred due to past development;
- ▶ good condition wetlands play a crucial role in maintaining water quality and quantity;
- ▶ the wetlands of the SWBPA and in particular, the SCP, contain a unique and highly diverse range of species and communities; and
- ▶ most wetlands are directly connected to regional and/or local groundwater aquifers.



Vasse-Wonnerup Wetlands, in the Shire of Busselton, is Ramsar listed. This photograph typifies freshwater wetlands of the western side of the Swan Coastal Plain where between 70 to 80% have been cleared, filled or drained, usually for agricultural purposes or urban development. Photo: Natalie Olsen

Conservation of the biodiversity characteristics of this category of natural areas is covered by the six following criteria:

Criterion 5 i). The natural area is a Conservation or Resource Enhancement category wetland and/or its buffer zone (Essential).

Criterion 5 ii). The natural area is an EPP Wetland and/or its buffer zone (Essential).

All wetlands meeting criteria for listing as Conservation Category or Resource Enhancement Wetlands (using the methods outlined in Environmental Protection

Authority (1993)) or designated as EPP Lakes (Government of Western Australia 1992b) within a Local Government area need be protected with an appropriate buffer. Schedule 5 of the EP Act states that vegetation should not be cleared if 'it is growing in, or in association with, an environment associated with a watercourse or wetland'. The EP (Clearing of Native Vegetation) Regulations also defines wetlands and their 50m buffers as 'environmentally sensitive areas' and thus limits the ability of landholders to develop this land.

Criterion 5 iii). The natural area is a channel wetland (e.g. river, stream, creek) and/or its associated riparian vegetation and/or its buffer zone (Essential).

Protection of wetland and riparian vegetation is a high priority in NRM planning due to the pivotal role healthy waterways play in hydro-geological cycles affecting both water quality and quantity and affecting land productivity. On many occasions, riparian vegetation will also form part of a designated Regional Ecological Linkage or local ecological linkage. The aim is to protect all riparian vegetation plus an appropriate buffer of upland vegetation where this still exists, to ensure effective filtering of nutrients and other pollutants. Natural areas that are wetlands or areas with riparian vegetation are often long and thin. Therefore, it is important that they are wide enough to be viable and function effectively as ecological linkages.

Criterion 5 iv). The natural area is within a floodplain area and/or its buffer zone (Essential).

Floodplains are generally no-development zones due to the risk of damage to infrastructure when flooding occurs, even if such flooding is an infrequent event. Any native vegetation occurring on or buffering floodplains is important for the stability of the soils and landform of the floodplain itself and the health of the associated river system or wetland. Floodplains, especially those that are regularly inundated, can also be important breeding and feeding sites for a wide range of fauna and important for the maintenance of life cycles of specialised plant groups. The filling of floodplains to allow construction of buildings, roads and other development typically leads to problems downstream due to the channelling of fast flowing water down a river system or flooding elsewhere in the case of wetlands.

Criterion 5 v). The natural area is part of an estuarine ecosystem and/or its fringing vegetation and/or its buffer zone (Essential).

Estuarine fringing vegetation is fundamental to the natural ecological processes that maintain the health of the associated waterway. Estuaries are some of the most biologically productive and significant ecosystems in any natural region. The estuary and its fringing estuarine vegetation contribute significantly to the maintenance of biodiversity on land and at sea. It is, therefore, essential that all estuarine fringing vegetation be retained and protected.

Criterion 5 vi). The natural area contains coastal vegetation on the foredunes and/or secondary dunes (Essential).

Apart from its biodiversity conservation value coastal vegetation is particularly important for the stabilisation of beaches and dunes along the coast. All foredune and secondary dune vegetation needs to be retained and protected to prevent costly losses of beach, dunes and infrastructure. Many coastal Local Governments around Australia have experienced catastrophic events that could have been avoided if foredune and secondary dune vegetation had been retained. The Statement of Planning Policy No. 2.6: State Coastal Planning Policy (Government of Western Australia 2003a) should be used along with this criterion to guide coastal development. The policy recommends a total setback from the coast of 100 m to protect buildings and infrastructure from physical processes by:

- ▶ absorbing the impact of a severe storm sequence;
- ▶ allowing for shoreline movement;
- ▶ allowing for global sea level rise; and
- ▶ allowing for the fluctuation of natural coastal processes.

The setback calculations outlined in this Statement of Planning Policy will not normally delineate the coastal foreshore reserve. The policy notes that factors other than physical processes will often require a greater setback than that recommended for protecting development from physical processes and these should be considered on a case-by-case basis. These factors include ecological values, landscape, seascape, visual amenity, indigenous and cultural heritage, public access, recreation and safety to lives and property.

With the exception of restriction on clearing for mining activities the EP Act does not appear to offer any special protection for near coastal vegetation.



The protection of coastal vegetation is important for dune stabilisation. Photo: K Savage.

5.2 Essential and Desirable criteria

All of the areas meeting any of the ecological criteria are considered locally significant from a biodiversity conservation perspective. However, limitations on resources available to Local Governments may require them to further consider the priorities for protection, retention and management of these Locally Significant Natural Areas. For this reason, the ecological criteria have each been designated as 'Essential' or 'Desirable'. All else being equal, these designations infer the current legislative and policy view on the necessity to retain and protect any given natural area. This further prioritisation of sites according to the criteria they meet is addressed in Tables 10 and 11 of Section 10.7 in this Addendum. In reality, the prioritisation of areas for conservation will also depend on parameters such as social and economic factors.

Threshold targets exist for the representation and rarity ecological criteria. Criteria are designated as Essential where conservation is of greater urgency. Where statistics show that clearing has already led to the ecological community being less than or equal to the percentage threshold for a given ecological criteria, then no further clearing should occur and all native vegetation of that ecological community should be retained. In some circumstances it is unlikely that all of the native vegetation meeting criteria having threshold targets will be in good or better condition and viable in the long-term. In these circumstances efforts to protect and manage LNAs meeting these criteria should focus on the areas that are most viable, in the best condition and have the greatest potential for connectivity to other good or better condition areas.

Where the extent of a remaining ecological community exceeds the threshold targets set for particular criteria, an opportunity exists to retain and protect a network of natural areas that are large, viable and in good or better condition. Once an ecological community is reduced to the threshold target based on statistics derived from remotely sensed data such as satellite or aerial photography, invariably, a much smaller proportion than this remains on the ground that is intact, viable and in good or better condition and so able to maintain biodiversity. Clearing down to the threshold target and retaining only those areas required to meet the target is not supported, especially if no land development constraints exist. Until we can better predict the thresholds required to conserve the unique biodiversity of South West ecological communities based on research in these actual ecosystems, the precautionary principle applies.

Table 7 in this Addendum provides a summary of the ecological criteria to identify Locally Significant Natural Areas, lists their priority and the appropriate assessment methods to determine the natural areas that meet each criterion. The Guidelines promote the use of two assessment methods: a desktop assessment using remotely collected information, as well as field assessment.

Table 7. Summary of ecological criteria to identify Locally Significant Natural Areas, their priority ('Essential' or 'Desirable') and the appropriate methods to determine natural areas that meet each criterion

Criteria	Priority	Assessment Method
1. Representation a) Regional		
i) The area is of recognised International, National, State or Regional value but not already protected and/or managed for conservation Estate	ESSENTIAL	DESKTOP (Potentially Locally Significant Natural Areas [PLSNAs]) FIELD CONFIRMATION
ii) The area is of an ecological community with only 1500 ha or 30% or less (whichever is greater) of its pre-European extent remaining in the South West NRM Region portion of the SCP or in the Southwest Forest Region portion of the JF and WAR regions.	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
iii) The area is a large (greater than 20 ha), viable natural area in good or better condition of an ecological community with over 30% remaining in the South West NRM Region portion of the SCP or in the Southwest Forest Region portion of the JF and WAR regions.	DESIRABLE	FIELD
iv) The area is of an ecological community with only 1500 ha or 10% or less (whichever is greater) protected in formal reserves in the Southwest Forest Region portion of the JF and WAR regions.	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
v) The area is of an ecological community with only 1500 ha or 15% or less (whichever is greater) protected in formal plus informal reserves in the Southwest Forest Region portion of the JF and WAR regions.	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION

Criteria	Priority	Assessment Method
1. Representation b) Local		
<p>i) of an ecological community with 10% or less remaining within the Local Government area</p> <p>The aim of this criterion is to conserve local biodiversity and local sense of place at a bare minimum level. However, 10% is not recognised as adequate for biodiversity conservation.</p> <p>No LNAs will meet this criterion where 10% of an ecological community is already protected in DEC Managed Estate or Regional Parks</p>	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
<p>ii) of an ecological community with 30% or less remaining within the Local Government area</p> <p>The aim of this criterion is to conserve local biodiversity and local sense of place at an adequate level for biodiversity conservation.</p> <p>No LNAs will meet this criterion where 30% of an ecological community is already protected in DEC Managed Estate, Regional Parks</p>	DESIRABLE	DESKTOP (PLSNAs) + FIELD CONFIRMATION
<p>iii) large (greater than 10 ha), viable natural areas in good or better condition of an ecological community with more than 30% remaining within Local Government area</p>	DESIRABLE	FIELD
2. Diversity		
<p>i) natural area in good or better condition that contains upland and wetland structural plant communities</p>	ESSENTIAL	FIELD
3. Rarity		
<p>i) of an ecological community with only 1500 ha or 10% or less (whichever is the greater) remaining in the IBRA subregion</p>	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
<p>iii) contains a threatened ecological community (TEC)</p>	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
<p>iv) contains Declared Rare Flora (DRF), Specially Protected Fauna (SPF) or significant habitat for these fauna</p>	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
<p>v) contains Priority or other significant flora or fauna or significant habitat for these fauna</p>	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION

Criteria	Priority	Assessment Method
4. Maintaining ecological processes or natural systems – connectivity		
i) natural areas acting as stepping stones in a Regionally Significant Ecological Linkage	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
ii) natural areas acting as stepping stones in a locally significant ecological linkage	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
5. Protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation		
i) Conservation or Resource Enhancement category wetland plus buffer	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
ii) EPP Lake plus buffer	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
iii) riparian vegetation plus buffer	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
iv) floodplain area plus buffer	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
v) estuarine fringing vegetation plus buffer	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION
vi) coastal vegetation on foredunes and secondary dunes	ESSENTIAL	DESKTOP (PLSNAs) + FIELD CONFIRMATION

5.3 Potentially Locally Significant Natural Areas

The Perth Biodiversity Project has developed a GIS dataset of Potentially Locally Significant Natural Areas (PLSNAs) using remotely collected, regional datasets to identify those LNAs likely to meet Essential and/or Desirable Criteria for local significance. A comparable dataset for the SWBPA is not currently available. However, there are datasets and conservation planning resources available to South West Biodiversity Project staff to help to determine PLSNAs. These include:

- ▶ Regional Forest Agreement datasets. These identify reserves, potential reserves and significant areas in the Jarrah Forest and Warren IBRA regions reflecting both State and Commonwealth Government conservation planning priorities;
- ▶ wetlands datasets that identify State, Commonwealth and International biodiversity conservation assets;
- ▶ relevant localised planning initiatives such as the Greater Bunbury Region Scheme (GBRS) (Western Australian Planning Commission 2007);

- ▶ vegetation complex, and associated remnant vegetation, mapping and analysis;
- ▶ reserves mapping;
- ▶ Swan Coastal Plain vegetation mapping;
- ▶ Threatened Ecological Community data;
- ▶ Rare and Priority Flora data; and
- ▶ Department of Environment and Conservation technical support.

A combination of these resources (and other relevant resources as they become available) will serve to identify most PLSNAs within the SWBPA. For more information it is suggested that staff at the South West Biodiversity Project be contacted directly.

It must be understood that these resources can provide information which is indicative only of the values of LNA's. GIS information is not available to address all Local Significance Criteria (for example it is impossible to accurately assess vegetation condition using current regional GIS datasets). In most cases, only field assessment can determine that a site meets one or more criteria. It is worth checking whether the required field information is already available through previous local investigations or from within the local community.

5.4 Consideration of other environmental and social values

It is important that LSNAs are identified using the standard ecological criteria discussed in Section 5.1 of this Addendum. Any LNA that meets at least one of these ecological criteria is considered locally significant. However, LSNAs are likely to provide many other environmental benefits in addition to being of importance for social reasons. These other environmental values add significance to sites that already meet ecological criteria and can help garner additional community support for the protection of LSNAs. Where there is community interest or support for the protection of a LSNA it is likely that this will be given considerable regard by decision-makers. Therefore, the values described below should not be used to identify LSNAs, but should be listed as part of an assessment of opportunities and constraints when considering the future of a LSNA.

Consideration of other environmental values

Biodiversity and natural areas provide fundamental ecosystem services such as maintenance of fresh water, clean air, soil fertility and biological pest control. Failure to sufficiently protect natural areas is one of the root causes of eutrophication of rivers and estuaries, dryland salinity, soil acidity, soil erosion and decreased water quality. For example, the maintenance of the water quality in our major waterways is closely linked to the natural areas in their catchments. To put the value of ecosystem services in perspective, a report by the World Resources Institute valued 'free' ecosystem services at over \$30 trillion to the global economy each year (as cited in Commonwealth of Australia 2001a).

Retention of LSNAs in many circumstances will contribute to the maintenance of natural water and nutrient cycles for the following reasons:

- ▶ natural areas are important for preventing silt and other unwanted materials from entering waterways, the settling of sediments, biological filtration and oxygenation;
- ▶ natural areas are required to protect the landscape and infrastructure from flood damage, for example, natural areas on or bordering flood plains;
- ▶ natural areas are required to protect development from physical processes at the coastline;
- ▶ natural areas are important for groundwater recharge to maintain water quality and quantity;
- ▶ natural areas are important for maintaining surface water quality and quantity; and
- ▶ natural areas provide habitat and resources for species which act as pollinators and pest controls necessary for agricultural production.

Many of the other environmental benefits of retaining and protecting natural areas are recognised by the State Government policies listed in Section 3.2 of this Addendum.

Consideration of other social values

Consideration of other social values may contribute to the opportunities for the retention and protection of a natural area. In instances where criteria are developed to reflect these values it will be important that this process is clearly stated and areas identified using these criteria are clearly distinguished from LSNAs meeting ecological criteria. Examples of some key social values are discussed below:

- ▶ Indigenous or European heritage or cultural value:
 - ▶ a natural area with Indigenous heritage or cultural value may be a registered Aboriginal Heritage Site. Initial identification of these sites may be made using the Aboriginal Heritage Inquiry System, maintained by the WA Department of Indigenous Affairs. However, this register does not cover all sites and any Aboriginal material or sites not registered must be reported (Department of Indigenous Affairs, undated). Consult further with the local Indigenous community and with the Department of Indigenous Affairs; and
 - ▶ a natural area with European heritage or cultural value, for example, built structure or past land use. Consult with the local community and the Heritage Council of WA for sites entered in the Register of Heritage Places.
- ▶ Education, community or passive recreation value:
 - ▶ active Friends/environmental group involved in protecting/managing the natural area;
 - ▶ natural area of particular value to the community. Consult with the local community; and
 - ▶ within walking distance (400 m) (Government of Western Australia 2000a) of the following:
 - ▶ educational facility (school, technical college, university). Determine the educational use and potential for management by faculty, students and local residents;
 - ▶ retirement village. Determine use for passive recreation and potential for management by local residents;
 - ▶ active recreational facility. Determine use for passive recreation and potential for management by recreation groups and local residents; and
 - ▶ outer edge of a residential area. Determine use for passive recreation and potential for management by local residents.
- ▶ Aesthetic value:
 - ▶ natural area located on a prominent high point in the landscape, for example, local hill, ridge-line;
 - ▶ natural area screening or buffering one land use from another (e.g. interface between industrial and residential);
 - ▶ natural area containing a scenic natural feature, for example, granite outcrop, open water wetland; and
 - ▶ natural area with general landscape value.

Optional criteria for icon species or communities – locally significant flora, fauna and/or communities

A Local Government may choose to create criteria for locally significant flora, fauna or ecological communities relevant to their area. Many members of the community can relate to the natural environment through identification of recognisable or significant flora or fauna species. Local Governments may wish to identify icon flora and fauna

through consultation with their local communities, which may be very common species and do not have to be unique to the Local Government area. These criteria allow a Local Government to focus on establishing a sense of place for the local community by promoting an easily identifiable species. It also allows the focus to be taken away from rare and threatened species that may not be encountered very often by the local community. The focus for locally significant fauna needs to be on protecting the habitat that supports these fauna.

An example of potential icon flora and fauna species are the floral and fauna emblems used by the Shire of Denmark, the red flowering gum (*Eucalyptus ficifolia*) and the Splendid Blue Wren (*Malurus splendens*) found in south-western Western Australia (Figure 5).



Figure 5. The red flowering gum (*Eucalyptus ficifolia*) and the Splendid Blue Wren (*Malurus splendens*) are the flora and fauna emblems of the Shire of Denmark.

6. Guidelines for viability assessment and determining ecological linkages

Many natural areas in the South West Biodiversity Project Area (SWBPA) are small in size and fragmented or isolated from other natural areas. This is particularly the case in the Swan Coastal Plain (SCP). This has significant implications for the management as well as the long-term integrity of biodiversity values. Even if an area meets any one of the ecological criteria (discussed in Chapter 5 of this Addendum) and is locally significant, it will be important to assess whether these values can be maintained into the future. An assessment of the viability of all natural areas will need to be undertaken as this has significant impact on the level and cost of management required for a natural area. Any assessment of viability is a simplification of a complex system based on a handful of easily measured viability factors.

6.1 Assessing the viability of natural areas

For the purposes of this Addendum, viability is considered to be a measure of the ability of an ecological community to be self-sustaining in supporting and maintaining the full range of living organisms it naturally contains over a protracted time frame, such as at least 50 years. Therefore viability depends a great deal on the inherent resilience of an ecological community. Resilience is the natural ability of a community to resist or recover from disturbance (for example, weed invasion, fire, pathogens, pest fauna species) and any other threats with the potential to deliver adverse environmental impacts.

Appropriate and effective management can influence viability. Although small and degraded areas may be viable with intensive management it is important to consider whether the level of management and the amount of resources required to make an area viable is justified by the biodiversity conservation outcomes.

It is very difficult to determine criteria for assessing viability for a given ecological community without long-term research. It is even more difficult to set criteria that apply to a wide range of communities such as those that occur across the SWBPA. Therefore these guidelines have been prepared to assist in the analysis of the viability of natural areas. The viability of natural areas should be assessed during the desktop and field assessment process detailed in Section 12 of this Addendum. It is an important consideration when setting priorities during the local biodiversity planning process and if necessary should be used in deciding the percentage, proportions and configurations of each natural area to be protected.

The five easily measured components of viability are discussed below:

- ▶ size;
- ▶ shape;
- ▶ perimeter to area ratio;
- ▶ condition; and
- ▶ connectivity.

6.1.1 Size

Size is an important factor in determining the long-term viability of a natural area; the bigger the area, the greater its capacity to retain its biodiversity, maintain ecological function and resist disturbance factors and threatening processes (Diamond 1975). However, the minimum size for a given area to be viable varies greatly between different ecological communities and depends on the presence of threats and how well these can be controlled. For example, on sandy soils, Banksia woodlands with a naturally dense shrub understorey may be relatively resistant to weed invasion and can be viable in small patches of only a few hectares. Some communities on clay-based soils on the eastern side of the SCP are also viable in small areas. In contrast, some ecological systems such as some of those dominated by tuart (*Eucalyptus gomphocephala*) woodland remain prone to weed incursion even when remnants of this system are over 100 hectares in size. This is a consequence of the herbaceous "grassy" understorey that naturally occurs within many of these systems (Attiwell and Wilson 2003).

Minimum size also depends on the habitat requirements of target species, as species differ in their requirements (Lambeck 1997). Remnants as small as four hectares are important for retaining intact examples of reptile diversity and areas of one hectare can retain viable populations of many reptile species if fire frequency and predation by feral animals are controlled (How and Dell 2000).

Small areas that can be consolidated in Regional Ecological Linkages or local ecological linkages may be particularly important for protection. Where possible small patches should be enhanced or increased in size to improve viability.

Studies of various bird species in temperate woodlands on farms in Australia have determined that about 10 ha is the minimum patch size for maintenance of habitat for a suite of bird species (Barrett 2000). Freudenberger (1999) found that many woodland birds in the ACT/NSW region were only found in patches of native vegetation of at least 10 ha and if sufficient scrub cover was present. Similar studies undertaken in the wheatbelt of Western Australia suggest a 15 ha minimum patch size for shrublands and heathlands and 50 ha for woodlands to maintain a viable suite of habitat-sensitive bird species (Lambeck 1998).

Studies of areas of various sizes for a given ecological community type are needed in the SWBPA to determine what size areas are viable on the ground, based on their ability to support wildlife, maintain their condition and resist the threats that may be present.

Setting a minimum patch size to use across the SWBPA is difficult for local biodiversity planning, because of the multitude of factors to consider when assessing viability. For example, a general minimum area of 20 ha was used for selecting regionally significant bushland within the Perth Metropolitan Area for the Bush Forever project although smaller areas were included for poorly represented ecological communities. There is substantial variation between the extent, quality and patch size of remnant vegetation managed by Local Governments across the SWBPA. It is recommended that although the 20 ha rule can still be applied as a minimum, Local Governments with few LNAs of that size should consider the management of smaller areas. This consideration will be based largely on the viability of individual LNAs.

The Urban Bushland Strategy suggested that Locally Significant Natural Areas (LSNAs) should be greater than 4 ha (Government of Western Australia 1995). This would depend on areas being no smaller than a 200 m by 200 m square, the core area of which is about 1 ha, assuming that edge effects extend about 50 m into the area. In reality many Local Governments are already protecting and managing areas less than 4 ha and even 1 ha, where clearing has already occurred without planning for the viability of these remnants.





*Beaumarke Park in Mindarie which contains the Declared Rare Flora *Eucalyptus argentea*. The small size of this remnant natural area means the long term existence of the native vegetation is under threat without intensive and on-going management. Photo: K Savage.*

Patches of vegetation this small usually require intensive management and can be costly to maintain. However, community expectations can be high for these areas as they may often be considered the 'local patch' and voluntary community support for management may be available. Despite this, these small patches frequently degrade over time and become only trees or large shrubs over weeds. This is commonly seen in Public Open Space and golf courses where small islands of bush have been left surrounded by landscaped areas. These areas are not generally considered viable for conserving biodiversity in the long term although there are some important exceptions to this rule.

The guiding principle when planning local reserves is that management costs are comparatively much lower per hectare for larger and more viable areas. Therefore, where clearing has not yet occurred, planning for local reserves of native vegetation for conservation (or passive recreation purposes) should not result in natural areas smaller than four hectares in a compact shape. Where reserves fall below four hectares, proponents and Local Governments should plan to increase these natural areas to the maximum size in a compact shape possible for a given site, by encouraging natural regeneration processes and where necessary, by revegetation (direct seeding or planting of local provenance material). This will buffer the natural area and improve viability.

For small areas of marginal viability the identification and control of threats is critical and sufficient funds for active management must be allocated on a regular basis. Local Governments may choose to seek financial assistance from developers during the planning stage of new projects to cover future management costs of natural areas to be retained within the development area. Planning should recognise that small areas not designed to use natural processes to maximise viability will require ongoing active management and will cost more to maintain. Alternatively, resources could be directed to management of the larger, more viable areas within a Local Government area as a trade-off for clearing of other less viable natural areas for development.

The following size classes can be applied to LNAs as a general guide to help determine viability:

Size greater than 20 ha	Higher Viability	Lower management costs per ha.
Size greater than 10 ha but less than 20 ha		
Size greater than 4 ha but less than 10 ha		
Size greater than 1 ha but less than 4 ha	Lower Viability	Higher Management costs per ha.
Size less than 1 ha	Very Low Viability	Very High Management costs per ha.

6.1.2 Shape

Shape influences the level of impact that threats may have on the edges of a natural area. These edge effects can be observed extending into natural areas. The degree that edge effects extend into natural areas varies greatly between different ecological communities and depends on the types of threats and how well these can be controlled. Threats acting at the edges include weed invasion, grazing and trampling, increased sun and wind exposure, pollutants (fertiliser, pesticide, toxins, excess water) drift or runoff, air pollution from traffic or industry, noise, artificial lighting at night (affects predator-prey relationships), rubbish accumulation or dumping and exposure to predators, feral animals, domestic pets, weeds and diseases from surrounding land uses.

According to Safstrom and Craig (unpub. 1997) edge effects can extend up to 50 m into relatively resilient heaths and shrublands in the Western Australian wheatbelt and up to 500 m in less resilient wheatbelt woodlands. Thus, the natural areas less

than 100 m wide primarily contain edge habitat with low viability and consequently, diminished wildlife habitat values even for relatively resilient communities. However, it was also noted that narrow areas of as little as 5 m in width can be viable on some soils if edge effects are managed. While thin, linear reserves generally have diminished species diversity and wildlife habitat values, in many cases there is little or no other remnant vegetation. As such, these remnants are the last refuge for many species and the linear habitat patches can often provide valuable connections between remnants within these highly fragmented landscapes (Saunders *et al.* 1991; Bennett 2003).



This narrow reserve in Dalyellup, Shire of Capel, is suffering from edge effects such as weed encroachment. Native shrubs and herb layers are greatly diminished in diversity. Photo: Shaun Molloy

In the SCP edge effects are typically observed to extend beyond 25 m into natural areas (Clarke, 2003 pers. comm.). Therefore, as a general guide, natural areas less than 50 m wide will contain mostly edge habitat of low viability.

Compact areas such as circles, squares and squat rectangles have the greatest viability, as their core areas are the largest possible for a given size. Long, thin shapes have the lowest viability, as most of their area is impacted by edge effects. Research has shown that native vegetation that acts as a link between larger viable natural areas should be at least 25-50 m wide for use by many bird species (Freudenberger 1999; Barrett 2000). Also, birds are more likely to use patches of native vegetation if these patches are within 500 – 1000 m of viable natural areas (Freudenberger 1999). Therefore, long thin areas at least 50 m wide located within 500 – 1000 m of a viable natural area may have important ecological linkage value despite the low viability of the poorly shaped area itself.

The following shape criteria can be applied to LNAs as a guide in determining viability:


Circle, square or squat rectangle	Higher Viability
Oval, squat oblong or equilateral triangle	↓
Irregular shape with few indentations	
Irregular shape with many indentations	
Long thin shape with large proportion of area greater than 50 m wide	Lower Viability
	↓
Long thin shape with large proportion of area less than 50 m wide	
	Very Low Viability

6.1.3 Perimeter to area ratio

Most impacts on natural areas occur around their edges and, as a general rule, because circular remnants have less edge relative to their area than long and narrow areas, the protected area within the natural area is greater for circles (Diamond 1975).

Perimeter to area ratio is determined by size and shape and therefore can be a useful indicator of viability. Divide the length of the perimeter by the area (always ensure both measurements are in the same units, for example, metres and metres squared). The higher the score, the lower the viability, as the natural area will be more prone to edge effects.

The following perimeter to area ratios can be applied to LNAs as a guide in determining viability:

Less than 0.01	Higher Viability
Greater than 0.01, less than 0.02	
Greater than 0.02, less than 0.04	
Greater than 0.04	Lower Viability

6.1.4 Condition

Vegetation condition is a measure of an area's similarity to what it would have looked like prior to the effects of disturbance by European settlement in Australia (Keighery 1994). This is difficult to determine with confidence without on-ground experience of the full range of intact, undisturbed plant communities for a given region. This experience can be hard to obtain in some areas of the SWBPA, especially for the SCP, due to the high degree of disturbance and fragmentation of the original plant communities. However, there are intact areas that can act as reference sites.

Various vegetation condition scales have been developed and used in Western Australia. The two most commonly used are Keighery (1994) and Kaesehagen (1994). On the SCP, the Keighery method has been used consistently by the EPA. In addition DEC has used this standard in the assessment of over 1000 reference plots and to describe the 287 sites in Bush Forever. DEC and the Wildflower Society of Western Australia have also used this scale in a number of regional studies.

The Kaesehagen condition scale is often used by the community and Local Government environmental staff. Section 12.7 of this Addendum shows a comparison of the Vegetation Condition Classes used in the Keighery and Kaesehagen methods. For comparisons with other, less commonly used scales, see Bush Forever Volume 2 (Government of Western Australia 2000b).

The various factors assessed using these condition scales are:

- ▶ plant community structure and composition;
- ▶ disturbance factors, for example, logging, grazing, partial clearing, inappropriate fire frequency and/or intensity, soil disturbance by rabbits, predation by feral animals, impacts from surrounding land uses;
- ▶ weed invasion; and
- ▶ vegetation health, for example, diseases, pests, threatening processes such as dryland salinity, lowering of watertable, climate change, fragmentation.

The effects of many disturbance factors and threatening processes take years to become obvious. It is often the case with long term disturbances, such as salinity and climate change, that by the time the effects of the disturbance are obvious the effective management for biodiversity conservation purposes may no longer be possible (Environmental Protection Authority 2007b). If an area is in "Very Good" or better condition, based on the Keighery condition scale, then the time since isolation from other natural areas should be determined to give an idea of how resilient the area

is to disturbance. If an area has been isolated for a long time (>20 years) and is still in "Very Good" condition, the viability of that area is likely to be high, assuming the severity of disturbance factors and threatening processes remain constant.

The condition of some non-vegetated natural areas can be assessed using established methods. Wetlands should be assessed using the methods outlined by the Environmental Protection Authority (1993) while those developed by Shepherd and Siemon (1999) should be used for assessing foreshore areas.

6.1.5 Connectivity – proximity and linkage to other natural areas

The viability of any natural area depends on its proximity to other natural areas and the quality of the linkage between them. These two factors influence the movement of individual organisms and the flow of genetic material between natural areas. In turn this influences the long term survival of species through;

- ▶ the provision of a greater diversity of habitats;
- ▶ allowing greater genetic variation within species;
- ▶ enabling species to adapt to environmental change; and
- ▶ enabling species to recolonise areas following local extinctions.

Therefore the viability of a given natural area is likely to increase:

- ▶ the closer it is to other protected natural areas (for example, DEC Managed Estate and Regional Parks);
- ▶ the greater the number of protected natural areas within close proximity; and
- ▶ the better the condition of the surrounding natural areas.

If the surrounding natural areas are degraded such as when a remnant is reduced in structure to trees and large shrubs over weeds, only a limited number of species will use these areas for linkage or as core habitat. Furthermore, significant degradation of vegetation structure may leave some fauna exposed to a greater than normal risk from both native and feral predators. In this way, degraded linkages can actually have a negative impact on native faunal populations (Saunders *et al.* 1991; Bennett 2003).

6.2 Regional and local ecological linkages

Habitat fragmentation is a key threatening process leading to loss of biodiversity (Bennett 2003). Once a given habitat type falls below about 30% of its original extent there is a rapid decline in the number of species that can survive in the landscape. This occurs as connectivity is lost and minimum habitat requirements for some species are not provided (Smith and Sivertsen 2001; Figure 2 of the Guidelines). This rapid decline may occur at higher levels of retention of original habitat if the habitat is of poor quality and exposed to ongoing threats (Department of Natural Resources and Environment 2002). When habitat patches become fragmented to this level, the spatial arrangement of natural areas across the landscape becomes critically important for maintaining biodiversity (Smith and Sivertsen 2001).

Much of the landscape in the SWBPA, especially on the SCP, is now fragmented to such an extent that substantial loss of biodiversity is already occurring. The survival of remaining species, even in large, consolidated and regionally significant areas will depend on well-planned and managed ecological linkages, in conjunction with careful management of the protected areas that are being linked. Thus, the long-term viability and conservation values of DEC Managed Estate and Regional Parks depend in part on an effective network of Regional Ecological Linkages. LNAs immediately adjacent, or in close proximity to regionally significant areas are particularly valuable for buffering the effects of threats to these significant areas.

6.2.1 Regional Ecological Linkages

Designated Regional Ecological Linkages serve to link protected natural areas of regional significance by retaining the best condition LNAs available that can act as stepping stones for flora and fauna between regionally significant areas. This increases the long-term viability of all the constituent areas. The regional linkages also need to connect to natural areas of regional significance that are protected outside the study area. To be effective the linkages should incorporate the major variation in plant communities and fauna habitat typical of the region so that the widest range of flora and fauna possible can use the links (Bennett 2003; Dell 2003 pers. comm.). For example, only using waterways as Regional Ecological Linkages will limit the movement of flora and fauna to only those species that use riparian habitat. Conversely a dramatic change in habitat type within a link may be a barrier to fauna movement. For example, an abrupt change from tall closed woodland to a low shrubland may prevent movement of arboreal fauna, either by forming a physical barrier or by causing greater exposure to hazards including predators that soon learn the benefits of patrolling these areas. Therefore, effective connectivity requires a range of links connecting habitats of similar type wherever possible.

The Darling Scarp forms a distinct geomorphological region and fauna and flora move primarily north-south within the various scarp habitat types, using the adjacent Darling Plateau or SCP habitats to a much lesser extent (Dell 2003 pers. comm.). Within the Darling Scarp, the habitats typical of the top of the scarp need to be linked. Similarly, granite outcrops need to be linked. On the Darling Plateau linking areas with similar topography will provide a good network of ecological linkages as habitat types there are strongly influenced by topography.

The identification of potential ecological linkages is the first step in the process of identifying those LNAs that can act as the stepping stones, which form Regional Ecological Linkages. These Regional Ecological Linkages will provide the framework within which each Local Government can identify local ecological linkages that aim to link their LSNAs to each other, to regionally significant natural areas and to the Regional Ecological Linkages. To optimise effectiveness at the Local Government scale, Regional Ecological Linkages should (if possible) be designed to have a width of 500 m or more (Dell 2007 pers. comm.).

Any LNAs identified as stepping stones need to be retained in their entirety, rather than just the portion of these areas within the mapped 500 m wide linkage. The viability of each of the stepping stones needs to be considered before designating it part of the linkage. If the linkage is identified using remotely collected data, the condition of each LNA and its suitability to provide resources for flora and fauna are unknown and need to be assessed in the field.

When undertaking field assessment the specific purpose or need for the linkage or stepping stone should be considered. Fauna and flora species vary in their needs for connectivity and linkages. These needs will depend on the characteristics of the species (Mitchell and Kaub 2003 pers. comm.) which may include:

- ▶ species mobility (high, low, none);
- ▶ availability of pollinators and seed dispersal mechanisms for flora;
- ▶ life history (for example, quenda might disperse as juveniles through a corridor or gap that they would never use as part of an established home range); and
- ▶ required frequency of broad genetic exchange (for some species broad scale mixing of the population's gene pool may only need to occur every few generations rather than continuously).

During the review of the opportunities and constraints associated with protecting each natural area it may be necessary to further refine these linkages if there are alternative areas of equal ecological value for linkage that provide greater opportunities for protection. The aim is to provide a network of good or better condition stepping stones linking like habitat with a maximum distance of 500 m to 1000 m (preferably 500 m) between them to connect the natural areas of regional significance.

6.2.1A Ecological linkages identified within the South West Biodiversity Project Area

Large scale planning and establishment of ecological linkages at a regional scale, comparable to the work that has been done within the Perth Metropolitan Region as part of the Perth Biodiversity Project, has not yet been undertaken within the SWBPA. At the time of publication of this Addendum the more prominent examples of ecological linkages within the SWBPA are:

- ▶ the South West Catchments Council's Regional Strategy for Natural Resource Management (2005) which makes a strong reference to ecological linkages in the Biodiversity section of this document stating within the directions for action (p.55), "Landscape connections (linkages, stepping stones, corridors) are identified, protected and restored to provide ecological linkages for species, population and communities". It then goes on to link this direction to seven individual management action targets;
- ▶ as part of the assessment of the draft Greater Bunbury Region Scheme in 2003 the Environmental Protection Authority prepared a strategy to identify regionally significant natural areas in its consideration of the GBRS portion of the SCP (Environmental Protection Authority 2003c). The strategy identifies a series of 16 ecological linkages within Greater Bunbury (Figure 6) and recognises the importance of the systematic identification of regionally significant natural areas and regionally important ecological linkages. Although the Greater Bunbury Region Scheme (Western Australian Planning Commission 2007) does not refer to these identified ecological linkages, Local Governments in Greater Bunbury should consider them when making planning decisions affecting these areas;
- ▶ in their report on the Vegetation, Flora, Fauna and Natural Areas of the Peel Harvey Eastern Estuary Area Catchment (Swan Coastal Plain), Keighery *et al.* (2006) describe 10 natural subdivisions within their study area of the SCP. These subdivisions are based on landform elements. Following consideration of currently reserved lands a preliminary identification is made of regionally significant sequences of ecological communities within and between the major landform elements in the study area (being the SCP parts of the Peel-Harvey Catchment area). These sequences have been described as ecological linkages. Although these linkages are described within the report this does not provide sufficient detail to allow them to be mapped; and
- ▶ Green Skills Inc established the Peel Harvey Regional Ecological Linkages Project with funding from the South West Catchments Council. The project identifies regional ecological linkages in the Eastern Peel Harvey Region outside of but adjoining the SWBPA. These connect the protected regionally significant natural areas via the most viable Local Natural Areas, in order to address the issue of fragmentation in the Peel Harvey Catchment and aid in the conservation of biodiversity in the region (Green Skills 2007).

6.2.2 Local Ecological Linkages

Local Governments need to identify local ecological linkages to apply Local Significance Criteria 4 ii) (Section 5.1.4 of this Addendum).

Local ecological linkages aim to link protected LSNAs to other LSNAs, protected regionally significant natural areas and Regional Ecological Linkages. Local ecological linkages are an important part of improving the viability of natural areas that may be too small, be of an unsuitable shape or be of an unsuitable condition to be viable on their own if isolated. The viability of all areas will be improved by including as many natural areas within each link as possible and maximising the number of connections to each area.

Regeneration and revegetation activities and reconstruction can then be prioritised in less viable areas to improve their condition and increase their size to buffer them as part of the overall objective of linking all natural areas. Revegetation to physically connect natural areas within the ecological linkage is of a much lower priority than

protecting natural areas from threats or undertaking regeneration activities to improve the viability of existing natural areas within linkages.

Guidelines for identifying local ecological linkages

To determine local ecological linkages, prepare a map of the Local Government Area and surrounding areas using the latest aerial photographs available overlaid with the following GIS datasets.

- ▶ Native Vegetation Extent by Administrative Planning Categories
 - ▶ DEC Conservation;
 - ▶ DEC State Forest;
 - ▶ DEC Other;
 - ▶ Regional Parks (Bush Forever and DEC);
 - ▶ other Regional Parks; and
 - ▶ LNAs.
- ▶ Local Government managed lands currently designated or proposed for conservation (obtained from the dataset Native Vegetation Extent by Ownership Category);
- ▶ System 6 areas outside of DEC Managed Estate, for the Jarrah Forest;
- ▶ Regional Ecological Linkages;
- ▶ any existing corridor/linkage proposals by the Local Government;
- ▶ existing local ecological linkages determined by surrounding Local Government areas;
- ▶ LNAs within 500 m of DEC Managed Estate, a System 6 area, other areas of regional value or a large, protected LSNA (>10 ha);
- ▶ wetlands and waterways; and
- ▶ major roads and railway routes.

A map containing the above layers and a transparent overlay can be used to draw in linkages that best fit the principles outlined below. Be prepared to modify the linkages as you progress. Peer review and public comment on the resultant map are important to ensure that the best linkages have been chosen. Expect to revise the map at least once before it is finalised as part of the ecological criteria. Ecological linkages may also need to be refined once LSNAs identified for protection are determined.

General principles for identifying local ecological linkages

The following points are the general ecological principles that should be used for identifying local ecological linkages:

- ▶ choose continuous corridors of native vegetation with a minimum width of 500 m where these are available. Thin corridors along roads mainly consisting of trees over a highly disturbed understorey may be of little value except for highly mobile species;
- ▶ if suitable continuous corridors of native vegetation are not available, choose a linkage made up of natural areas that form stepping stones between larger intact areas. Aim for a linkage in which the maximum distance between natural areas is no more than 500 m to 1000 m on average (the closer the natural areas, the better) and in which most of the natural areas are at least 1 ha to 4 ha in size. Avoid crossing major regional roads or transport routes as these are significant barriers to fauna movement;
- ▶ include as many natural area stepping stones within each link as possible;
- ▶ include the widest range of habitat types as possible within the linkages, with similar habitats no more than 500 m to 1000 m apart;



- ▶ maximise the number of links to any given natural area as this improves overall connectivity across the landscape and long-term viability of individual natural areas; and
- ▶ aim to maximise the width, connectivity and structural complexity of vegetation in linkages as much as possible to make them suitable for a broad range of fauna and flora.

Consider the following areas as a high priority for inclusion in the linkage:

- ▶ natural areas forming the most direct links with Regionally Significant Natural Areas or Regional Ecological Links;
- ▶ natural areas that form a network of links across the north-south and east-west gradients of variation in ecological communities within a Local Government area (due to soils, geology, landform and climate);
- ▶ natural areas located within 500 m of DEC Managed Estate, System 6 areas, other areas of regional value, protected LSNA (>10 ha). These areas buffer the large, viable, already protected natural areas and the association improves the viability of each of the site;
- ▶ riparian vegetation along waterways (including an appropriate buffer of non-riparian vegetation); and
- ▶ natural areas at high points in the landscape that are in the line of sight of other natural areas. These are important for the movement of song birds and butterflies (Dell, 2007 pers. comm.).

To improve connectivity once the local ecological linkages are identified:

- ▶ focus management on improving the condition and hence viability of existing natural areas (through assisted natural regeneration) within the linkage before putting resources into reconstruction or creation of continuous corridors on disturbed land;
- ▶ use bush regeneration techniques as much as possible to increase the size of natural areas within the linkage to a minimum area of 4 ha; and
- ▶ where reconstruction or creation of habitat is undertaken, aim to form continuous vegetated links (that is, corridors) at least 100 m wide. If this is not possible, ensure stepping stones of reconstructed or created habitat are at least 2 ha to 4 ha in size and no more than 500 m to 1000 m apart. Ensure that linkages avoid crossing major regional roads or transport routes.

Part B – Local biodiversity planning process

10.7 Guidance on prioritising Locally Significant Natural Areas

There will be various points in the local biodiversity planning process at which Local Governments will need to prioritise Local Natural Areas to maximise protection or management outcomes.

This section provides guidance on a prioritisation process for natural areas in the South West Biodiversity Project Area (SWBPA) based on ecological rationale and it takes into account current legislation and Government policy. The ecological prioritisation framework recommended is designed for where the ecological values of a natural area have been confirmed as locally significant in the field. However, the framework can also be applied to instances where field assessment is yet to occur, and this is described in Section 10.7.3 of this Addendum.

Ideally, prioritisation of natural areas for protection or management related purposes should only occur after all areas have been assessed in the field to determine which areas meet the Local Significance Criteria. This includes circumstances where Locally Significant Natural Areas (LSNAs) may be prioritised for:

- ▶ protection or retention within a greater area as part of a development proposal (e.g. structure plan) being assessed under the Local Planning Policy for Biodiversity Conservation (LPP);
- ▶ delivery of financial/technical assistance to landholders under the Incentives Strategy Private Land Conservation; and
- ▶ protection and management where they occur on Local Government managed lands.

For many Local Governments in the SWBPA, the extent of the biodiversity resource within their area will be extremely large, and much of it may exist in private ownership. In these circumstances prioritisation will often need to occur to sort or target natural areas for field assessment. This includes where Local Governments are:

- ▶ applying the LPP;
- ▶ targeting landholders for involvement in the Incentives Strategy; and
- ▶ planning for the management of biodiversity on Local Government lands.

10.7.1 The ecological prioritisation framework for protection of natural areas

The framework below gives natural areas a primary priority of 1 (A or B), 2 or 3 based on ecological values as described by the Local Significance Criteria. In some instances, natural areas may need to be further ranked within these primary priorities. Table 10 in this Addendum provides a suggested framework for further prioritising LSNAs once they have been assigned a priority of 1 (A or B), 2 or 3. Some LSNAs will need to go through more steps than others. However within each Priority level, the final ranking is graded from areas having the highest viability estimate to those having the lowest. The Natural Area Initial Assessment Summary Template (Section 12.5 in this Addendum) provides a simple viability estimate and will indicate whether a natural area meets one or more of the Local Significance Criteria.

Table 10. Priority 1, 2 and 3 Locally Significant Natural Areas and subsequent ranking of value within each grouping.

	ECOLOGICAL VALUES		SOCIAL/ECONOMIC VALUES		ECOLOGICAL VALUES
	1st Prioritisation (use Table 11)	2nd Prioritisation (use Table 11)	3rd Prioritisation (use Table 12)		4th Prioritisation Final ranking by relative viability (using the Natural Area Initial Summary Template)
DECREASING PRIORITY	Priority 1 Areas confirmed as meeting one or more Essential or Desirable Criteria that are of high value in a regional (or greater) context	Priority 1A Meeting one or more of the Essential Criteria that are of high value in a regional (or greater) context	Priority: 1A1	Prioritisation within the 1A subset based on the Federal and State government legislation and policy offering protection	VIABILITY ESTIMATE
			1A2		
			1A3		
			1A4		
			1A5		
			1A6		
		Priority 1B Meeting Desirable criteria 1a) iii) only			
	Priority 2 Areas confirmed as meeting one or more Essential Criteria that are not also of high value in a regional (or greater) context				
	Priority 3 Areas confirmed as meeting one or more Desirable Criteria but no Essential Criteria that are not also of high value in a regional (or greater) context				

Table 10 describes the overall framework for prioritisation. The discussion below details the rationale behind assigning LSNAs as Priority 1 (A or B), 2 or 3 according to the Local Significance Criteria. This information is summarised in Tables 11 and 12 of this Addendum which should be referred to in the prioritisation process.

Priority 1 - High Value Locally Significant Natural Areas

A number of Local Significance Criteria identify natural areas that are of biodiversity conservation value within a regional (or greater) context as well as at the local level (discussed in Chapter 5 of this Addendum). Their lack of current protection is partly due to the focus of nature conservation being on the retention of rare and threatened species and communities rather than on the protection of the biodiversity resource to prevent further species and communities becoming rare and threatened. All these high value LSNAs are designated Priority 1 to recognise their importance.

In some cases it has not yet been possible to put in place mechanisms to protect these high value LSNAs. In other cases, decisions may already have been made to exclude these areas from Federal, State and/or regional biodiversity conservation plans (such as Bush Forever), due to socio-economic constraints. Thus the Priority 1 LSNAs have been further broken down into Priority 1A and 1B.

Priority 1A

The Priority 1A LSNAs are natural areas that are of high value in a regional (or greater) context for their ecological values, even if this has not been formally recognised in current Government legislation and/or policy. They are natural areas that:

- ▶ meet any of the regional representation criteria (except for Criteria 1 a) iii) - see below);
- ▶ meet any of the rarity criteria;
- ▶ are part of a regional ecological linkage; or
- ▶ meet any of the criteria for protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation.

Where a development proposal has the potential to impact significantly on a Priority 1A LSNA and the Local Government can not prevent the impacts through negotiations with the development proponent, then Local Government is expected, and in some cases required by law, to refer these development proposals to the Federal Government and/or State Government. Referral requirements to the various State and Federal Government agencies are provided in the sample LPP (Section 13.2 of the Guidelines). It is good practice for these agencies to be notified of proposed developments within high value LSNAs or adjacent to designated conservation areas as soon as possible, even if significant impacts are likely to be avoided. These agencies can provide valuable assistance in developing alternative development options that are compatible with conservation. Various policies and guidelines exist to assist in decision-making with regard to these high-value natural areas. It is not the sole responsibility of Local Government to protect these areas.

Guidance Statement No. 10 (Environmental Protection Authority 2006b) provides detailed information on what is expected by State Government for development proposals with the potential to destroy or otherwise negatively impact on natural areas that are of high ecological value in a regional (or greater) context. This includes development proposals near designated conservation areas, due to the effects adjacent land uses can have on conservation areas.

Priority 1B

These are LSNAs that only meet Criterion 1 a) iii).

This criterion is designated Desirable (rather than essential) (see Section 5.2 in this Addendum) due to socio-economic constraints that have required a minimum threshold of only 30% for retention of native vegetation cover to be set by State and Federal Government policy makers.

The 30% threshold is a generalisation that is based on a range of studies (Chapter 17 of the Guidelines). Unfortunately none of these studies were based in the unique ecological communities of the SWBPA. Therefore, for natural areas meeting criterion

1a) iii) there is the opportunity to select the most viable areas with the best condition and the greatest potential for connectivity with other good condition areas to meet the target of 30%.

It is also important to remember that higher thresholds for native vegetation cover may be required for natural resource management objectives other than biodiversity conservation, for example, maintenance of surface or groundwater quantity and quality.

Priority 2 and Priority 3 - Other Locally Significant Natural Areas

The prioritisation of the remaining LSNAs (those meeting the remaining criteria for retention and protection from a biodiversity perspective) can then be made using the following:

- ▶ the designation of the specific criterion or criteria met as either Essential (Priority 2) or Desirable (Priority 3); and
- ▶ if only Desirable criteria are met, prioritise according to the number of criteria the natural area meets.

Table 11. Summary of Local Significance Criteria to identify Priority 1, Priority 2 and Priority 3 Locally Significant Natural Areas. Priority 1 LSNAs are of high value in a regional (or greater) context.

Criteria	Primary priority
1. Representation a) Regional	
i) The area is of recognised International, National, State or Regional value but not already protected and/or managed for conservation.	Priority 1A
ii) The area is of an ecological community with only 1500 ha or 30% or less (whichever is greater) of its pre-European extent remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions.	Priority 1A
iii) The area is a large (greater than 20 ha), viable natural area in good or better condition of an ecological community with over 30% remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions.	Priority 1B
iv) The area is of an ecological community with only 1500 ha or 10% or less (whichever is greater) protected in formal reserves in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions.	Priority 1A
v) The area is of an ecological community with only 1500 ha or 15% or less (whichever is greater) protected in formal plus informal reserves in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions.	Priority 1A
3. Rarity	
i) The area is of an ecological community with only 1500 ha or 10% or less (whichever is the greater) of its pre-European extent remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions.	Priority 1A
iii) The area contains a Threatened Ecological Community (TEC).	Priority 1A

Criteria	Primary priority
iv) The area contains Declared Rare Flora (DRF), Specially Protected Fauna (SPF) or significant habitat for Specially Protected Fauna.	Priority 1A
v) The area contains Priority or other significant flora or fauna or significant habitat for these fauna.	Priority 1A
4. Maintaining Ecological Processes or Natural Systems – Connectivity	
i) The natural area acts as an ecological stepping stone within an existing “regional ecological linkage” which has been identified in a published report relevant to the study area (or part of the study area) (Note: published “regional ecological linkage” information will not be available for some areas).	Priority 1A
5. Protection of Wetland, Streamline and Estuarine Fringing Vegetation and Coastal Vegetation	
i) The natural area is a Conservation or Resource Enhancement category wetland and/or its buffer zone.	Priority 1A
ii) The natural area is an EPP Wetland and/or its buffer zone.	Priority 1A
iii) The natural area is a channel wetland (e.g. river, stream, creek) and/or its associated riparian vegetation and/or its buffer zone.	Priority 1A
iv) The natural area is within a floodplain area and/or its buffer zone.	Priority 1A
v) The natural area is part of an estuarine ecosystem and/or its fringing vegetation and/or its buffer zone	Priority 1A
vi) The natural area contains coastal vegetation on the foredunes and/or secondary dunes.	Priority 1A
1. Representation b) Local	
i) The area is of an ecological community with 10% or less remaining within the Local Government area.	Priority 2
ii) The area is of an ecological community with 30% or less remaining within the Local Government area.	Priority 3
iii) The area is a large (greater than 10 ha), viable natural area in good or better condition of an ecological community with more than 30% remaining within the Local Government area.	Priority 3
2. Diversity	
i) The area is a natural area generally in good or better condition that contains both upland and wetland plant communities.	Priority 2
4. Maintaining Ecological Processes or Natural Systems - Connectivity	
ii) The natural area acts as an ecological stepping stone within a “local ecological linkage” that has been identified by a Local Government.	Priority 2

10.7.2 Further prioritisation of Priority 1A natural areas based on socio-economic opportunities for protection

In some circumstances further prioritisation of natural areas meeting or having the potential to meet Priority 1A criteria may be required. For example, some Local Governments may need to determine priorities for retention or protection (e.g. in a District Structure Planning process). However, where natural areas are already set aside for conservation and it is necessary to rank these areas for management, only ecological and not socio-economic factors should be considered (Section 10.7.4 in this Addendum).

An approach to further prioritise natural areas that meet or potentially meet Priority 1A criteria is outlined in Table 12. This approach is based on the precedent set by application of current Federal and State Government legislation and policy for retention of natural areas (rather than ecological values).

Natural Areas meeting criteria 3 i), 3) iii) and 3) iv) are assigned as a primary priority 1A (Table 11). Given that Federal and State Government biodiversity conservation legislation and policy is focused on the retention of rare and threatened species and communities, these criteria can be further prioritised as 1A1. Criterion 3 v) refers to priority or other significant flora or fauna and is also assigned as a primary priority 1A. However, retention of natural areas meeting this criterion has not been well supported by Federal and State legislation and policy in comparison to the other rarity criteria and can therefore be prioritised as a 1A4.

Priority 1A criteria relating to the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation can be further prioritised as a 1A4 with the exception being criterion 5) i) which can be designated as a 1A3 due to the strong support from the State Government for retention of Conservation and Resource Enhancement category wetlands.

The recognition of retaining ecological communities at a certain threshold is not strongly integrated into Federal and State Government legislation and policy, therefore Local Significance Criteria 1) ii), 1) iv) and 1) v) can be designated as a 1A5.

Similarly, recognition for the importance of maintaining ecological process through connectivity is only tenuously reflected in Federal and State Government legislation and policy and as such natural areas meeting criterion 4) i) can be designated as a 1A6.

Where a natural area meets more than one of these criteria it should be ranked according to the criteria assigned the highest level of priority.

Table 12. Further Prioritisation within the Priority 1A natural areas based on *Federal and State government legislation and policy*.

Ecological Criteria	Further Prioritisation within Priority 1A	Key Legislation/Policy
3. Rarity		
i) The area is of an ecological community with only 1500 ha or 10% or less (whichever is the greater) of its pre-European extent remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions.	1A1	National Targets and Objectives for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001a) EPA Guidance Statement No. 10 (Environmental Protection Authority 2006b)
iii) The area contains a Threatened Ecological Community (TEC).	1A1	Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (but only for the most threatened TECs) Greater Bunbury Region Scheme (Western Australian Planning Commission (2007) CALM Draft Policy Statement No. 9 (Department of Conservation and Land Management 2003) and database of TECs EPA Guidance Statement No. 33 (Environmental Protection Authority 2005b) EPA Guidance Statement No. 10 (Environmental Protection Authority 2006b)
iv) The area contains Declared Rare Flora (DRF), Specially Protected Fauna (SPF) or significant habitat for Specially Protected Fauna.	1A1	Environment Protection and Biodiversity Conservation Act 1999 (but not all are listed) Greater Bunbury Region Scheme (Western Australian Planning Commission (2007) Wildlife Conservation Act 1950 and gazetted flora and fauna lists EPA Guidance Statement No. 33 (Environmental Protection Authority 2005b) EPA Guidance Statement No. 10 (Environmental Protection Authority 2006b)

Ecological Criteria	Further Prioritisation within Priority 1A	Key Legislation/Policy
1. Representation a) Regional		
i) The area is of recognised International, National, State or Regional value but not already protected and/or managed for conservation.	1A2	<p>EPBC Act for some areas</p> <p>EPA Guidance Statement No. 33 (Environmental Protection Authority 2005b)</p> <p>Forest Management Plan 2004 – 2013 (Conservation Commission 2003) for proposed conservation reserves</p> <p>System 6 recommendations in the Jarrah Forest outside DEC Managed Estate (Department of Conservation and Environment 1983)</p> <p>Greater Bunbury Region Scheme (Western Australian Planning Commission (2007)</p> <p>EPA Guidance Statement No. 10 (Environmental Protection Authority 2006b)</p> <p>Western Australian Planning Commission (WAPC) Statement of Planning Policy (SPP) No. 2: Environment and Natural Resources (Government of Western Australia 2003b)</p>
5. Protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation		
i) The natural area is a Conservation or Resource Enhancement category wetland and/or its buffer zone.	1A3	<p>Water and Rivers Commission Position Statement: Wetlands (Water and Rivers Commission 2001)</p> <p>Wetlands Conservation Policy for Western Australia (Government of Western Australia 1997)</p> <p>Greater Bunbury Region Scheme (Western Australian Planning Commission (2007)</p> <p>EPA Position Statement No. 4: Environmental Protection of Wetlands (preliminary) (Environmental Protection Authority 2004a)</p> <p>EPA Guidance Statement No. 33 (Environmental Protection Authority 2005b)</p> <p>WAPC SPP No. 2 :Environment and Natural Resources (Government of Western Australia 2003b)</p>

Ecological Criteria	Further Prioritisation within Priority 1A	Key Legislation/Policy
3. Rarity		
v) The area contains Priority or other significant flora or fauna or significant habitat for these fauna.	1A4	<p>Conservation And Land Management Draft Statement of Policy No. 9 (Department of Conservation and Land Management 2003) and Priority Flora and Fauna lists</p> <p>Greater Bunbury Region Scheme (Western Australian Planning Commission (2007)</p> <p>EPA Guidance Statement No. 33 (Environmental Protection Authority 2005b)</p> <p>EPA Guidance Statement No. 10 (Environmental Protection Authority 2006b)</p>
5. Protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation		
ii) The natural area is an EPP Wetland and/or its buffer zone.	1A4	<p>Environmental Protection (Swan Coastal Plain Lakes) Policy (Government of Western Australia 1992b)</p> <p>EPA Guidance Statement No. 33 (Environmental Protection Authority 2005b)</p> <p>WAPC SPP No. 2 :Environment and Natural Resources (Government of Western Australia 2003b)</p>
iii) The natural area is a channel wetland (e.g. river, stream, creek) and/or its associated riparian vegetation and/or its buffer zone.	1A4	<p>WAPC SPP No. 2 :Environment and Natural Resources (Government of Western Australia 2003b)</p> <p>Peel-Harvey Coastal Plain Catchment SPP No. 2.1 (Government of Western Australia 1992d)</p> <p>Environmental Protection (Peel Inlet-Harvey Estuary) Policy (Government of Western Australia 1992a)</p> <p>WAPC Development Control (DC) Policy 2.3 (Western Australian Planning Commission 2002c)</p>

Ecological Criteria	Further Prioritisation within Priority 1A	Key Legislation/Policy
iv) The natural area is within a floodplain area and/or its buffer zone.	1A4	WAPC SPP No. 2: Environment and Natural Resources (Government of Western Australia 2003b) Peel-Harvey Coastal Plain Catchment SPP No. 2.1 (Government of Western Australia 1992d) Environmental Protection (Peel Inlet-Harvey Estuary) Policy (Government of Western Australia 1992a) WAPC DC Policy 2.3 (Western Australian Planning Commission 2002c)
v) The natural area is part of an estuarine ecosystem and/or its fringing vegetation and/or its buffer zone	1A4	EPA Guidance Statement No. 33 (Environmental Protection Authority 2005b) Greater Bunbury Region Scheme (Western Australian Planning Commission (2007) WAPC SPP No. 2: Environment and Natural Resources (Government of Western Australia 2003b) WAPC DC Policy 2.3 (Western Australian Planning Commission 2002c)
vi) The natural area contains coastal vegetation on the foredunes and/or secondary dunes.	1A4	WAPC SPP No. 2.6: State Coastal Planning Policy (Government of Western Australia 2003a) EPA Guidance Statement No. 33 (Environmental Protection Authority 2005b) WAPC SPP No. 2: Environment and Natural Resources (Government of Western Australia 2003b) WAPC DC Policy 2.3 (Western Australian Planning Commission 2002c) Greater Bunbury Region Scheme (Western Australian Planning Commission (2007)
1. Representation a) Regional		
ii) The area is of an ecological community with only 1500 ha or 30% or less (whichever is greater) of its pre-European extent remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions.	1A5	National Targets and Objectives for Biodiversity Conservation 2001–2005 (Commonwealth of Australia 2001a) EPA Guidance Statement No. 10 (Environmental Protection Authority 2006b)

Ecological Criteria	Further Prioritisation within Priority 1A	Key Legislation/Policy
iv) The area is of an ecological community with only 1500 ha or 10% or less (whichever is greater) protected in formal reserves in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions.	1A5	Forest Management Plan 2004 – 2013 (Conservation Commission 2003) EPA Guidance Statement No. 10 (Environmental Protection Authority 2006b)
v) The area is of an ecological community with only 1500 ha or 15% or less (whichever is greater) protected in formal plus informal reserves in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions.	1A5	EPA Guidance Statement No. 10 (Environmental Protection Authority 2006b)
4. Maintaining ecological processes or natural systems – connectivity		
i) The natural area acts as an ecological stepping stone within an existing “regional ecological linkage” which has been identified in a published report relevant to the study area (or part of the study area) (Note: published “regional ecological linkage” information will not be available for some areas).	1A6	WAPC SPP No. 2: Environment and Natural Resources (Government of Western Australia 2003b) Forest Management Plan 2004 – 2013 (Conservation Commission 2003)

10.7.3 Priorities for Further Investigation (PFI)

Ideally, the prioritisation of natural areas should only occur once a field assessment has been completed and all the ecological values are confirmed. However it is likely that some Local Governments will need to prioritise potentially Locally Significant Natural Areas (PLSNAs) (Section 5.3 in this Addendum) at some stage in the preparation or implementation of a Local Biodiversity Strategy. This prioritisation is usually for the purpose of field assessment, although it may also occur when a Local Government is establishing Natural Area Condition (NAC) targets (see Section 9.2.4 in the Guidelines).

To assist Local Governments where this initial prioritisation process is required, the South West Biodiversity Project will be developing the PLSNA dataset when further regional datasets become available and will include information relating to ‘Priorities for Further Investigation’ (see Table 13 in this Addendum). The PFI information is based on the same criteria and principles used in the ecological prioritisation framework (Section 10.7.1 in this Addendum). The highest priority for further investigation are those designated PFI 1A.

The PLSNA and the PFI information should not be used on its own as a valid argument for protecting or not protecting a natural area as these decisions should only be made once a field assessment has been undertaken to provide verification. However, PFI can be used to assist in the setting of NAC targets and the prioritisation of where field assessments are to be carried out.

Table 13. *Priorities for Further Investigation (PFI) of Local Natural Areas*

Priority for Further Investigation	Local Significance Criteria potentially met
PFI 1	Areas potentially meeting one or more Local Significance Criteria that identify PLSNAs of high value in a regional (or greater) context (Table 11)
	PFI 1A - Areas potentially meeting one or more Essential Local Significance Criteria in the Priority 1 category (Table 11)
	PFI 1B - Areas potentially meeting only the Desirable Local Significance Criterion 1 a) iii) (Table 11)
PFI 2	Areas potentially meeting one or more Essential Local Significance Criteria that do not also identify PLSNAs of high value in a regional (or greater) context (Table 11)
PFI 3	Areas potentially meeting one or more Desirable Local Significance Criteria but no Essential Local Significance Criteria that do not also identify PLSNAs of high value in a regional (or greater) context (Table 11)
PFI 4	All remaining natural areas of which some may be found to meet Essential or Desirable Local Significance Criteria following field assessment

Examples of where a Local Government may need to prioritise natural areas before field assessment include:

- ▶ application of the LPP (verification of information collected by proponents) Local Governments may wish to verify information collected by development proponents as required under the Local Planning Policy. This may be achieved by visiting the natural area or obtaining independent expert advice. Any verification by Local Government will require a high level of ecological expertise. Resource constraints may mean that not every proposal will be able to be verified by the Local Government. In these instances, Local Governments are encouraged to prioritise natural areas based on the potential values of the site to determine those areas requiring field verification.
- ▶ determining priorities for targeting the Incentive Strategy for Private Land Conservation - as part of the process for determining landholder eligibility for incentives, field assessment is required to determine the ecological significance of the natural area(s). Local Governments with a large extent of natural areas in private ownership may have to prioritise (and target) those natural areas based on the highest potential biodiversity value.
- ▶ determining priorities for field assessment of Local Government controlled land - Local Governments are encouraged to budget for and undertake field assessment of all reserves managed or controlled by Local Government as soon as possible and over a designated time frame. For those Local Governments with many reserves under their control, some prioritisation to determine which reserves to assess first may be required if the assessment process is to occur over an extended timeframe (e.g. two years or longer). In these circumstances, it will be important to target those reserves with natural areas that are Potentially Locally Significant Natural Areas and where little or no known ecological information exists or where no management actions are currently being undertaken.

Some Local Governments may need to further prioritise natural areas that have the potential to meet Priority 1A criteria to undertake field assessment (simply because so much of the resource meets PFI 1A). Further prioritisation of those areas with potential to meet priority 1A criteria can be achieved through applying the subsequent prioritisation process outlined in Table 12 of this Addendum.

10.7.4 Prioritisation for the management of natural areas

It is likely that Local Governments will need to prioritise (for management) natural areas under their control because resources are always finite. This process will firstly need to be based on the ecological values of these areas; the ecological prioritisation framework for protection (Section 10.7.1 in this Addendum) is suitable for this purpose. Further prioritisation of Priority 1A natural areas (as discussed in Section 10.7.2) is not applicable because it is reliant on socio-economic opportunities for protection only.

The next step to prioritise for management requires an analysis of the level of the threats to each natural area as well as the capacity of the Local Government to ameliorate the threat. This will depend on the individual circumstance of each natural area and each Local Government. Therefore a generic process to guide Local Government in the allocation of management resources and funds cannot be provided.

Part C – Important information to help in developing a Local Biodiversity Strategy

Part C of the Guidelines provides important background information to assist Local Governments in the local biodiversity planning process. This includes important statistics, templates for natural area assessment, planning policies, natural area protection mechanisms and a simple guide to the planning system.

12. Natural Area Initial Assessment templates and supporting information

The Guidelines encourage use of the standard templates developed by the Perth Biodiversity Project when collecting information on natural areas for local biodiversity planning. These four templates were developed using field survey techniques for flora and vegetation used in the Perth Metropolitan Region and have since been modified for use within the SWBPA and are included in this Addendum.

12.1 Initial desktop and field assessment methods

The templates compile information on ecological values, current vegetation condition, threats (threatening processes and disturbance factors) and, where present, existing management infrastructure. They will provide a basis for building a database about the natural areas occurring within a Local Government area.

The four templates include:

- ▶ Natural Area Initial Desktop Assessment template;
- ▶ Natural Area Initial Field Assessment A template;
- ▶ Natural Area Initial Field Assessment B - Significant Species and Communities template; and
- ▶ Natural Area Initial Assessment Summary template.

Before conducting field assessments, a Natural Area Initial Desktop Assessment template (Section 12.2 in this Addendum) should be completed for each Local Natural Area, to compile existing information for verification during the field assessment.

Two field assessment templates are provided. The first, the Natural Area Initial Field Assessment A template (Section 12.3 in this Addendum), is for Local Governments, community groups and consultants (if appropriate) to document the basic ecological values of a given natural area.

The skills required to complete the Natural Area Initial Field Assessment A template include the ability to:

- ▶ differentiate between native versus weed species and upland versus wetland plant species for a given locality;
- ▶ recognise and describe plant communities based on structural layers and dominant species;
- ▶ assess vegetation condition using a standard scale;
- ▶ identify threats;
- ▶ document management infrastructure; and
- ▶ make initial recommendations for management.

Trials in the City of Wanneroo have found that for natural areas under 100 ha, three to four hours of field work is required to complete the Natural Area Initial Field Assessment A template. Another six to eight hours should be allocated per area to

complete the Natural Area Initial Desktop Assessment template, undertake necessary information collection and record and assess all the information gathered from the desktop and field work. This means allocating about three days for every two natural areas. This time may be reduced where a large number of sites are to be studied, or the natural areas are small.

The Natural Area Initial Field Assessment B template (Section 12.4 in this Addendum), requires a higher skill level. It is designed to record the presence of significant species or communities such as Declared Rare Flora (DRF) or Priority Flora, Specially Protected or Priority Fauna, other significant species (for example, those listed in Government of Western Australia (2000b)) and TECs. These skills may be available within the Local Government or local community but in many instances it will be necessary to contract a specialised ecological consultant to undertake this part of the assessment at the appropriate time of year to determine the presence of any expected significant species or communities.

Consultants will have their own templates for this type of work and could be contracted to assess all natural areas within a Local Government area for significant species and communities as a separate brief. The Natural Area Initial Field Assessment B template will guide Local Government in preparing such a brief as it shows the kind of data collection required to address the ecological criteria for local significance on the basis of rarity.

The ideal situation would be to use assessors with the required skill level to undertake both of the initial field assessment templates at the same time. Completing two templates at once does not take much more time than completing the Natural Area Initial Field Assessment A template alone. If both are completed by the same assessor, this ensures greater consistency in the information collected. Assessors with the required skill level could be contracted to undertake both templates on the understanding that Local Government staff work alongside them during the assessment process to build staff capacity to understand and use the information. However, the resources may not be available to use highly skilled assessors for both tasks. Even if the two templates are completed by different assessors there is a good opportunity to train and mentor Local Government staff during the field assessment process.

The Appendices to the assessment templates (Sections 12.6 – 12.11 in this Addendum) contain useful reference material for completion of the templates. Section 12.6 provides more detail on the skill levels required to complete the field assessment work. Section 12.10 is an appendix to be prepared by each Local Government for its own local area to assist with completion of Natural Area Initial Field Assessment B template for significant species and communities.

The Natural Area Initial Assessment Summary template (Section 12.5 in this Addendum) allows the recording of Local Significance Criteria met by a Local Natural Area. It should be completed after the desktop and field assessments have occurred.

Note that these initial assessment templates do not require the collection of comprehensive flora and fauna species lists (except where TECs are thought to exist). For the purposes of comprehensive management planning or determining whether regional significance diversity criteria are met, comprehensive flora and fauna lists will be required. These could easily be compiled during the initial assessment process.



Information collected through the Natural Area Initial Desktop Assessment template will need to be verified in the field. Photo R Ryan.

For the purpose of making the plant communities information collected during the initial assessment process compatible with the National Vegetation Information System (NVIS), there are several places in the templates where additional information needs to be noted using NVIS methods. This will allow structural plant communities to be described using the NVIS Level 5 description methods for plant associations (Executive Steering Committee for Australian Vegetation Information 2003). NVIS contains nationally standardised methods to allow State of the Environment reporting at national, state and regional scales. However, these are not the methods that have been used to date in Western Australia, especially at the regional level. These templates use the methods previously adopted for studies in the Perth Metropolitan Region based on Keighery (1994). In the future the NVIS methods are likely to become more important and will be required for contributing information to State managed GIS datasets of vegetation type and extent that are needed for monitoring biodiversity conservation objectives and targets.

Date of assessment _____

Name of area _____

12.2 Natural Area Initial Desktop Assessment

Native Vegetation Unique ID No. _____

Database Site No. _____

Name of area _____

Other names used _____

Location (address/street name) _____

Prepare the following maps and label with the name of the area.

Map 1: Location of _____

Photocopy of street directory showing location of site _____

Map 2: Reference Sites/Plots and Linkage for _____

A GIS print-out of general area showing vegetation complexes, potential reference sites and plots, mapped wetlands and their management category, areas of any previously recorded Declared Rare Flora, Specially Protected Fauna, Priority Flora or Fauna or Threatened Ecological Communities plus location of Regional and, if available, Local Ecological Linkages. If no Local Ecological Linkages have been determined for the Local Government area, use this map to mark potential local ecological linkages to other natural areas.

Map 3: Aerial photograph of _____

Date of photography _____

Scale _____

GIS print-out of aerial photographs (with topography, if available) at a scale that ensures site covers most of an A4 page. Easy-to-use scales are 1:2000 (1 cm = 20 m), 1:3000 (1 cm = 30 m), 1:4000 (1 cm = 40 m) or 1:5000 (1 cm = 50 m). For large sites, spread over several A4 pages at one of these scales if necessary.

Area (ha) _____

Perimeter (m) _____

Perimeter (m) to area (m²) ratio _____

Priority for Further Investigation _____

Lot/Location/Reserve Number/s _____

Ownership (Local Government Reserve / Other Govt (Agency?) / Private) _____

Land Manager _____

Vesting Purpose _____

Regional Scheme Reservation or Zoning (Peel Region
Scheme or Greater Bunbury Region Scheme) _____

Local Planning Scheme _____

Reservation or Zoning _____

Protection Status _____ none / conservation covenant / conservation zone / conservation vesting purpose
/ Regional Open Space in a Regional Scheme / protected DEC land

Current Status/Use of land _____

Long term plans? _____

Recognised International/ National/ State/ Regional Conservation Value _____

yes / no

Specify: _____

Part of a Regional Ecological Linkage _____ yes / no

Specify (links which areas?): _____

Date of assessment _____ Name of area _____

Mapped Vegetation Complex/es _____

Mapped Soil Type/s (if maps available) _____

Mapped wetland/s yes / no Environmental Protection Policy (EPP) Lake: yes / no

Wetland Management Category: Conservation Category/Resource Enhancement/Multiple Use

Is it a mapped floodplain area? yes / no

Potential Reference Sites and Plots (e.g. Gibson *et al.* 1994 Flora Survey Plots, DEC Reserves, see Map 2). For reference sites on the coastal plain, note name, floristic community type (FCT) and whether FCT is actual or inferred.

Existing biological information for area or for potential Reference Sites (reports/ surveys/ species lists)

Conservation Management Plan yes / no Current or Review needed?

Title/Author/Year _____

Part of a Local Ecological Linkage yes / no

(if these have not already been determined by Local Government mark potential linkages on Map 2)

Time since isolation from other natural areas

(consult local community, historical aerial photographs) <5 years/ 5 - 20 years/ >20 years

Does it contain any mapped Threatened Ecological Communities (see Map 2)? yes / no

Specify: _____

Does it contain any mapped Declared Rare Flora (see Map 2) or is it a known location for any Specially Protected Fauna or significant habitat for these fauna? yes / no

Specify: _____

Name of area _____

yes / no

Name of group and contact details

- Indigenous or European Cultural or Historical Heritage Value yes / no

Date of assessment _____ Name of area _____

12.3 Natural Area Initial Field Assessment A

Native Vegetation Unique ID No. _____		Database Site No. _____	
Location (address/street name) _____			
Assessor	_____	*Skill Level	_____
Recorder	_____	Skill Level	_____
Recorder	_____	Skill Level	_____
Recorder	_____	Skill Level	_____

**Important Note: Skill level 4 or above is required by the assessor to complete this template (see Section 12.6 in this Addendum).*

Photographs

Indicate photograph no., location and direction of each photo on Map 4 during the field assessment.
e.g. Photo 4 looking North)

Photographer's Name _____

Latitude And Longitude (for various locations noted during assessment, optional)

Global Positioning System (GPS) used: _____ yes / no GPS datum: AGD66 AGD84 GDA94 WGS84 (circle one)

Descriptor and Location No. (eg. BMX jump GPS 1)	Reading/calculation (mark location No. on Map 4)	
	Latitude (S) or Northing	Longitude (E) or Easting

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Prepare the following map during the field assessment and label with the name of the area.

Map 4 (transparent overlay on aerial photograph, Map 3): Uplands/Wetlands, Structural Plant Communities, Vegetation Condition, Spot Weed Occurrences, Areas of Disturbance and Management Infrastructure of

Uplands, Wetlands And Structural Plant Communities – Description And Mapping

On Map 4 divide the site into upland and wetland areas and then into broad sections based on structural plant communities. Allocate a number to each community and describe each community using a representative sample point. Note the vegetation condition of each sample point as well as drawing a vegetation condition map for the whole site.

Describe each community using page 5 of these templates OR if preferred the templates of Keighery (1994) (see Section 12.11 of this Addendum). If using the Keighery templates, describe each community on Recording Sheets 1 & 2 and list common native species present on Recording Sheet 3. Note that Section 12.11 contains minor modifications to the Keighery (1994) templates to include the additional information required.

Each structural plant community is described by noting the dominant species in each growth form layer of the community (see Section 12.8). Collect specimens for identification if necessary, provided you have a licence from DEC and land owner permission. Carefully label all specimens. DO NOT collect species suspected of being Declared Rare Flora. Instead take a good photo and accurately note location. Do not collect whole plants unless they are very small species and do not collect at all if only a few are present; take a good photo as an alternative.

Date of assessment _____ Name of area _____

Photocopy this page and complete for each Structural Plant Community identified

Structural Plant Community No. _____ Indicate location of point described on Map 4. Upland or Wetland? (circle one)			
Landform and Soils SLOPE: flat/ gentle/ steep ASPECT: n/a or N/ NE/ E/ SE/ S/ SW/ W/ NW SURFACE SOIL: Colour: _____ Texture: sand/ loamy sand/ sandy loam/ loam/ clay/ gravel EXPOSED ROCK (type and % of surface) _____ SUB-SURFACE SOIL: Colour: _____ Texture: sand/ loamy sand/ sandy loam/ loam/ clay/ gravel UNDERLYING ROCK (type and depth if known) _____ DRAINAGE: well/ moderate/ poor WET: all year/ winter and spring only OR n/a Topographic Position Circle position of point described on a transect diagram of site below.			
Growth Form Layer	Dominant species (list all obviously dominant species for each growth form layer, record species in order of dominance) (* record % cover and height for each spp. for NVIS) (** record % cover for each spp. and which spp. <0.5m for NVIS)	Crown Cover (Keighery 1994) 2-10% / 10-30% / 30-70% / over 70%	Crown Cover (NVIS) Record % crown cover to nearest 5-10%
Trees over 30 m			
Trees 10-30 m			
Trees under 10 m			
Mallees over 8 m *			
Mallees under 8 m *			
Shrubs over 2 m			
Shrubs 1-2 m			
Shrubs under 1 m **			
Herbs **			
Sedges/ Rushes **			
Grasses **			
Other (e.g. climbers)			
Common Native Species Note species observed.			
Icon Flora Species (Note if present)			
Vegetation Condition (Note scale used) (see Section 12.7)			
Description Of Structural Plant Community No. ____ (see Section 12.8)			
Icon Community (tick if an icon community)			

Name of area _____

[illegible]

	✓	Comments
Evidence of Foxes (burrows, wildlife kills)		
Evidence of Rabbits (burrows, dung piles, grazing)		
Evidence of Dogs (droppings, scratchings)		
Evidence of Cats (wildlife kills)		
European Honey Bees (hives in tree hollows)		
Evidence of Horses/ Cattle/ Sheep (foot prints, droppings)		
Evidence of Pigs (soil disturbance)		
Rainbow Lorikeets		
Other		

Date of assessment _____

Name of area _____

Native Fauna Note species observed or evidence of presence of species, indicate any that are icon species

Species	Comments: Observed directly, evidence of presence (scats, tracks and traces) or likely habitat?

Native Fauna Habitat	✓	Comments
Areas of dense understorey vegetation		
Tree hollows in old mature trees		
Dead branches as perches for hunting/ look outs		
Large fallen logs on the ground		
Granite or other natural rocky outcrops		
Wetlands or waterways		

Vegetation Health

Note dead or dying trees, shrubs, herbs and so on. Note the species concerned and the pattern of deaths/changes in the vegetation. *Phytophthora* dieback moves in fronts and along drainage lines therefore noting patterns helps to determine whether *Phytophthora* spp. are present. Section 12.9 in this Addendum lists common indicator species that are affected by *Phytophthora* spp. Do not automatically assume dead or dying plants means that *Phytophthora* is present.

	✓	Comments
Numerous tree stumps (not from logging)		
Dead or dying species		
Heavy leaf/stem damage by insects (e.g. lerps, stem borers)		
Diseases/pests suspected		
Drought/lowering of groundwater table suspected		
Flooding/rise in groundwater table suspected		

Date of assessment _____

Name of area _____

Miscellaneous Disturbance Factors and Threatening Processes

Determine the range and extent of disturbance factors and threatening processes occurring at the site. If appropriate, mark on Map 4 and photograph as required. If the site is large it may be beneficial to divide it into sections and evaluate each separately.

Factor/Process	✓	Comments
Evidence of salinisation (e.g. scalding, seeps)		
Erosion (e.g. gullies, bank collapse)		
Wetland eutrophication (e.g. algal blooms)		
Stormwater drains/sumps		
Service corridors (e.g. Water Corp, Telstra, Western Power, Alinta Gas)		
Mining/extraction		
Evidence of past logging (e.g. selective removal of large trees)		
Previous clearing (may be partially cleared areas or evidence of previous clearing and regrowth over much of site)		
Overgrazing (e.g. rabbits, stock, goats; over-population by kangaroos)		
Firewood collection (e.g. recent chainsaw/axe cuts, sawdust piles)		
Dope plants/ production equipment		
Soil movement (dumping or removal)		
Factor/Process	✓	Comments
Rubbish dumping (note type, e.g. construction, garden waste, weed source?)		
Proliferation of tracks (fire breaks, walk trails)		
Off road vehicle use (4WD / trail bikes/ BMX/ mountain bikes)		
Cubby construction		
Vandalism (damage to plants)		
"Enrichment Planting" (revegetation with species not found in that local plant community, are these becoming weeds?)		
Impacts of High Fire Frequency and/or Intensity		
Reduced range of tree ages		
Fire scars high up (due to a hot burn)		
Major trunk damage		
Trees suckering from trunk and branches		
Amount of leaf litter reduced		
Large fallen logs nearly burnt away		
Evidence of arson (burnt grass tree skirts, matches, cigarette lighters, exploded spray cans)		
Time since last fire (estimate)		<2 years/ < 5 years/ <10 years/ <20 years (circle one)

Date of assessment _____

Name of area _____

Vegetation Condition Map

For initial assessment, the overall vegetation condition of the site can be determined by familiarising yourself with the site. Then on Map 4, divide the site into broad sections based on condition. Using the map, estimate the % area each section occupies of the total site and score each section for condition in the boxes below, for example, 'Section 1: 75% of site, Very Good. Section 2: 25% of site, Degraded.' For most sites there will be very degraded areas along tracks, for example, where rubbish has been dumped. If not extensive these can be referred to by adding a statement such as 'areas of severe localised disturbance' in the comments (Government of WA 2000b).

Vegetation Condition Scales Use either the Keighery (1994) or Kaesehagen (1994) condition scale (see Section 12.7). Indicate which condition scale is used in table below. Indicate % area each section occupies of the total site (ensure adds up to 100%). Draw boundary of each section and note condition of each on Map 4.						
Keighery (1994)	Pristine	Excellent	Very Good	Good	Degraded	Completely Degraded
% area						
Kaesehagen (1994)		Very Good to Excellent	Fair to Good		Poor	Very Poor
% area						
Comments						

Existing Management Infrastructure

Describe type in box below and mark location on Map 4, photograph if required.

	✓	Comments
Fences		
Fence condition		
Gates		
Paths		Soil; concrete; limestone; mulch
Path condition		
Path fencing		
Path fence condition		
Fire Access Tracks		Slashed; sprayed; ploughed
Signs		Name of area/ other
Previous works		

Social Significance Values

	✓	Comments
Evidence of Community/ Education/ Passive Recreation Interest		
Landscape amenity (e.g. screen/ buffer between conflicting land uses)		
Scenic Features (e.g. high point in landscape)		
Indigenous / European Heritage (Cultural or Historical)		
Other		

Name of area _____

	✓	Comments
Surrounding Land Uses (note type/s and indicate likely impacts/benefits. (e.g. source of rubbish; weed seeds blowing into site; potential for community interest and volunteers to assist management)		

List potential management actions (for example, Phytophthora dieback assessment by an accredited assessor; fencing; signage to identify as a conservation area; rubbish removal; weed survey and mapping; fire response plan)

[illegible]

Date of assessment _____

Name of area _____

Confirmation of GIS Mapped Boundaries

Prepare the following map if recommending changes to wetland or native vegetation mapping and label with the name of the area.

Map 5: (overlay on aerial photo): Recommended GIS Boundary Changes for

When recommending changes, forward a completed copy of all four Initial Natural Area Initial Assessment Templates to the South West Biodiversity Project, PO Box 21, Bunbury WA 6231 for distribution to the relevant custodian of database.

GIS dataset		Changes recommended (yes/no)
		Prepare Map 5 if recommending changes to A or B only. Draw boundaries that correspond with your field assessment and assign accordingly 'A' and/or 'B'. Outline the rationale for each change against the relevant category (A or B)
A	Mapped Native Vegetation	Yes / No
Rationale: _____		

B	Mapped Wetland/s and Management Category	Yes / No / NA
	Conservation Category, Resource Enhancement or Multiple Use (DEC current update)	For changes to the maps of non-flowing wetlands on the Swan Coastal Plain complete and attach EPA Bulletin 686 (Environmental Protection Authority 1993) to determine the new boundary and management category.
Rationale: _____		

C	Mapped Vegetation Complex/es	Yes / No
	(Heddl, Loneragan and Havel 1980 or Mattiske and Havel 1998)	More likely to be
Rationale: (do not map)		

Date of assessment _____ Name of area _____

12.4 Natural Area Initial Field Assessment B – Significant Species and Communities

Native Vegetation Unique ID No. _____ Database Site No. _____
 Location (address/street name) _____
 Assessor _____ *Skill Level _____
 Recorder _____ Skill Level _____
 Recorder _____ Skill Level _____
 Recorder _____ Skill Level _____

**Important Note: Skill level 5 or above is required by the assessor to survey natural areas for significant species. Skill Level 6 is required to survey for threatened ecological communities (see Section 12.6 in this Addendum).*

NO significant species or communities recorded through Field Assessment B If searches for significant flora, significant fauna and Threatened Ecological Communities by an appropriately skilled assessor have NOT recorded any significant species or communities on this site during this assessment, tick the box and continue no further.	
---	--

Partial Assessment ONLY In situations where significant species or communities have been recorded during Field Assessment A but a comprehensive Field Assessment B has NOT yet taken place, transfer the relevant information to these forms for entry in the database and tick this box.	
---	--

Date of assessment _____ Name of area _____

Photographs

Indicate photograph no., location and direction of each photo on Map 4 during the field assessment. e.g.
Photo 4 looking North

Photographer's Name _____

Latitude And Longitude **(for various locations noted during assessment, compulsory)**

GPS used:	yes / no	GPS datum:	AGD66 AGD84 GDA94 WGS84 (circle one)
Descriptor and Location No.	Reading/calculation (mark location number on Map 6)		
(eg. Species A GPS 1)	Latitude (S) or Northing	Longitude (E) or Easting	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	

Prepare the following map during the field assessment and label with the name of the area. Consult Map 4 prepared for Natural Area Initial Field Assessment A for the structural plant communities and vegetation condition mapping, update on Map 6 if necessary.

Map 6 (overlay on aerial photograph): Location of Threatened Ecological Communities, significant native flora or fauna or suitable habitat for these fauna.

Threatened Ecological Communities (TECs) (see Section 12.10 in this Addendum)
List the Threatened Ecological Communities present or believed to be present on the site and the reasons why. For those TECs based on floristic community types, map the boundary of each TEC by cross referencing with the structural plant communities mapped during the Natural Area Initial Field Assessment A (Map 4). During spring, describe a standard 10 x 10 m quadrat and compile a species list for each structural plant community representing a TEC (see section on Threatened Ecological Communities – Description and Mapping).

Date of assessment _____

Name of area _____

Significant Native Flora (see Section 12.10 in this Addendum)

Note presence of Declared Rare, Priority or other significant flora. Note location of species on Map 6. Indicate in which structural plant communities they occur (refer to Map 4 of the Natural Area Initial Field Assessment A).

Species and Significance	Comments eg. structural plant community, population size

Significant Native Fauna (see Section 12.10)

Note presence or evidence for presence of Specially Protected, Priority or other significant fauna. Note location of species/evidence on Map 6. Indicate which structural plant communities they occur in or use.

Species and Significance	Comments: observed directly, evidence of presence or likely habitat?

Date of assessment _____

Name of area _____

Photocopy this page and complete for each Structural Plant Community identified as a TEC OR if preferred use Recording Sheets 1 & 2 of Keighery (1994) (see Section 12.11) to describe each community. Note that Section 12.11 contains minor modifications to the Keighery (1994) templates to include the additional information required below.

Threatened Ecological Communities – Description and Mapping

For TECs based on floristic community types, description and mapping needs to be undertaken during spring to provide the definitive floristic information needed to confirm the presence of a TEC. On Map 6, draw the boundary of each Threatened Ecological Community present and label with the TEC to which it belongs. These boundaries should be based on the structural plant communities identified on Map 4 of the Natural Area Initial Field Assessment A template. Locate the number assigned to each structural plant community representing a TEC and describe each below using a permanently located and representative 10 x 10 m quadrat. Note the vegetation condition of each quadrat. Compile a list of the plant species present within each quadrat.

Structural Plant Community No. _____ Indicate location of point described on Map 6.

Upland or Wetland? (circle one)

Landform and Soils

SLOPE: flat/ gentle/ steep ASPECT: n/a or N/ NE/ E/ SE/ S/ SW/ W/ NW

SURFACE SOIL: Colour: _____ Texture: sand/ loamy sand/ sandy loam/ loam/ clay/ gravel

EXPOSED ROCK (type and % of surface) _____

SUB-SURFACE SOIL: Colour: _____ Texture: sand/ loamy sand/ sandy loam/ loam/ clay/ gravel

UNDERLYING ROCK (type and depth if known) _____

DRAINAGE: well/ moderate/ poor WET: all year/ winter and spring only OR n/a

Topographic Position Circle position of point described on a transect diagram of site below.

Growth Form Layer	Dominant species (list all obviously dominant species for each growth form layer, record species in order of dominance) (* record % cover and height for each spp. for NVIS) (** record % cover for each spp. and which spp. <0.5m for NVIS)	Crown Cover (Keighery 1994) 2-10% / 10-30% / 30-70% / over 70%	Crown Cover (NVIS) Record % crown cover to nearest 5-10%
Trees over 30 m			
Trees 10–30 m			
Trees under 10 m			
Mallees over 8 m *			
Mallees under 8 m *			
Shrubs over 2 m			
Shrubs 1-2 m			
Shrubs under 1 m **			
Herbs **			
Sedges/ Rushes **			
Grasses **			
Other (e.g. climbers)			

Name of area _____

Photocopy this page and complete for each Structural Plant Community identified as a Threatened Ecological Community

Plant Species Note native and weed species observed within a standard 10 x 10 m quadrat.		
Trees / Mallees	Herbs	
Shrubs		
		Sedges / Rushes
		Grasses
Vegetation Condition (Note the scale used) (see Section 12.7 in this Addendum)		
Description Of Structural Plant Community No. ____ (see Section 12.8)		

Date of assessment _____

Name of area _____

12.5. Natural Area Initial Assessment Summary

ECOLOGICAL CRITERIA	
1. Representation	
1a. Regional Representation	
i) The area is of recognised International, National, State or Regional value but not already protected and/or managed for conservation. Specify:	yes/no
ii) The area is of an ecological community with only 1500 ha or 30% or less (whichever is greater) of its pre-European extent remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions. Specify:	yes/no
iii) The area is a large (greater than 20 ha), viable natural areas in good or better condition of an ecological community with over 30% remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions. (For all vegetation complexes not meeting Criteria 1aii). Specify:	yes/no
iv) The area is of an ecological community with only 1500 ha or 10% or less (whichever is greater) protected in formal reserves in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions. Specify:	yes/no
v) The area is of an ecological community with only 1500 ha or 15% or less (whichever is greater) protected in formal plus informal reserves in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions. Specify:	yes/no
1b. Local Representation	
i) The area is of an ecological community with 10% or less remaining of its pre-European extent within the Local Government Area. Specify:	yes/no
ii) The area is of an ecological community with 30% or less remaining of its pre-European extent within the Local Government Area. Specify:	yes/no
iii) The area is a large (greater than 10 ha), viable natural areas in good or better condition of an ecological community with more than 30% remaining within the Local Government Area. Specify:	yes/no
2. Diversity	
i) The area is of a natural area generally in good or better condition that contains both upland and wetland plant communities. Specify:	yes/no
3. Rarity	
i) The area is of an ecological community with only 1500 ha or 10% or less (whichever is greater) of its pre-European extent remaining in the South West NRM Region portion of the Swan Coastal Plain IBRA Bioregion or in the Southwest Forest Region portion of the Jarrah Forest and Warren IBRA Bioregions. Specify:	yes/no
iii) The area contains a Threatened Ecological Community (TEC). Specify:	yes/no

Date of assessment _____ Name of area _____

iv) The area contains Declared Rare Flora (DRF), Specially Protected Fauna (SPF) or significant habitat for Specially Protected Fauna. Specify:	yes/no	
v) The area contains Priority or other significant flora or fauna or significant habitat for these fauna. Specify:	yes/no	
4. Maintaining Ecological Processes or Natural Systems - Connectivity		
i) The natural area acts as an ecological stepping stone within an existing "regional ecological linkage" which has been identified in a published report relevant to the study area (or part of the study area) (Note: published "regional ecological linkage" information will not be available for some areas). Specify:	yes/no	
ii) The natural area acts as an ecological stepping stone within a "local ecological linkage" that has been identified by a Local Government. Specify:	yes/no	
5. Protection of Wetland, Streamline and Estuarine Fringing Vegetation and Coastal Vegetation		
i) The natural area is a Conservation or Resource Enhancement category wetland and/or its buffer zone	yes/no	
ii) The natural area is an EPP Wetland and/or its buffer zone	yes/no	
iii) The natural area is a channel wetland (e.g. river, stream, creek) and/or its associated riparian vegetation and/or its buffer zone	yes/no	
iv) The natural area is within a floodplain area and/or its buffer zone	yes/no	
v) The natural area is part of an estuarine ecosystem and/or its fringing vegetation and/or its buffer zone	yes/no	
vi) The natural area contains coastal vegetation on the foredunes and/or secondary dunes	yes/no	
VIABILITY ESTIMATE		
Viability Factor	Category	Score
Size	Greater than 20 ha	5
	Greater than 10 ha less than 20 ha	4
	Greater than 4 ha less than 10 ha	3
	Greater than 1 ha less than 4 ha	2
	Less than 1 ha	1
	Size Score =	
Shape	Circle, square or squat rectangle	3.5
	Oval, rectangle or equilateral triangle	3
	Irregular shape with few indentations	2.5
	Irregular shape with many indentations	2
	Long thin shape with large proportion of area greater than 50 m wide	1.5
	Long thin shape with large proportion of area less than 50 m wide	1
	Shape Score =	
Perimeter to area ratio	Less than 0.01	4
	Greater than 0.01 less than 0.02	3
	Greater than 0.02 less than 0.04	2
	Greater than 0.04	1
	Perimeter to area ratio Score =	

Date of assessment _____

Name of area _____

Vegetation condition NB: based on Keighery (1994) condition scale	Pristine 10 x % =	
	Excellent 8 x % =	
	Very Good 6 x % =	
	Good 4 x % =	
	Degraded 2 x % =	
	Completely Degraded 0 x % =	
	Total calculated score =	
Connectivity	A. Forms part of a Regional Ecological Linkage and is contiguous with a protected natural area of size greater than 4ha	5
	B. Not part of a Regional Ecological Linkage but contiguous with a protected natural area of size greater than 4ha	4.5
	C. Forms part of a Regional Ecological Linkage and is within 500 m of more than 4 protected natural areas each having an area greater than 4 ha	4
	D. Not part of a Regional Ecological Linkage but within 500 m of more than 4 protected natural areas each having an area greater than 4 ha	3.5
	E. Forms part of a Regional Ecological Linkage and is within 500 m of 3 or 4 protected natural areas each having an area greater than 4 ha	3
	F. Not part of a Regional Ecological Linkage but within 500 m of 3 or 4 protected natural areas each having an area greater than 4 ha	2.5
	G. Forms part of a Regional Ecological Linkage and is within 500 m of 2 protected natural areas each having an area greater than 4 ha	2
	H. Not part of a Regional Ecological Linkage but within 500 m of 2 protected natural areas each having an area greater than 4 ha	1.5
	I. Forms part of a Regional Ecological Linkage and is within 500 m of 1 protected natural area each having an area greater than 4 ha	1
	J. Not part of a Regional Ecological Linkage but within 500 m of 1 protected natural area each having an area greater than 4 ha	0.5
	K. Forms part of a Regional Ecological Linkage but is not within 500 m of any protected natural areas each having an area greater than 4 ha	0.25
	Connectivity Score =	
TOTAL SCORE		

12.6 Skill level matrix for natural area assessment

Skill Level	Description
1	No relevant environmental qualification, no training specific to bushland management and no previous experience in undertaking biological surveys
2	Basic introductory training in bushland management ¹ but no previous experience in biological surveys
3a	Training specific to bushland management ² but no previous experience in undertaking biological surveys
3b	Relevant environmental qualification ³ but no training specific to bushland management and no previous experience in undertaking biological surveys
3c	Relevant environmental qualification ³ , and training specific to bushland management ² but no previous experience in undertaking biological surveys
4a	Training specific to bushland management ² and some experience in undertaking biological surveys
4b	Relevant environmental qualification ³ , no training specific to bushland management but some experience in undertaking biological surveys
4c	Relevant environmental qualification ³ and training specific to bushland management and some experience in undertaking biological surveys
4d	Some experience in undertaking biological surveys
5a	Training specific to bushland management ² and extensive experience in undertaking biological surveys
5b	Relevant environmental qualification ³ , no training specific to bushland management but extensive experience in undertaking biological surveys
5c	Relevant environmental qualification ³ and training specific to bushland management and extensive experience in undertaking biological surveys
5d	Extensive experience in undertaking biological surveys
6a	Training specific to bushland management ² and extensive experience in undertaking biological surveys in the South West Region
6b	Relevant environmental qualification ³ , no training specific to bushland management but extensive experience in undertaking biological surveys in the South West Region
6c	Relevant environmental qualification ³ and training specific to bushland management and extensive experience in undertaking biological surveys in the South West Region
6d	Extensive experience in undertaking biological surveys in the South West Region

¹ for example, APACE Introduction to Bush Regeneration course (minimum of four days study)

² for example, a Certificate in Bush Regeneration (such as Certificate II or III in Conservation and Land Management) (minimum of six months study)

³ for example, a Degree or Diploma in Environmental Science or Biology (minimum of three years study)

It is expected that people in each of the above skill levels would have the following capabilities:

- ▶ good observation skills
- ▶ familiarity with common plant and animal species of the local area
- ▶ map/aerial photo reading skills
- ▶ mathematical skills (for example, can read scales, draw to scale)
- ▶ basic map drawing skills, contours, latitude/longitude calculation
- ▶ ability to use a GPS for determining coordinates for mapping where required.

And in addition for Skill Level 4 and above:

- ▶ ability to distinguish between wetland and upland areas;
- ▶ ability to distinguish between weed/feral species and species that are native to a given area;
- ▶ knowledge of steps required to identify plant and animal species, for example, ability to use identification keys.

And in addition for Skill Level 5 and above:

- ▶ ability to survey for Declared Rare Flora, Specially Protected Fauna, Priority and other significant species of flora and fauna.

And in addition for Skill Level 6:

- ▶ ability to survey for threatened ecological communities in the South West region.

12.7 Vegetation condition scales for natural area assessment

A comparison of the Keighery (1994) and Kaesehagen (1994) vegetation condition scales for natural area assessment

Keighery Condition Scale (Keighery 1994)	Kaesehagen Condition Scale (Kaesehagen 1994)
Pristine Pristine or nearly so, no obvious signs of disturbance	
Excellent Vegetation structure intact; disturbance affecting individual species; weeds are non-aggressive species	Very good to excellent 80% to 100% native flora composition Vegetation structure intact or nearly so Cover/abundance of weeds <5% No or minimal signs of disturbance
Very good Vegetation structure altered; obvious signs of disturbance For example, disturbance to vegetation structure caused by repeated fires; the presence of some more aggressive weeds; dieback; logging; grazing	Fair to good 50% to 80% native flora composition Vegetation structure modified Cover/abundance of weeds 5% to 20%, any number of individuals Minor signs of disturbance
Good Vegetation structure significantly altered; very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate. For example, disturbance to vegetation structure caused by very frequent fires; the presence of some very aggressive weeds at high density; partial clearing; dieback; grazing.	
Degraded Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires; the presence of very aggressive weeds; partial clearing; Phytophthora dieback; grazing	Poor 20% to 50% native flora composition Vegetation structure completely modified or nearly so Cover/abundance of weeds 20% to 60%, any number of individuals Disturbance incidence high
Completely Degraded The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.	Very Poor 0% to 20% Native flora composition Vegetation structure disappeared Cover/abundance of weeds 60% to 100%, any number of individuals Disturbance incidence very high

12.8 Growth Form Layers and Vegetation structure classification scheme for natural area assessment (for comparison to National Vegetation Information System)

Growth Form Layers (Adapted from Keighery 1994; McDonald *et al.* 1990 and Executive Steering Committee for Australian Vegetation Information 2003)

- Tree:** woody plant with a single trunk and canopy, the canopy is less than or equal to 2/3 of the height of the trunk, no lignotuber apparent
- Mallee:** woody plant with many woody stems, canopy well above the base, lignotuber usually apparent, commonly of the genus *Eucalyptus*
- Shrub:** woody plant with one or many woody stems, foliage all or part of the total height of the plant, includes grass trees (*Xanthorrhoea* spp.) and cycads (inc. *Macrozamia* spp.)
- Herb:** non-woody plant with stems, generally under 0.5 m tall and not a grass, sedge or rush
- Grass:** non-woody plant that comes from the plant family Poaceae; all have inconspicuous individual flowers that are pollinated by wind; leaf sheath always split, ligule present, leaf usually flat, stem cross-section circular, evenly spaced internodes.
- Sedge:** non-woody, tufted or spreading plant that comes from the plant family Cyperaceae; most have inconspicuous flowers that are pollinated by wind; leaf sheath never split, usually no ligule, leaf not always flat, extended internode below inflorescence
- Rush:** same as sedge but comes from the plant families Juncaceae, Restionaceae, Typhaceae or Xyridaceae; leaf sheath may be split in Restionaceae
- Climbers:** plants that climb or scramble over other plants for support.

Classification System Used to Describe Vegetation Structure (Keighery 1994), as adapted from Muir (1977) and Aplin (1979)

Growth Form/ Height Class	Canopy Cover			
	100% to 70 %	70% to 30 %	30% to 10 %	10% to 2 %
Trees over 30 m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland
Trees 10-30 m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees under 10 m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Mallee over 8 m (Tree Mallee)	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee under 8 m (Shrub Mallee)	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub
Shrubs over 2 m	Closed Tall Scrub	Tall Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1-2 m	Closed Heath	Open Heath	Shrubland	Open Shrubland
Shrubs under 1 m	Closed Low Heath	Open Low Heath	Low Shrubland	Very Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

12.9 Common indicator species for the presence of disease caused by *Phytophthora cinnamomi*

Plant species that indicate the presence of *Phytophthora cinnamomi* are those that are consistently susceptible to the disease. Useful indicators vary with the type of vegetation present. Common indicator species in the jarrah forest include jarrah (*Eucalyptus marginata*), bull banksia (*Banksia grandis*), holly leafed banksia (*B. ilicifolia*) and swamp banksia (*B. littoralis*), purple flag and yellow flag (*Patersonia* spp.), snottygobble (*Persoonia longifolia*) and grass tree (*Xanthorrhoea preissii* and *X. gracilis*). A more comprehensive list of useful indicators in South West locations can be found at DEC's Nature Base website <http://www.naturebase.net/content/view/213/548/1/4/> (Department of Environment and Conservation undated c). However, for many local plant species susceptibility to *Phytophthora* infection remains unknown.

If plants of these indicator species are selectively dead or dying amongst otherwise healthy bushland plants then best practice methods for the management of *Phytophthora cinnamomi* should be implemented by Local Government until the disease can be positively identified or ruled out by a qualified dieback expert. Refer to 'Managing Phytophthora Dieback - Guidelines for Local Government' (Dieback Working Group 2000).















*Training for Local Government employees in awareness raising and treatment methods for *Phytophthora cinnamomi* has been provided by the South West Biodiversity Project. Photo: Jodie Wood*

Part C - Important information to help in developing a Local Biodiversity Strategy

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BUSHLAND PLANT SURVEY RECORDING SHEET 2 – use pencil only	
3. VEGETATION STRUCTURE AND COVER	From 'Bushland Plant Survey' written by B. Keighery (1994) and published by the Wildflower Society of WA (Inc.), PO Box 64 Nedlands WA 6008.

For each layer **record** – appropriate **growth form**, **cover class** (see below) and **dominant species** in their order of dominance, up to a maximum of 3 species. If more than 3 species are obviously dominant record as many as appropriate to describe each layer. For NVIS record max. height of layer & % crown cover to nearest 5%.

Cover Class		2 – 10%	10 – 30%	30 – 70%	over 70%
TREES					
	over 30m	10 – 30m	under 10m	over 8m	under 8m
GROWTH FORM					 30m 10m
COVER CLASS (%)		#		#	
HEIGHT & CROWN COVER (NVIS)					
DOMINANT SPECIES					
SHRUBS					
	over 2m	2m – 1m	under 1m		
GROWTH FORM			 2m 1m		
COVER CLASS (%)		#		#	
HEIGHT & CROWN COVER (NVIS)					
DOMINANT SPECIES					
GRASSES					
	GRASSES	HERBS	SEDGES	OTHER (eg. ferns)	
GROWTH FORM				 1m	
COVER CLASS (%)		#		#	
HEIGHT & CROWN COVER (NVIS)					
DOMINANT SPECIES					
4. VEGETATION CONDITION (see Keighery 1994 in Section 12.7 of this Addendum)					
1 'PRISTINE'		COMMENTS (give reasoning for choice)			
2 EXCELLENT					
3 VERY GOOD					
4 GOOD					
5 DEGRADED					

BUSHLAND PLANT SURVEY RECORDING SHEET 3 – use pencil only

5. SPECIES PRESCENCE	From 'Bushland Plant Survey' written by B. Keighery (1994) and published
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5. SPECIES PRESCENCE	From 'Bushland Plant Survey' written by B. Keighery (1994) and published
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Database SITE No			Record on sheet			Column 1 plant name Column 2 plant number Column 3 identification checked - ✓ when checked		
Date	No	ID		No	ID		No	ID
TREES								
MALLEES			GRASSES					
						SEDGES		
SHRUBS								
			HERBS					
Icon Flora Species (Note on list above if present)			Icon Community (tick if an icon community)					
Description of Structural Plant Community No. __ (Refer to Section 12.8)								

16. Information and statistics

Information and statistics are presented in this section to assist in the development of a Local Biodiversity Strategy and in particular the setting of objectives and Natural Area Condition targets.

16.1 Datasets to assist Local Governments identify and describe natural area resources

Tables 17 to 24 provide statistics that were prepared to assist Local Government in completing components of Phase 2 of the local biodiversity planning process. The statistics presented in Tables 17 to 24 were derived from interpretation and analysis of the following datasets:

- ▶ Native Vegetation Extent by Administrative Planning Categories
- ▶ Native Vegetation Extent by Ownership Category
- ▶ Native Vegetation Extent by Vegetation Complex
- ▶ Native Vegetation Extent by Peel Region Scheme Zoning
- ▶ Native Vegetation Extent by Greater Bunbury Region Scheme Zoning
- ▶ Native Vegetation Extent by Town Planning Scheme Zoning

The above datasets were prepared by interpretation and analysis of the Vegetation Extent for the South West Biodiversity Project Area (SWBPA), Western Australia dataset (Department of Food and Agriculture Western Australia (DAFWA) 2006) with other GIS datasets (South West Biodiversity Project 2007b). The Native Vegetation Extent mapping dataset was prepared using the DAFWA native vegetation extent mapping and merging this with the Department of Environment and Conservation's (DEC) native vegetation mapping within the Swan Bioplan project area. The DAFWA's native vegetation extent mapping was created by desktop interpretation of digital ortho-photos acquired between April 2000 and December 2004 at a scale of 1:20,000. The Swan Bioplan project area includes the Swan Coastal Plain from the City of Mandurah to the Shire of Busselton. The native vegetation mapping within this area was created by desktop interpretation of 2005 ortho-photos at a scale of 1:10,000. The two datasets were stitched together by the DAFWA for use by the SWBP.

When viewing the statistics provided in Tables 17 - 24 it is important to consider the limitations associated with mapped native vegetation extent and it should therefore not be assumed that the statistics provided are accurate to the nearest hectare. Based on the scale of capture it is estimated that an error of up to 5% may be associated with calculated areas for individual polygons in the SWBPA native vegetation mapping dataset, although the overall error for summarised areas from this dataset will be much lower (Shepherd, 2003 pers.comm.). Additional factors that should be considered when viewing the statistics in Table 17 to 24 include the following:

- ▶ the preferential mapping of treed landscapes, leading to some mapping of areas that are parkland cleared or completely degraded
- ▶ the inclusion of areas that are approved for clearing through development approvals and/or clearing permits
- ▶ some areas have been cleared since the time of the aerial photography.

Where a zero (0) appears in the tables this indicates that mapped native vegetation does occur but it has an area less than 0.5 ha. Where there are blank cells within a table it indicates that no mapped native vegetation exists.

Table 17. Native Vegetation Extent by Administrative Planning Category

This table was derived from the Native Vegetation Extent by Administrative Planning Category dataset and provides a broad overview of the different themes of native vegetation according to existing administrative planning and protection categories. Importantly this table quantifies the spatial extent of vegetated Local Natural Areas (LNA). LNAs are the major focus of Local Biodiversity Strategies.

Table 18. Native Vegetation Extent by Ownership Category

This table was derived from the Native Vegetation Extent by Ownership Category dataset and categorises native vegetation extent according to ownership. This is an important consideration when determining opportunities and constraints for protection and management of vegetated natural areas and for identifying the extent of vegetated natural areas for which Local Government has a management responsibility.

Table 19. Native Vegetation Extent in Local Government Reserves

This table, which was included in the Guidelines, has not been prepared for the SWBPA as currently no Bush Forever Sites or Regional Parks exist within the project area.

Table 20. Vegetated Local Natural Areas by Ownership Categories

This table was derived from the Native Vegetation Extent by Ownership Category dataset and categorises vegetated LNAs by ownership categories.

Table 21. Native Vegetation Extent by Vegetation Complex per Local Government

The information in Table 21 has been incorporated into Table 24 for each Local Government Authority.

Table 22a. Native Vegetation Extent by Peel Region Scheme (PRS) Zoning

This table was derived from Native Vegetation Extent by PRS Zoning dataset and is useful for determining the planning constraints associated with the native vegetation and the degree of threat due to future development within the City of Mandurah and Shires of Murray and Waroona. For example native vegetation zoned Urban under the PRS faces a different level of threat compared to native vegetation that exists on Rural zoned land. This table also includes the PRS Zoning of vegetated LNAs.

Table 22b. Native Vegetation Extent by Greater Bunbury Region Scheme (GBRS) Zoning

This table was derived from Native Vegetation Extent by GBRS Zoning dataset and is useful for determining the planning constraints associated with the native vegetation and the degree of threat due to future development within the City of Bunbury and Shires of Harvey, Dardanup and Capel. For example native vegetation zoned Urban under the GBRS faces a different level of threat compared to native vegetation that exists on Rural zoned land. This table also includes the GBRS Zoning of vegetated LNAs.

Table 22c. Native Vegetation Extent by Local Planning Scheme (LPS) Zoning

This table was derived from Native Vegetation Extent by LPS Zoning dataset and is useful for determining the planning constraints associated with the native vegetation and the degree of threat due to future development where currently no Region Scheme exists. For example native vegetation zoned Urban under the LPS faces a different level of threat compared to native vegetation that exists on Rural zoned land. This table also includes the LPS Zoning of vegetated LNAs.

Table 23 (a, b and c). Vegetated Local Natural Areas by PRS, GBRS and LPS

Table 23 (a, b and c) has been incorporated into the relevant Table 22 (a, b and c).

Table 24. Vegetation Complex Retention and Protection Information for the Local Government Authorities within the SWBPA.

This table provides information that would be useful for identifying which vegetation complexes should be a priority for protection to contribute to meeting regional biodiversity targets and provide a guide for formulating local biodiversity targets within the Local Government.

Information within the tables has been derived from the Native Vegetation Extent by Vegetation Complex dataset and categorises native vegetation extent according to vegetation complexes mapped by Matiske and Havel (1998) and Heddle, Longeragan and Havel (1980). For the SWBPA, vegetation complexes are the most appropriate units for defining ecological communities for establishing quantitative targets based on area. These vegetation complexes are based on the patterning of vegetation at a regional scale reflected by the underlying key determining factors of landform, soil and climate.

It is important to recognise that the remnant native vegetation mapping used to derive the statistics was created from dated aerial photography (in this case circa. 2005) with limited ground-truthing. Consequently the statistics for the amount of each vegetation complex remaining are generally an over-estimate of that remaining on the ground at present. The principal factors contributing to this over-estimation are:

- ▶ the preferential mapping of treed landscapes, leading to some mapping of areas that are parkland cleared or completely degraded
- ▶ the inclusion of areas that are approved for clearing through development approvals and/or clearing permits
- ▶ some areas that have been cleared since the time of the aerial photography (Environmental Protection Authority 2006b).

This mapping also does not give any indication of the condition of the native vegetation in the areas mapped.

It is very important to bear these limitations in mind when the statistics for percentage of the vegetation complexes remaining are approaching target figures set for Local Significance Criteria e.g. 10 or 30% and take a precautionary approach when determining the future of LNAs within vegetation complexes indicated to be above threshold targets.

Table 17. Native Vegetation Extent by Administrative Planning Category

Key to Table 17

DEC Conservation - Area (ha) of mapped native vegetation occurring in DEC Conservation Estate (Conservation Reserve, National Park, Nature Reserve).

DEC State Forest - Area (ha) of mapped native vegetation occurring in DEC State Forest and Timber Reserves.

DEC Other - Area (ha) of mapped native vegetation occurring in DEC estate excluding DEC Conservation and DEC State Forest and Timber Reserves (Executive Director Freehold land, 5(1)(g) Reserves and 5(1)(h) Reserves and Miscellaneous Reserves).

Vegetated Local Natural Areas - Area (ha) of mapped native vegetation not occurring within DEC estate. This represents only the vegetated extent of Local Natural Areas and therefore does not include the other components of Local Natural Areas (e.g. open water, rock outcrops etc).

Local Government	DEC Conservation (ha)	DEC State Forest (ha)	DEC Other (ha)	Vegetated Local Natural Areas (ha)	Total (ha)
Augusta-Margaret River	44337	67511	0	41232	153080
Bridgetown-Greenbushes	16600	44506	526	12833	74465
Bunbury	2		14	1622	1639
Busselton	10786	29757	250	22183	62977
Capel	1453	6850		10960	19264
Dardanup	8945	11219	674	5505	26342
Donnybrook-Balingup	7680	65460	1317	17828	92284
Harvey	2622	60355	3673	24258	90907
Mandurah	3603		82	5375	9060
Manjimup	350668	189494	3051	49782	592994
Murray	4912	72578	114	15539	93143
Nannup	77475	143808	2088	25577	248948
Waroona	8767	7679	19602	9805	45853
Total Area	537851	699217	31389	242500	1510957

Table 18. Native Vegetation Extent by Ownership Category

Key to Table 18

Commonwealth - Area (ha) of mapped native vegetation occurring on Commonwealth Land.
 Local Government - Vested - Area (ha) of mapped native vegetation occurring on land vested with the Local Government.
 Local Government - Freehold - Area (ha) of mapped native vegetation occurring on land owned (freehold) by the Local Government.
 Multiple Vesting - Area (ha) of mapped native vegetation occurring on land vested in multiple agencies, most often a Local Government and a State Agency.
 Unknown - Area (ha) of mapped native vegetation occurring on land where the ownership details are unknown to the SWBP at the time of mapping.
 Private - Area (ha) of mapped native vegetation occurring on private land.
 State Government - Area (ha) of mapped native vegetation occurring on State Government land.
 State Forest - Area (ha) of mapped native vegetation occurring within DEC State Forest.
 Vacant Crown land - Area (ha) of mapped native vegetation occurring on Vacant Crown land.

Local Government	Commonwealth (ha)	Local Gov't - Vested (ha)	Local Gov't - Freehold (ha)	Multiple Vesting (ha)	Unknown (ha)	Private (ha)	State Gov't (ha)	State Forest (ha)	Vacant Crown Land (ha)	Total (ha)
Augusta-Margaret River	0	1940	83		11898	29530	47501	58269	3859	153080
Bridgetown-Greenbushes	0	95	10	41	4467	10182	17086	41866	718	74465
Bunbury	0	130	152		68	249	1021		19	1639
Busselton	1	671	34	229	3702	16646	13587	27627	479	62977
Capel	0	393	2		833	7899	3139	6827	169	19261
Dardanup	0	48	34	2	461	4599	10351	10814	33	26343
Donnybrook-Balingup	0	228	8		2552	14205	12631	62152	508	92284
Harvey	99	195	208	21	1338	18916	11806	58230	94	90907
Mandurah	0	136	49		284	3815	4470	0	306	9060
Manjimup	0	579	19		9784	33482	359573	186879	2678	592994
Murray	0	248	9		8113	12552	6563	65471	188	93143
Nannup		86	5		7618	17903	80492	139575	3270	248948
Waroona		263	11		981	7333	17554	19422	289	45852
Total Area	101	5013	623	293	52098	177312	585773	677131	12610	1510955

Table 20. Vegetated Local Natural Areas by Ownership Categories**Key to Table 20**

Commonwealth - Area (ha) of mapped native vegetation occurring on Commonwealth Land.

Local Government – Vested - Area (ha) of mapped native vegetation occurring on land vested with the Local Government.

Local Government – Freehold - Area (ha) of mapped native vegetation occurring on land owned (freehold) by the Local Government.

Multiple Vesting - Area (ha) of mapped native vegetation occurring on land vested in multiple agencies, most often a Local Government and a State Agency.

Unknown - Area (ha) of mapped native vegetation occurring on land where the ownership details are unknown to the SWBP at the time of mapping.

Private - Area (ha) of mapped native vegetation occurring on private land.

State Government - Area (ha) of mapped native vegetation occurring on State Government land.

State Forest - Area (ha) of mapped native vegetation occurring within DEC State Forest.

Vacant Crown land - Area (ha) of mapped native vegetation occurring on Vacant Crown land.

Local Government	Commonwealth (ha)	Local Gov't – Vested (ha)	Local Gov't - Freehold (ha)	Multiple Vesting (ha)	Unknown (ha)	Private (ha)	State Gov't (ha)	Vacant Crown Land (ha)	Total (ha)
Augusta-Margaret River	0	1067	83		2650	29527	4048	3858	41232
Bridgetown-Greenbushes	0	95	10	41	1363	10180	427	718	12833
Bunbury	0	130	152		68	249	1004	19	1622
Busselton	1	327	34	112	1874	16646	2710	479	22183
Capel	0	393	2		833	7899	1662	169	10958
Dardanup	0	48	34	2	456	4599	332	33	5505
Donnybrook-Balingup	0	228	8		1336	14205	1545	506	17828
Harvey	99	195	208	21	1329	18638	3673	94	24258
Mandurah	0	136	49		250	3815	819	306	5375
Manjimup	0	579	19		7138	33346	6065	2635	49782
Murray	0	248	9		1072	12552	1470	188	15539
Nannup		86	5		3463	17885	870	3269	25577
Waroona		263	11		598	7333	1311	289	9805
Total Area	101	3796	623	176	22430	176876	25935	12562	242498

Table 22a. Native Vegetation Extent by Peel Region Scheme (PRS) Zoning

Key to Table 22a

PRS Zoning

All Natural Areas (ha) - Area (ha) of native vegetation according to Peel Region Scheme Zoning.

Vegetated Local Natural Areas (ha) - Area (ha) of vegetated Local Natural Areas according to Peel Region Scheme Zoning.

PRS Zoning	Mandurah		Murray		Waroona	
	All Natural Areas (ha)	Local Natural Areas (ha)	All Natural Areas (ha)	Local Natural Areas (ha)	All Natural Areas (ha)	Local Natural Areas (ha)
Industrial	0	0	160	159	129	129
Other Regional Roads	1	1	0	0		
Primary Regional Roads	162	162	173	156	143	95
Private Recreation	1	1	35	35		
Public Purposes (High School)	8	8				
Public Purposes (Hospital)	9	9	0	0		
Public Purposes (Public Utilities)	53	53	271	271		
Public Purposes (Special Uses)	1	1				
Public Purposes (University)	11	11				
Railways	6	6	216	203	19	19
Regional Open Space	4889	1230	7042	2117	18444	1082
Rural	2731	2730	12044	11954	8320	8268
State Forests			72667	202	18658	119
Urban	1149	1149	290	288	81	81
Urban Deferred			58	58		
Waterways	38	14	188	98	58	13
Total Area	9060	5375	93144	15540	45853	9805

Table 22b. Native Vegetation Extent by Greater Bunbury Region Scheme (GBRS) Zoning

Key to Table 22b**GBRS Zoning**

All Natural Areas (ha) - Area (ha) of native vegetation according to Greater Bunbury Region Scheme Zoning.

Vegetated Local Natural Areas (ha) - Area (ha) of vegetated Local Natural Areas according to Greater Bunbury Region Scheme Zoning.

NB. Total area per Local Government below may differ to that in Table 17 due to differences between the boundary of the GBRS and the LGA boundary datasets.

GBRS Zoning	Bunbury			Capel			Dardanup			Harvey		
	All Natural Areas (ha)	Local Natural Areas (ha)	All Natural Areas (ha)	All Natural Areas (ha)	Local Natural Areas (ha)	All Natural Areas (ha)	All Natural Areas (ha)	Local Natural Areas (ha)	All Natural Areas (ha)	All Natural Areas (ha)	Local Natural Areas (ha)	Local Natural Areas (ha)
Industrial	169	162	11	11	93	93	1179	848				
Other Regional Roads	0	0										
Port Installations	13	13										
Public Purposes (Airport)	21	21										
Public Purposes (High School)	1	1	8	8	2	2	11	11				
Public Purposes (Hospital)	4	4										
Public Purposes (Prison)	2	2										
Public Purposes (Public Utilities)	0	0	52	52			59	59				
Public Purposes (Special Uses)	17	17					148	117				
Public Purposes (Technical School)	13	13										
Public Purposes (University)	41	41										
Primary Regional Roads	47	44	138	127	106	106	202	196				
Private Recreation	5	5	37	37			45	45				
Railways	2	2	67	67	41	39	50	50				
Regional Centre	0	0										
Regional Open Space	969	968	2576	1125	4604	74	6475	1475				
Rural	128	124	8846	8841	4988	4966	21933	20057				
State Forests			6856	20	16409	146	59424	377				
Urban	195	195	424	424	75	75	953	942				
Urban Deferred	0	0	197	197	0	0	36	36				
Waterways	11	11	50	50	8	1	365	43				
Total Area	1638	1623	19261	10958	26325	5500	90880	24256				

Table 22c. Native Vegetation Extent by Local Planning Scheme (LPS) Zoning

Key to Table 22c

LPS Zoning

All Natural Areas (ha) - Area (ha) of native vegetation according to Local Planning Scheme Zoning.

Vegetated Local Natural Areas (ha) - Area (ha) of vegetated Local Natural Area + s according to Local Planning Scheme Zoning.

LPS Zoning	Augusta-Margaret River			Bridgetown-Greenbushes			Busselton			Donnybrook-Balingup			Manjimup			Nannup			Waroona		
	All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)	
blank	1641	1524		702	636		1376	1356		1416	902								20		17
Agriculture							10199	10166													
Airstrip													1	1							
Bushland Protection							146	146													
Business							1	1													
Caravan Park	16	16																			
Civil and Cultural Areas										0	0										
Cluster Farm													4	4							
Coastal Protection & Foreshore	30	1																			
Commercial				0	0					0	0		1	1							
Community				5	5																
Composite Industry	3	3																			
Conservation							2099	2098											882	443	
Conservation and Recreation																			12537	192	
Deferred Vasse Development Zone							4	4													
Development	204	204																			
Foreshore Protection and Management	57	57																			
General Farming Pastoral										10863	8391										

LPS Zoning	Augusta-Margaret River			Bridgetown-Greenbushes			Busselton			Donnybrook-Balingup			Manjimup			Nannup			Warroona		
	All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)	
General Farming Scenic										3757	3662										
General Industry										114	114	104									
Highway				117	109														76	73	
Important Local Road	282	281																			
Industry	2	2		34	34	15	15														
Institutional Use	5	5																			
Intensive Agriculture Cluster	11	11																			
Intensive Farming										2377	2305										
Landscape & Landform Protection	123	30																			
Light Industry	2	2								1	1										
Major Highway	126	126								60	53	19									
Major Road				37	28											373	351		62	53	
Mixed Use	0	0																			
National or Proposed National Park																		4493	137		
No Zone																					
Ocean	110	94																			
Other Commercial	1	1																			
Parks and Recreation	20038	3963		193	193					1483	1233	3817	25034	5757							
Private Clubs & Institutions	1	1										43	43								
Private Recreation	37	37																			
Protection of Native Flora	4	4																			
Public Purposes	2298	2128		34	33	274	272			25	25					6	6		8	8	
Public Purposes, Civic and Cultural												46									

LPS Zoning	Augusta-Margaret River			Bridgetown-Greenbushes			Busselton			Donnybrook-Balingup			Manjimup			Nannup			Waroona		
	All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)	
Railway				81	69					176	172		429	429		157	139		17	17	
Recreation				27	25		43798	3077											8	8	
Regional Road										4	4										
Residential	83	83		11	11		235	235		53	53		74	74							
Residential Development				3	3																
Rural	30005	28027		131	131								99441	37255		17108	16086				
Rural - Multiple Occupancy													50	50		241	241				
Rural - River Foreshore Protection	750	702																			
Rural 1 - Extensive Farming				3973	3508																
Rural 1 - General Farming																			2874	2805	
Rural 2 - General Agriculture				4744	4093																
Rural 2 - Irrigated Agriculture																			40	40	
Rural 3 - Blackwood Valley				3168	2993																
Rural 3a - Coastal																			814	812	
Rural 3b - Coastal Highway																			376	363	
Rural 4 - Greenbushes				170	146																
Rural 4 - Hills Face																			1851	1845	
Rural 5 - Darling Range																			2147	2076	
Rural 6 - Rural Residential																			647	632	
Rural Landscape							81	81													
Rural Residential							2527	2527		250	239										
Service Commercial	24	24																			
Service Industry													10	10							
Short Stay Residential													65	62							

LPS Zoning	Augusta-Margaret River			Bridgetown-Greenbushes			Busselton			Donnybrook-Balingup			Manjimup			Nannup			Waroona		
	All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)		All Natural Areas (ha)	Local Natural Areas (ha)	
Special Additional Use			2	2	2																
Special Development												164			162						
Special Industry																			101		101
Special Purpose							65	62													
Special Residential	42	42	31	31	31				6	6	77	77									
Special Restricted Use			19	19	19																
Special Rural	1728	1728	151	151	151							579	579	316	316						
Special Use	895	894	19	19	19				47	47				6	6				4		3
State Forest and Timber Reserves	94485	1166	60813	595					71562	533	408011	930	203255	582							
Tourist							67	67													
Tourist Accommodation	19	19																			
Tourist Development - (Landscape Protection Zone)	3	3																			
Tourist Enterprise											1	1									
Tourist/Landscape Protection	48	48																			
Town Centre	0	0																			
Urban									89	87			40	40							
Urban 5 - Special Residential																11	11				11
Urban 7 - Industrial																1	1				1
Urban 9 - Preston Beach																65	65				65
Vasse Development Zone							12	12													
Viticulture/Tourism							1973	1973													
Water Production, Mining, Recreation																18819					102
Waterways/Ocean	8	8					106	91													
Total Area	153080	41232	74465	12833			62977	22183	92284	17828	592994	49782	248948	25577		45852					9805

Table 24. Vegetation Complex Retention and Protection Information for the Local Government Authorities within the SWBPA.

Key to Table 24

Vegetation Complex - Name allocated to the vegetation complex by Mattiske and Havel (1998) and Heddle, Longergan and Havel (1980).
Pre-European - Total (ha) - Pre-European extent of each vegetation complex within the Local Government.
Pre-European - % - Pre-European extent of each vegetation complex as a percentage of the Local Government area
Remaining extent - Total (ha) - The extent of each vegetation complex remaining in circa. 2005 for the Local Government.
Remaining extent - % - The extent of each vegetation complex remaining in circa. 2005 as a percentage of the pre-European extent of each vegetation complex.
Protection Assumed - The area of vegetation complex remaining that has some level of assumed protection. Those areas of each vegetation complex that fall within the administrative planning categories of DEC CONS (National Parks, Nature Reserves and Conservation Parks).
DEC SF - The area of vegetation complex remaining within the administrative planning category DEC SF (DEC State Forest and Timber Reserves).
DEC OTHER - The area of vegetation complex remaining within the administrative planning category DEC OTHER (DEC Executive Director Freehold land, 5(1)(g) and 5(1)(h) Reserves and Miscellaneous Reserves).
LNA - Those areas of vegetation complex that are considered to be Local Natural Areas, i.e. all those areas outside of the DEC Estate (DEC CONS, DEC SF, DEC OTHER).
Regional Representation and Rarity, Local Significance Criteria - Essential - Those vegetation complexes that are identified in Table 3 and Table 4 as being essential for retention to ensure that regional representation and rarity Local Significance criteria are addressed are indicated with a 'yes'. (Note it is essential that vegetation for those complexes indicated with 'yes' are retained). Those complexes that are close to meeting the criteria target thresholds are indicated with an N*.
Local Natural Area Targets to meet Regional Representation and Rarity, Local Significance Criteria - Essential - This indicates that for all those vegetation complexes meeting ('yes') Regional Representation and Rarity, Local Significance Criteria - Essential, all Local Natural Areas should be retained.
Local Representation 10% Target - Area Required - The area of each vegetation complex required to be retained to achieve 10% representation of the pre-European extent of the complex within the Local Government.
Local Representation 10% Target - Achieved - Those vegetation complexes that have an area of the complex with 'protection assumed' that is greater than or equal to the 'area required' are indicated with a 'yes'.
Local Representation Suggested Actions for 10% Target - Local Natural Area Protection - For those complexes that do not meet the target (indicated by 'no' in the Local Representation 10% Target - Achieved column). Opportunities may exist to protect additional LNAs. The number indicated in the column refers to the amount of LNA that needs to be protected to meet the target.
Local Representation Suggested Actions for 10% Target - Restoration - For those complexes that don't meet the target and do not have enough LNA to meet the protection target restoration/revegetation may be considered. The area required to be restored/revegetated is indicated in the column.
Local Representation 30% Target - Area Required - The area of each vegetation complex required to be retained to achieve 30% representation of the pre-European extent of the complex within the Local Government.
Local Representation 30% Target - Achieved - Those vegetation complexes that have an area of the complex with 'protection assumed' that is greater than or equal to the 'area required' are indicated with a 'yes'.
Local Representation Suggested Actions for 30% Target - Local Natural Area Protection - For those complexes that do not meet the target indicated by 'no' in the Local Representation 30% Target - Achieved column; LNAs may be retained to meet the target. The number indicated in the column refers to the amount of LNA that needs to be retained to meet the target.
Local Representation Suggested Actions for 30% Target - Restoration - For those complexes that do not meet the target or have enough LNA to meet the protection target restoration/revegetation may be considered. The area required to be restored/revegetated is indicated in the column.
NB. Total areas may differ to that in previous tables due to differences between the boundary of the vegetation complex mapping and the LGA boundary datasets.

Shire of Augusta-Margaret River

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation								
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target	
		Pre-European	Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	Essential	Essential	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	
		Total (ha)							(ha)										
Bidella	Bd	9795	9593	98	1562	7940		90	N			979	Y			2938	N	90	1286
Blackwood	B	4584	3432	75	1032			2400	Y			458	Y			1375	N	343	
Blackwood	Bd	357	318	89	171			147	Y			36	Y			107	Y		
Blackwood	Bf	633	360	57	187			174	Y			63	Y			190	N	3	
Blackwood	BK	11901	11354	95	6271	4785		298	N			1190	Y			3570	Y		
Blackwood	Bw	3268	1817	56	455			1363	Y			327	Y			980	N	526	
Blackwood	Bwy	65	58	89	13			45	Y			7	Y			20	N	6	
Coate	CE	9222	7478	81	171	7009		298	N			922	N		453	2766	N	298	2297
Cowaramup	C1	18982	7903	42	2103	258		5542	Y			1898	Y			5695	N	3592	
Cowaramup	C2	5202	1923	37	114	4		1806	Y			520	N			1561	N	1447	
Cowaramup	Cd	1987	1507	76	437			1070	Y			199	Y			596	N	159	
Cowaramup	Cr	473	436	92	239			197	Y			47	Y			142	Y		
Cowaramup	Cw1	6144	2062	34	542	61		1460	Y			614	N			1843	N	1302	
Cowaramup	Cw2	2808	659	23	80	1		579	Y			281	N			842	N	579	184
Darradup	DP	852	807	95	608	199			N			85	Y			256	Y		
D'Entrecasteaux	D	408	318	78				318	Y			41	N			123	N	123	
D'Entrecasteaux	D5	1290	1246	97				1246	Y			129	N			387	Y	387	
D'Entrecasteaux	Dd	484	462	95	114			348	N			48	Y			145	N	31	
D'Entrecasteaux	DE5	540	376	70				376	N			54	N			162	N	162	
D'Entrecasteaux	Dr	45	25	57				25	Y			4	N			13	N	13	
D'Entrecasteaux	Drd	148	140	94				140	Y			15	N			45	N	45	
Glenarty Hills	H	7710	2865	37	651			2214	Y			771	N			2313	N	1662	
Glenarty Hills	Hd	271	201	74	157			44	Y			27	Y			81	Y		

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
			Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)				Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation								
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			Essential	10% target		30% Target		Suggested Actions for 30% Target			
			Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)			(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
			Total (ha)																
Wilyabrup	W1	7296	4420	61	1843	101		2477	N			730	Y	2189	N	346			
Wilyabrup	W2	836	206	25				206	Y			84	N	251	N	206	45		
Wilyabrup	WE	188	151	80	117			34	Y			19	Y	57	Y				
Wilyabrup	WEw	17	15	88	13			2	Y			2	Y	5	Y				
Wilyabrup	Wr	439	325	74	82	0		244	Y			44	Y	132	N	50			
Wilyabrup	Ww1	2268	1405	62	418	83		904	Y			227	Y	680	N	262			
Wilyabrup	Ww2	304	114	37	4			109	Y			30	N	91	N	87			
Total Area		222851	152374	68	43796	67510	0	28473				22285		66855	585	22058	12038		

Shire of Bridgetown-Greenbushes

Vegetation Complex	Veg Class	Original	Remaining					Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation							
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER			LNA	Essential	10% target		30% Target		Suggested Actions for 30% Target	
		Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	Essential	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)
Balingup	BL	12914	3485	27	370	1306	200	1608	Y	1608	N	1291	N	3874	N	1608	1896
Balingup	BLf	799	134	17		1	2	132	Y	132	N	80	N	240	N	132	108
Bevan 1	BE1	10635	7793	73	1031	5875	22	866	N*	866	N	1063	N	3190	N	866	1294
Bevan 2	BE2	9180	8679	95	2539	5988	28	125	N		Y	918	Y	2754	N	125	91

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation												
			Pre-European	Total (ha)	Remaining Extent		Protection (DEC CONS)	DEC SF			DEC OTHER	LNA	Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target			
					Total (ha)	%	Assumed (ha)	(ha)			(ha)			(ha)	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Boonarie	BO	111	111	100			108			3	Y	3	N	8	33	N	3	30					
Bridgetown	BT	7808	1782	23	47	62	134			1539	Y		N		2342	N	1539	756					
Bridgetown	BTf	1216	487	40				8		479	Y		N		365	N	365						
Carbunup	CB	2596	2057	79	1023	891	54			88	N		Y		779	Y							
Catterick	CC1	11732	4715	40	583	3128	2			1001	N*		N		3520	N	1001	1935					
Catterick	CC2	1454	1071	74	612	439				21	N		Y		436	Y							
Collis 1	CO1	2007	1272	63	42	1094				137	Y		N	22	602	N	137	423					
Collis 2	CO2	1257	1145	91	507	577	4			57	Y		Y		377	Y							
Corbalup	CL1	4757	3638	76	5	3376				257	Y		N	214	1427	N	257	1165					
Corbalup 2	CL2	7225	6109	85	3361	2436	21			291	N		Y		2168	Y							
Dalmore	DMg	631	70	11						70	Y		N		189	N	70	119					
Dalmore 1	DM1	2320	960	41	609	54				297	Y		Y		696	N	87						
Dwellingup	D1	13704	8769	64	1106	6055	1			1606	Y		N		4111	N	1606	1398					
Goonaping	G	523	206	39		181				25	N		N	27	157	N	25	132					
Grimwade	GR	5272	1797	34	243	770	3			781	Y		N		1582	N	781	557					
Hester	HR	4213	1800	43	333	702	37			728	N		N		1264	N	728	203					
Kapalarup	KP	114	50	44		32				18	Y		N		34	N	18	16					
Kirup	Kr	35	7	20						7	N		N		11	N	7	3					
Lukin 1	LK1	1272	485	38	210	165				110	Y		Y		382	N	110	62					
Mattaband 1	MT1	1327	1261	95		1212				49	Y		N	83	398	N	49	349					
Mattaband 2	MT2	419	414	99	254	160					Y		Y		126	Y							
Newgalup 1	NW1	3453	736	21	52					685	Y		N		1036	N	685	299					
Newgalup 2	NWf1	826	248	30						248	Y		N		248	N	248						
Newgalup 3	NWg1	6863	1318	19	640	1				677	Y		N		2059	N	677	742					

Vegetation Complex	Veg. Class	Original	Remaining					Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation									
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER			LNA	Essential	10% target		Suggested Actions for 10% target		30% target		Suggested Actions for 30% target	
			Total (ha)	%	Assumed (ha)	(ha)	(ha)			Remaining (ha)		Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Pemberton	PM2	9	9	100		9			Y			1	N	0	1	3	N	0	3
Pindalup	Pn	18	0	0					N			2	N	0	2	5	N	0	5
Quagering	Q	172	102	60		83			N		20		N	17		51	N	30	32
Southampton	SP	197	54	27			0	54	Y		54	20	N	20		59	N	54	6
Wheatley	WH1	72	72	100		68		4	N*		4	7	N	4	3	22	N	4	18
Wheatley	WH2	419	419	100	282	133		4	Y		4	42	Y			126	Y		
Wheatley	WH3	4606	3642	79	1272	2194	9	167	Y		167	461	Y			1382	N	110	
Wilga	WG	136	43	31		12		31	N			14	N	14		41	N	31	10
Yanmah	YN1	848	831	98		826		5	N			85	N	5	80	255	N	5	249
Yanmah	YN2	2959	2878	97	237	2588		53	Y		53	296	N	53	7	888	N	53	598
Yerraminup	YE	46	46	100	4	42			N			5	N	0	5	14	N	0	10
Yornup	YR	9537	5769	60	1239	3937		593	N*			954	Y			2861	N	593	1029
Total Area		133681	74465	56	16600	44506	526	12833				13368		4199	452	40104		12003	13538

City of Bunbury

Vegetation Complex	Original	Remaining				Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation							
	Pre-European	Remaining Extent	Protection (DEC CONS)	DEC OTHER	LNA	Essential	Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target	
	Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)		Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Guildford	10	3	25		3	Y	3	1	N	1		3	N	3	
Karrakatta-Central & South	757	310	41		310	N		76	N	76		227	N	227	
Quindalup	797	252	32	0	252	N		80	N	80		239	N	239	
Southern River	2205	745	34		730	Y	730	220	N	220		661	N	661	
Swan	306	93	31		93	Y	93	31	N	31		92	N	92	
Vasse	784	41	5		41	N*	41	78	N	41	37	235	N	41	194
Yongarillup	1436	170	12		170	N		144	N	144		431	N	170	261
Total Area	6294	1614	26	0	1599			629		593	37	1888		1433	455

Shire of Busselton

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation								
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target	
			Total (ha)	%								Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Abba		44100	3748	8	105	18	3625	Y	3625	4410	N	3625	680	13230	N	3625	9500		
Bidella	BD	7902	7233	92	454	6730	12	37	N	790	N	37	299	2371	N	37	1880		
Blackwood	BK	98	96	98		96			N	10	N		10	29	N		29		
Cartis	CSs	58	37	64		20		17	Y	6	N	6		17	N	17			
Cartis		94	35	38		11		25	Y	9	N	9		28	N	25	3		

Vegetation Complex	Veg. Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation					
			Remaining Extent			Protection (DEC CONS)	DEC SF	DEC OTHER			10% target		30% Target		Suggested Actions for 30% target	
			Total (ha)	%	Assumed (ha)	(ha)	(ha)	(ha)			Area Required (ha)	Achieved	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Coate	CE	1149	759	66	104	653			N		115	N	345	N	2	239
Cowaramup	C2	8486	3434	40	552	193			Y	2689	849	N	2546	N	1994	
Cowaramup	Cd	2080	1267	61	229	3			Y	1035	208	Y	624	N	395	
Cowaramup	Cr	444	154	35	13				Y	141	44	N	133	N	120	
Cowaramup	Cw2	3847	1026	27	148	21			Y	857	385	N	1154	N	857	149
Darradup	DP	1	1	83		1			N		0	N	0	N		
Gracetown	G3	1180	1009	86	240				N	769	118	Y	354	N	114	
Gracetown	GE	3522	3263	93	1885		195		N	1183	352	Y	1057	Y		
Jalbaragup	JL	2601	1833	70	180	1572			N*	80	260	N	780	N	80	520
Jarraahwood		14	0	2					Y	0	1	N	4	N	0	4
Kilcarnup	KB	9	1	12	1				Y	0	1	Y	3	N	0	2
Kilcarnup	KbE	160	51	32	44				Y	7	16	Y	48	N	4	
Kilcarnup	KE	361	208	58	175		1		N		36	Y	108	Y		
Kilcarnup	Kr	771	698	91	444		34		N		77	Y	231	Y		
Kingia	KI	12274	11655	95	1577	10025	8	45	N		1227	Y	3682	N	45	2060
Ludlow		7615	1514	20	590	177	0	746	Y	746	761	N	2284	N	761	933
Metricup	M	824	595	72	114	124		357	Y	357	82	Y	247	N	133	
Metricup	Mv	972	561	58	67	17		477	Y	477	97	N	292	N	225	
Preston	PR	1210	823	68		710		114	Y	114	121	N	363	N	114	249
Preston		1	1	90		1		0	Y	0	0	N	0	N		
Quindalup		6138	2027	33	373			1654	N		614	N	1841	N	1468	
Rosa	RO	5329	4876	92	2017	2715		143	N*	143	533	Y	1599	Y		
Southern River		713	149	21		55		94	Y	94	71	N	214	N	94	120
Telerah	TL	4318	3661	85	400	3214		47	N		432	N	1295	N	47	848

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation							
		Pre-European	Remaining Extent	Protection (DEC CONS)	DEC SF	DEC OTHER	LNA	Essential	10% target	Suggested Actions for 10% target		30% Target		Suggested Actions for 30% target				
		Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	
Treeton	T	6171	2939	48	469	784		1685	Y	1685	617	N	148		1851	N	1382	
Treeton	Td	18	10	56		0		9	Y	9	2	N	2		5	N	5	
Treeton	Tw	1569	489	31	102	88		299	Y	299	157	N	55		471	N	299	70
Whicher Scarp	WC	1216	1070	88	225	825		20	Y	20	122	Y			365	N	20	120
Whicher Scarp	WCv	15	10	67		10			Y		2	N		2	5	N		5
Willyabrup	W2	3272	1359	42	64			1295	Y	1295	327	N	263		982	N	918	
Willyabrup	Wd	235	135	57				135	Y	135	24	N	24		71	N	71	
Willyabrup	We	214	139	65	91			47	Y	47	21	Y			64	Y		
Willyabrup	Wr	671	510	76	13			497	Y	497	67	N	54		201	N	188	
Willyabrup	Ww2	1028	489	48	1			488	Y	488	103	N	102		308	N	307	
Yelverton	Y	8405	2784	33	76	1240		1468	Y	1468	840	N	764		2521	N	1468	977
Yelverton	Yd	2058	1144	56	4	182		957	Y	957	206	N	202		617	N	613	
Yelverton	Yf	37	7	19				7	Y	7	4	N	4		11	N	7	4
Yelverton	Yw	4096	1172	29	26	271		875	Y	875	410	N	384		1229	N	875	328
Total Area		145274	62975	43	10786	29757	250	22181		18191	14527		6985	1008	43582		16310	18040

Shire of Capel

Vegetation Complex	Veg Class	Original	Remaining				Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation											
			Remaining Extent		Protection (DEC CONS)	DEC SF			LNA	Essential	10% target		30% Target		Suggested Actions for 10% target		Suggested Actions for 30% target			
			Total (ha)	%	Assumed (ha)	(ha)			Remaining (ha)	Essential	Area Required (ha)	Achieved	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	LNA Protection (ha)	Restoration		
Abba		9134	734	8		18	716	Y	716	N	913	N	716	197	716	N	2740	N	716	2024
Bassendean-Central & South		4947	1244	25			1244	N*		1244	N	495	N	495			1484	N	1244	240
Bidella	BD	399	306	77		215	91	N			40	N	N	40			120	N	91	28
Cartis		915	202	22		27	175	Y		175	N	91	N	91			274	N	175	100
Gulldford		6367	642	10	3		639	Y		639	N	637	N	634			1910	N	639	1268
Jalbaragup	JL	601	580	97		495	85	N*		85	N	60	N	60			180	N	85	95
Jarrahwood		18	0	0		0	0	Y		0	2	N	N	0	2		5	N	0	5
Karrakatta-Central & South		5584	3129	56	956		2173	N			558	Y				1675	N	719		
Kingia	KI	1883	1695	90		1425	271	N			188	N	N	188			565	N	271	294
Kingia		6	2	35			2	Y		2	1	N	N	1			2	N	2	0
Ludlow		1213	465	38	157	215	93	Y		93	121	Y	Y				364	N	93	114
Preston	PR	670	121	18		3	119	Y		119	67	N	N	67			201	N	119	82
Preston		72	29	41		12	17	Y		17	7	N	N	7			21	N	17	4
Quindalup		1932	980	51			980	N			193	N	N	193			580	N	580	
Rosa	RO	4034	3039	75		2397	642	N*		642	403	N	N	403			1210	N	642	568
Serpentine River		213	100	47			100	Y		100	21	N	N	21			64	N	64	
Southern River		9727	2102	22	180	63	1859	Y		1859	973	N	N	792			2918	N	1859	879
Swan		2261	464	21		2	462	Y		462	226	N	N	226			678	N	462	216
Vasse		1328	371	28	30		341	N*		341	133	N	N	102			398	N	341	27
Whicher Scarp	WC	2041	1671	82		1173	498	Y		498	204	N	N	204			612	N	498	115
Whicher Scarp	WCv	510	250	49		108	142	Y		142	51	N	N	51			153	N	142	11
Yelverton	Y	645	620	96		563	57	Y		57	64	N	N	57	8		193	N	57	136
Yelverton	Yd	158	135	85		51	84	Y		84	16	N	N	16			48	N	48	
Yelverton	Yw	123	83	68		83	0	Y		0	12	N	N	0	12		37	N	0	37
Yoongarillup		1021	294	29	126		168	N			102	Y	Y				306	N	168	12
Total Area		55802	19261	35	1452	6850	10958			7275	5580			3	219		16739		9033	6255

Shire of Dardanup

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation							
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target
		Pre-European									Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
		Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	Essential (ha)									
Balingup	BL	1291	805	62		552		253	Y	253	N	129			387	N	253	134
Bassendean-Central & South		2	1	24				1	N*	1	N	0			1	N	1	0
Cartis		417	77	18	45	3		30	Y	30	Y	42	Y		125	N	30	51
Catterick	CC1	375	338	90		324		14	N*	14	N	37	N	14	112	N	14	98
Dardanup		985	80	8				80	Y	80	N	99	N	80	296	N	80	216
Darling Scarp	DS2	3220	662	21	4	102		557	Y	557	N	322	N	318	966	N	557	406
Donnybrook	DB3	7	6	95		6			Y		N	1	N	0	2	N	0	2
Dwellingup	D1	189	47	25	30			16	Y	16	Y	19	Y		57	N	16	10
Grimwade	GR	538	538	100		533		5	Y	5	N	54	N	5	161	N	5	157
Guldford		9366	846	9	20	36		790	Y	790	N	937	N	790	2810	N	790	2000
Helena 1	He1	1938	1928	99	1873	0		55	N		Y	194	Y		582	Y		
Hester	HR	9303	7980	86	3583	3645	397	355	N		Y	930	Y		2791	Y		
Jalbaragup	JL	1045	789	75	111	619		59	N*	59	Y	104	Y		313	N	59	144
Jarrahwood		27	6	20				6	Y	6	N	3	N	3	8	N	6	3
Karrakatta-Central & South		231	32	14				32	N		N	23	N	23	69	N	32	37
Kingia	KI	3455	3001	87	376	2459		166	N		Y	346	Y		1037	N	166	494
Kingia		293	77	26	28	4		45	Y	45	N	29	N	1	88	N	45	15
Layman	LY	15	15	100		15			Y		N	1	N	0	4	N	0	4
Lowdon	Lo	5682	2244	39	846	145	106	1148	Y	1148	Y	568	Y		1705	N	859	
Mungardup		58	58	100	42	16			Y		Y	6	Y		17	Y		
Murray 1	My1	3250	1477	45	1119	310		48	N		Y	325	Y		975	Y		
Preston	PR	1095	280	26		50		230	Y	230	N	109	N	109	328	N	230	98

Vegetation Complex	Veg Class	Original	Remaining					Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation								
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER			LNA	Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target
		Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	(ha)	Area Required (ha)		Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Preston		146	24	16	2	7	14	Y	14	15	N	N	12		44	N	14	27
Rosa	RO	1308	1166	89		1077	89	N*	89	131	N	N	89	42	393	N	89	304
Southern River		3330	976	29			976	Y	976	333	N	N	333		999	N	976	23
Swan		1407	178	13			178	Y	178	141	N	N	141		422	N	178	244
Whicher Scarp	WC	797	255	32	31	128	96	Y	96	80	N	N	49		239	N	96	112
Yarragill 1	Yg1	3027	2457	81	837	1190	260	N*	260	303	Y	Y			908	N	71	
Yoongarillup		37	3	8			3	N		4	N	N	3	1	11	N	3	8
Total Area		52833	26343	50	8945	11219	674		4846	5283			2100	263	15850		4570	4587

Shire of Donnybrook-Balingup

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation								
		Pre-European	Remaining Extent	Protection (DEC CONS)	DEC SF	DEC OTHER	LNA	Essential	Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target			
		Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration		
Balingup	BL	42832	15011	35	523	5488	472	8528	Y	8528	4283	N	N	3761		12849	N	8528	3799
Balingup	BLf	2126	201	9		20	4	177	Y	177	213	N	N	177	35	638	N	177	460
Bentley	BN	455	134	29		3		131	Y	131	46	N	N	46		137	N	131	5
Bevan 1	BE1	778	650	84		485	132	32	N*	32	78	N	N	32	46	233	N	32	201
Bidella	BD	2663	2088	78		1933		155	N*		266	N	N	155	111	799	N	155	644
Boonarie	BO	2632	2555	97		2549		6	Y		263	N	N	6	257	790	N	6	783

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation										
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			Essential	Essential	10% target		30% Target		Suggested Actions for 10% Target		Suggested Actions for 30% Target		
			Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)					(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Bridgetown	BT	7110	1802	25	102	242	545	913	Y		913	N	711	N	609		2133	N	913	1118	
Bridgetown	BTf	738	136	18	0		18	118	Y		118	N	74	N	74		221	N	118	103	
Catterick	CC1	13877	11615	84	1253	9708	6	647	N*		647	N	1388	N	134		4163	N	647	2262	
Coate	CE	485	193	40		184		9	N			N	48	N	9	39	145	N	9	136	
Darling Scarp	DS1	1133	200	18		111		89	Y			N	113	N	89	24	340	N	89	250	
Darling Scarp	DS2	434	39	9				39	Y			N	43	N	39	4	130	N	39	91	
Donnybrook	DB3	1826	590	32		254		336	Y			N	183	N	183		548	N	336	212	
Dwellingup	D1	10602	10067	95	2112	7697	4	254	Y			N	1060	Y			3181	N	254	814	
Goonaping	G	581	516	89		497	1	17	N			N	58	N	17	41	174	N	17	157	
Grimwade	GR	14108	8555	61	1073	6514	36	931	Y			N	1411	N	338		4233	N	931	2228	
Hester	HR	17662	14287	81	561	12176	64	1486	N			N	1766	N	1205		5298	N	1486	3251	
Jalbaragup	JL	449	448	100		446		1	N*			N	45	N	1	44	135	N	1	134	
Kingia	KI	5217	4626	89		4347		279	N			N	522	N	279	243	1565	N	279	1286	
Kirup	Kr	3424	2134	62	135	1165		834	N			N	342	N	207		1027	N	834	58	
Layman	LY	180	41	23		23		19	Y			N	18	N	18		54	N	19	36	
Mumballup	ML	2581	397	15	22	4	22	350	Y			N	258	N	236		774	N	350	403	
Murray 1	My1	485	220	45		220		0	N			N	48	N	0	48	145	N	0	145	
Pindalup	Pn	773	595	77		549		46	N			N	77	N	46	31	232	N	46	185	
Preston	PR	2189	381	17		56		325	Y			N	219	N	219		657	N	325	332	
Queenwood	QW	1418	591	42		171		420	Y			N	142	N	142		425	N	420	6	
Queenwood	QWf	726	159	22				159	N*			N	73	N	73		218	N	159	59	
Rosa	RO	5882	3724	63		2943		782	N*			N	588	N	588		1765	N	782	983	
Southampton	SP	211	143	68			11	131	Y			N	21	N	21		63	N	63		
Swamp	S	425	44	10		16		28	N			N	43	N	28	15	128	N	28	100	

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation									
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target		
			Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)				(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
	TL	326	192	59		182			9	N		33	N	9	23	98	N	9	88	
	WH2	34	26	76		26	0		0	Y	0	3	N	0	3	10	N	0	10	
	WC	11	11	100		10			1	Y	1	1	N	1	0	3	N	1	2	
	WCv	72	72	100		69			3	Y	3	7	N	3	5	22	N	3	19	
	WG	8706	7598	87	1727	5442			429	N		871	Y			2612	N	429	456	
	WS2	879	552	63		432			120	Y	120	88	N	88		264	N	120	144	
	WSv	260	95	37		80			16	Y	16	26	N	16	10	78	N	16	63	
	YN2	31	30	95		30				Y		3	N	0	3	9	N		9	
	Yg1	1548	1500	97	171	1322			7	N*	7	155	Y			465	N	7	286	
	Yg2	66	66	100		66			0	N*	0	7	N	0	7	20	N	0	20	
	Total Area	155935	92284	59	7680	65460	1317		17828		14691	15594		8848	989	46781		17760	21338	

Shire of Harvey

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation								
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target	
			Total (ha)	%	Assumed (ha)	(ha)	(ha)	(ha)			Essential	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Bassendean-Central & South		19020	8871	47	112	1059	1032	6667	N*		6667	1902	N	1790		5706	N	5594	
Cannington		1487	149	10				149	Y		149	149	N	149		446	N	149	297
Cooke	Ce	1084	1084	100		1061	23		0	N		108	N	0	108	325	N	0	325
Cottesloe-Central & South		1334	568	43	182	306			79	N		133	Y			400	N	79	139
Dardanup		4216	204	5	29		5		170	Y		422	N	170	223	1265	N	170	1066
Darling Scarp	DS2	6633	1579	24	74	46	1	1457	Y		1457	663	N	589		1990	N	1457	459
Darling Scarp		176	16	9					16	Y		18	N	16	2	53	N	16	37
Dwellingup	D1	45570	40111	88	58	37670	199	2184	Y		2184	4557	N	2184	2314	13671	N	2184	11428
Forrestfield	Fo	273	165	61	54		33		78	Y		27	Y			82	N	28	
Forrestfield		1767	310	18	9		2	298	Y		298	177	N	168		530	N	298	223
Goonaping	G	336	334	100		334				N		34	N	0	34	101	N	0	101
Guildford		17196	651	4			3	648	Y		648	1720	N	648	1072	5159	N	648	4511
Helena 1	He1	2838	1902	67	0	400		1502	N			284	N	284		851	N	851	
Karrakatta-Central & South		5114	1994	39	25	317	640		1012	N		511	N	486		1534	N	1012	497
Lowdon	Lo	10489	4058	39	309	504	133	3113	Y		3113	1049	N	740		3147	N	2838	
Murray 1	My1	7470	4829	65	4	3346	837	643	N			747	N	643	100	2241	N	643	1594
Not Mapped		2310	234	10	122			112				231	N	109		693	N	112	459
Quindalup		3809	2854	75	536				2319	N		381	Y			1143	N	607	
Serpentine River		6776	917	14	459	4	2	453	Y		453	678	N	219		2033	N	453	1121
Southern River		1	0	6				0	Y		0	0	N			0	N		
Swamp	S	276	271	98		271				N		28	N	0	28	83	N	0	83
Swan		2532	379	15				379	Y		379	253	N	253		759	N	379	381

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation							
		Pre-European	Remaining Extent	Protection (DEC CONS)	DEC SF	DEC OTHER	LNA	Essential	Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target		
		Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	
Vasse		1615	573	35	160	13	400	N*	400	162	N	2		485	N	325		
Yarragil 1	Yg1	13375	11781	88	4	11200	27	550	N*	550	N	550	783	4012	N	550	3458	
Yarragil 2	Yg2	4011	3451	86		3427		23	N*	23	N	23	378	1203	N	23	1180	
Yongarillup		10954	3476	32	437	395	736	1908	N		N	659		3286	N	1908	942	
Total Area		170661	90761	53	2574	60355	3673	24160		16586	17066	9681	5042	51198		20324	28301	

City of Mandurah

Vegetation Complex	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation							
	Pre-European	Remaining Extent	Protection (DEC CONS)	DEC SF	DEC OTHER	LNA	Essential	Essential	Essential	10% target		Suggested Actions for 10% target		30% target		Suggested Actions for 30% target	
	Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	(ha)	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Bassendean-Central & South	73	29	39				29	N*	29	7	N	7		22	N	22	
Cottesloe-Central & South	4701	2126	45	907			1219	N		470	Y			1410	N	503	
Herdsmen	251	66	26	31			35	Y	35	25	Y			75	N	35	9
Karrakatta-Central & South	1760	1265	72	226			1039	N		176	Y			528	N	302	
Not Mapped	1052	144	14	111			33			105	Y			316	N	33	172
Quindalup	1884	1294	69	575			719	N		188	Y			565	Y		
Vasse	507	192	38	36			95	N*	95	51	N	15		152	N	95	21
Yongarillup	6498	3429	53	1576			1853	N		650	Y			1949	N	373	
Total Area	16725	8544	51	3462		62	5020		159	1672		22	0	5017		1363	202

Shire of Manjimup

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation														
			Pre-European	Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER			LNA	Essential	Essential	10% target				30% Target				Suggested Actions for 10% Target		Suggested Actions for 30% Target	
				Total (ha)	%	Assumed (ha)	(ha)	(ha)			(ha)			(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration			
Angove	A	35314	32220	91	26139	2379	43	3659	N		3531	Y			10594	Y									
Balingup	BL	62	62	100		62			Y		6	N	0	6	19	N	0		19						
Barlee	Ba	1	1	100	1	0			Y		0	Y			0	Y									
Bevan	BEb	5306	5014	95	2295	2698		21	N		531	Y			1592	Y									
Bevan	BEs	70	70	100	69			0	Y		7	Y			21	Y									
Bevan 1	BE1	36480	29180	80	3595	22755	355	2474	N*		3648	N	53		10944	N	2474		4875						
Bevan 1	BEy1	27979	27695	99	17213	10323		159	Y		2798	Y			8394	Y									
Bevan 2	BE2	30180	27165	90	7353	18483		1328	N		3018	Y			9054	N	1328		372						
Bevan 2	BEy2	1688	1656	98	1645			11	Y		169	Y			506	Y									
Blackwater	BW	756	733	97	733				Y		76	Y			227	Y									
Blackwater	BWp	29577	27915	94	24644	383		2888	N		2958	Y			8873	Y									
Broad Swamps	S4	1569	1060	68	353	15	1	692	Y		157	Y		692	471	N	118								
Burnett	BU	7029	7029	100	6920	31		78	N		703	Y			2109	Y									
Caldyanup	CA	7081	7081	100	7077	4			N		708	Y			2124	Y									
Camballup	CM	8339	7947	95	5844	1871		233	N		834	Y			2502	Y									
Carbunup	CB	2632	2152	82	441	1599		112	N		263	Y			790	N	112		236						
Cattaminup	CP	3943	3938	100	2367	1549	1	21	N		394	Y			1183	Y									
Catterick	CC1	58	58	100		58			N*		6	N	0	6	17	N	0		17						
Catterick	CC2	4376	3819	87	2463	1146		211	N		438	Y			1313	Y									
Cleave	CV	1205	1097	91	760			336	Y		120	Y			361	Y									
Coate	CE	255	255	100	205	50			N		25	Y			76	Y									
Collis	COb	21261	18924	89	15598	1618	9	1699	N		2126	Y			6378	Y									
Collis	COD	2118	1540	73	602	261	167	510	Y		212	Y			635	N	33								

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation								
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			Essential	Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target
		Total (ha)	%	Assumed (ha)	(ha)	(ha)	(ha)	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)		Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration		
		Pre-European	Total (ha)																
Collis 1	CO1	2878	1811	63	600	921	3	286	Y		286	288	Y			863	N	264	
Collis 1	COy1	15149	13627	90	11405	909	7	1306	N			1515	Y			4545	Y		
Collis 2	CO2	1949	1839	94	428	1349		63	Y		63	195	Y			585	N	63	94
Collis 2	COy2	102	92	90	88			4	N			10	Y			31	Y		
Corbalup	CL1	9181	6124	67	1516	4054	26	527	Y		527	918	Y			2754	N	527	711
Corbalup 2	CL2	13271	11749	89	4839	6480		430	N			1327	Y			3981	Y		
Cormint	CT	2969	2827	95	793	1854	10	169	Y		169	297	Y			891	N	97	
Crowea	CRb	49813	42538	85	15372	23543	425	3197	N			4981	Y			14944	Y		
Crowea	CRd	1744	1384	79	747	459		177	Y		177	174	Y			523	Y		
Crowea	CRy	33502	24084	72	8368	12613	343	2761	N			3350	Y			10051	N	1683	
Darling Scarp	DS1	1	1	100	1			0	Y		0	0	Y			0	Y	0	
Darradup	DP	2	2	100	2				N			0	Y			1	Y		
D'Entrecasteaux	Dd	1232	1232	100	1224			8	N			123	Y			370	Y		
D'Entrecasteaux	Dd5	3696	3687	100	3687				N			370	Y			1109	Y		
D'Entrecasteaux	DE5	1709	1607	94	1607				N			171	Y			513	Y		
D'Entrecasteaux	E	308	276	90	275		0	0	Y		0	31	Y			92	Y		
Donnelly	DO	1246	1246	100	1138	108		0	N			125	Y			374	Y		
Frankland Hills	FH1	2474	2171	88	1893			279	N*		279	247	Y			742	Y		
Frankland Hills	FH2	4347	2996	69	2536			460	N*		460	435	Y			1304	Y		
Frankland Hills	FH3	1736	1531	88	1504			28	N			174	Y			521	Y		
Frankland Hills	FH4	253	116	46	80			35	Y		35	25	Y			76	Y		
Frankland Hills	FH5	3224	2201	68	977			1224	N*		1224	322	Y			967	Y		
Gardner	Gg	89	84	95	84			0	Y		0	9	Y			27	Y		
Granite Valleys	S1	20793	18900	91	11241	6590		1069	N			2079	Y			6238	Y		

Vegetation Complex	Veg Class	Original		Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation									
		Pre-European	Total (ha)	Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA	Essential	Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target			
				Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	(ha)	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration		
Granite Valleys	S2	3958	3911	99	2478	1401			32	N		396	Y			1187	Y				
Granite Valleys	V1	2123	1985	94	232	1625			127	Y		212	Y			637	N	127			277
Granite Valleys	V4	3681	3579	97	3377	97			105	N		368	Y			1104	Y				
Granite Valleys	Va2	353	353	100	351	2				N		35	Y			106	Y				
Granite Valleys	Va3	194	194	100	194					N		19	Y			58	Y				
Granite Valleys	Vh2	7181	6426	89	2775	2807		15	829	N		718	Y			2154	Y				
Granite Valleys	Vh3	9781	9305	95	7392	1277		78	558	N		978	Y			2934	Y				
Hawk	HK	3394	3087	91	2663	131		0	293	N		339	Y			1018	Y				
Hazelvale	HA	2695	1382	51	400	230			752	Y		269	Y			808	N	409			
Jasper	JA	694	653	94	518	26		9	100	Y		69	Y			208	Y				
Kapalarup	KP	1046	530	51	83	239			209	Y		105	N		22	314	N	209			22
Keystone	KB	16992	15805	93	13467	985		75	1278	Y		1699	Y			5098	Y				
Keystone	Kg	676	649	96	649			0	0	Y		68	Y			203	Y				
Keystone	Ks	483	481	100	442				40	Y		48	Y			145	Y				
Keystone	Ky	7413	7291	98	7025	228		1	37	N		741	Y			2224	Y				
Kingia	KI	1	1	100	1					N		0	Y			0	Y	0			
Kordabup	KO	1199	923	77	261	60		4	598	Y		120	Y			360	N	99			
Lakes & Open Water	L	11285	805	7	631				174	Y		1129	N		174	324	3386	N	174		2581
Leroy	LF	12774	10469	82	2629	5336		763	1742	N		1277	Y			3832	N	1203			
Lindesay	Lg	54	54	100	54					Y		5	Y			16	Y				
Lindesay	Lp	2709	2709	100	2704	5				N		271	Y			813	Y				
Mattaband	MTb	9995	9810	98	7686	2072		4	49	N		1000	Y			2999	Y				
Mattaband 1	MT1	1011	866	86		733			134	Y		101	N		101		303	N	134		170
Mattaband 1	MTy1	13550	13173	97	11120	1935			118	N		1355	Y			4065	Y				

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation										
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			Essential	10% target				30% Target		Suggested Actions for 10% Target		Suggested Actions for 30% Target	
			Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)				(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	
Mattaband 2	MT2	2685	2655	99	510	2086		59	Y	59	268	Y	805	N	59	237					
Meerup	Mc	6421	6256	97	5670			586	N		642	Y	1926	Y							
Meerup	Mf	6871	6838	100	6590			248	N		687	Y	2061	Y							
Meerup	Mp	16445	16158	98	15557			601	N		1645	Y	4934	Y							
Meerup	Mr	272	255	94	163			93	Y	93	27	Y	82	Y							
Meerup	Ms	7078	6951	98	6303			648	N		708	Y	2124	Y							
Meerup	Mu	11264	6630	59	6591			39	N		1126	Y	3379	Y							
Meerup	My	222	220	99	220				Y		22	Y	67	Y							
Owingup	OW	610	555	91	520		0	35	N		61	Y	183	Y							
Pemberton	PM1	23796	15058	63	2236	10330	150	2342	Y	2342	2380	N	7139	N	2342	2560					
Pemberton	PM2	3733	1993	53		1476	46	471	Y	471	373	N	1120	N	471	649					
Pingerup	Pi	12390	12340	100	11579	589		171	N		1239	Y	3717	Y							
Quaering	Q	12576	12197	97	10389	1197	12	600	N		1258	Y	3773	Y							
Quartzite Hills	QT	317	292	92		286		7	Y	7	32	N	95	N	7	88					
Quindabellup	QN	1324	1324	100	1153	171		0	N		132	Y	397	Y							
Quininup	QP	647	612	95		600	1	11	Y	11	65	N	194	N	11	183					
Scott	Sd	1224	1216	99	1212			4	N		122	Y	367	Y							
Scott	Sd2	29	29	100	28			0	Y	0	3	Y	9	Y							
Scott	Swd	50	50	100	50				N		5	Y	15	Y							
Shallow Valleys	S3	5269	4860	92	3314	1175		371	N		527	Y	1581	Y							
Sidcup	SC	72	72	100	2	71			Y		7	N	22	N	0	20					
Stratton	ST	2325	1845	79	170	1408	2	265	Y	265	233	N	698	N	265	263					
Toponup	TP	990	950	96		931		19	Y	19	99	N	297	N	19	278					
Trent	TR1	170	170	100	170				N		17	Y	51	Y							

Vegetation Complex	Veg Class	Original		Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation							
		Pre-European	Total (ha)	Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA	Essential	Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target	
				Total (ha)	%							Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Unicup	UC1	3373	2428	72	1002				1426	Y		337	Y			1012	N	10	
Unicup	UC2	2068	1713	83	1396				317	N		207	Y			620	Y		
Unicup	UC3	1580	422	27	235				187	Y		158	Y			474	N	187	51
Unicup	UC4	1957	1862	95	1411				451	N		196	Y			587	Y		
Valley Terrace	T	171	171	100	169		2			Y		17	Y			51	Y		
Walpole	Wp	449	338	75	204			12	122	Y		45	Y			135	Y		
Warren	WA	6118	5521	90	2538		1997	209	777	N		612	Y			1835	Y		
Wheatley	WH1	13357	10230	77	2047		6501	135	1547	N*		1336	Y			4007	N	1547	413
Wheatley	WH2	6444	3886	60			2831	51	1004	Y		644	N	644		1933	N	1004	929
Wheatley	WH3	161	63	39			46		17	Y		16	N	16		48	N	17	31
Wilgarup	WL	5906	3691	62	655		2151	22	863	Y		591	Y			1772	N	863	254
Wishart	WS2	368	368	100	358		10			Y		37	Y			110	Y		
Yanmah	YN1	11749	8478	72	3030		4333	24	1091	N		1175	Y			3525	N	495	
Yanmah	YN2	3982	2887	73	12		2503	41	332	Y		398	N	332	54	1195	N	332	851
Yerraminup	YE	4949	2326	47	663		1099		564	N		495	Y			1485	N	564	258
Yerraminup	YEf	167	32	19	0				32	Y		17	N	17		50	N	32	18
Yornup	YR	9034	5843	65	645		4350	5	843	N*		903	N	258		2710	N	843	1222
Total Area		700803	592967	85	350645		189494	3051	49777			70080		2234	554	210241		18121	17679

Shire of Murray

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation						
		Pre-European	Remaining Extent	Protection (DEC CONS)	DEC SF	DEC OTHER	LNA	Essential	Essential	10% target		30% Target		Suggested Actions for 10% target		Suggested Actions for 30% Target	
		Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Bassendean-Central & South		13703	2804	20	44		14	2747	N*	2747	1370	N	4111	N	2747	1320	
Cannington		10497	1713	16	890			823	Y	823	1050	N	3149	N	823	1436	
Cooke	CE	1713.7	1674	98		1674		0	N*	0	171	N	514	N	0	514	
Cottesloe-Central & South		1809.1	768	42	82			686	N*	686	181	N	543	N	461		
Darling Scarp	DS2	5521.3	2484	45	13	268		2204	Y	2204	552	N	1656	N	1643		
Darling Scarp		1129	445	39	49			396	Y	396	113	N	339	N	290		
Dwellingup 1	D1	44419	40769	92	904	39213	4	648	Y	648	4442	N	13326	N	648	11773	
Dwellingup 2	D2	235.7	236	100		236		0	N*	0	24	N	71	N	0	71	
Forrestfield		5086.8	607	12	11			596	Y	596	509	N	1526	N	596	919	
Guildford		28555	1568	5	6		1	1561	Y	1561	2855	N	8566	N	1561	6999	
Helena 1	He1	2399.3	2124	89	554	815		755	N*	755	240	Y	720	N	166		
Herdsmen		1550.1	608	39	258			350	Y	350	155	Y	465	N	207		
Murray 1	My1	9264.9	6986	75	879	5311	96	700	N*	700	926	N	2779	N	700	1200	
Pindalup	Ph	89.273	89	100		89		0	N*	0	9	N	27	N	27	27	
Serpentine River		493.08	42	9				42	Y	42	49	N	148	N	42	106	
Southern River		6556.4	1506	23	159			1346	Y	1346	656	N	1967	N	1346	461	
Swamp	S	1252.5	1226	98		1226		0	N*	0	125	N	376	N	0	376	
Swan		4082.1	587	14				587	Y	587	408	N	1225	N	587	638	
Vasse		5128.9	1916	37	840			1076	N*	1076	513	Y	1539	N	1076		
Yarragil 1	Yg1	15080	13774	91	201	12784	0	788	N*	788	1508	N	4524	N	788	3534	
Yarragil 2	Yg2	11271	10963	97		10963		0	N*	0	1127	N	3381	N	0	3381	
Yongarillup		273.33	134	49				134	N*	134	27	N	82	N	134		
Total Area		170111	93023	55	4891	72578	114	15440		15440	17011		51033		13841	32755	

Shire of Nannup

Vegetation Complex	Veg Class	Original	Remaining							Complexes that meet Regional Representation & Rarity and Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation							
		Pre-European	Remaining Extent	Protection (DEC CONS)	DEC SF	DEC OTHER	LNA	Essential	Essential	10% target	Suggested Actions for 10% target		30% Target	Suggested Actions for 30% target					
		Total (ha)	Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration		
Angove	A	151	149	98	32	109	0	7	N			15	Y			45	N	7	6
Balingup	BL	2310	757	33	1	302	109	345	Y	345		231	N	230		693	N	345	347
Balingup	BLf	48	7	15	0	0	0	7	Y	7		5	N	5		14	N	7	7
Barlee	Ba	1468	1026	70	196	696	0	135	Y	135		147	Y			440	N	135	110
Bentley	BN	1680	1269	76	21	1108	0	140	Y	140		168	N	140	7	504	N	140	343
Bevan 1	BE1	28889	26288	91	995	23846	146	1302	N*	1302		2889	N	1302	592	8667	N	1302	6370
Bidella	BD	27027	25765	95	11933	13563	0	268	N			2703	Y			8108	Y		
Blackwood	BK	9363	8694	93	3229	4916	9	540	N			936	Y			2809	Y		
Bridgetown	BT	6560	1490	23	0	97	370	1022	Y	1022		656	N	656		1968	N	1022	946
Bridgetown	BTf	489	81	17	0	0	9	72	Y	72		49	N	49		147	N	72	75
Catterick	CC1	212	158	75	38	90	0	30	N*	30		21	Y		63	N	25		
Cleave	CV	833	675	81	517	26	0	132	Y	132		83	Y		250	Y			
Coate	CE	13185	13121	100	6000	6970	0	152	N			1319	Y		3956	Y			
Collis 1	CO1	220	216	98	0	214	0	2	Y	2		22	N	2	20	66	N	2	64
Corbalup	CL1	1241	1238	100	0	1232	0	6	Y	6		124	N	6	118	372	N	6	366
Cornint	CT	160	160	100	2	158	0	0	Y	0		16	N	0	14	48	N	0	46
Crowea	CRb	2940	2648	90	337	2305	0	7	N			294	Y			882	N	7	539
Crowea	CRd	160	158	99	0	158	0	0	Y	0		16	N	0	16	48	N	0	48
Crowea	CRy	262	251	96	38	209	0	4	N			26	Y			79	N	4	37
Darling Scarp	DS1	2144	765	36	429	134	5	198	Y	198		214	Y			643	N	198	17
Darradup	DP	3232	2081	64	720	625	19	717	N			323	Y			970	N	250	
D'Entrecasteaux	D	154	22	14	0	0	0	22	Y	22		15	N	15		46	N	22	24
D'Entrecasteaux	D5	1545	1420	92	272	0	0	1147	Y	1147		154	Y			463	N	191	

Vegetation Complex	Veg Class	Original	Remaining							Complexes that meet Regional Representation and Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation								
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA	Essential			Essential	10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target	
			Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)				(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
D'Entrecasteaux	Dd	4866	4488	92	2771	0	0	1717	N			487	Y			1460	Y			
D'Entrecasteaux	Dd5	4518	4386	97	2245	0	3	2139	N			452	Y			1355	Y			
D'Entrecasteaux	DE5	5215	4399	84	746	0	0	3654	N			522	Y			1565	N	819		
Donnelly	DO	1041	1011	97	880	76	0	54	N			104	Y			312	Y			
Gale	GA	1122	852	76	90	639	0	123	Y	123		112	N	22		337	N	123	124	
Grimwade	GR	2089	942	45	0	544	35	363	Y	363		209	N	209		627	N	363	264	
Hester	HR	770	354	46	0	180	0	173	N			77	N	0	77	231	N	173	58	
Jalbaragup	JL	5340	5140	96	821	4096	20	203	N*	203		534	Y			1602	N	203	578	
Jangardup	JN	4692	3743	80	1585	1516	2	640	N			469	Y			1408	Y			
Jasper	JA	834	819	98	703	72	0	43	Y	43		83	Y			250	Y			
Kingia	KI	53772	52697	98	19492	32320	3	883	N			5377	Y			16132	Y			
Lakes & Open Water	L	479	12	2	12	0	0	0	Y	0		48	N	0	36	144	N	0	132	
Layman	LY	1234	1035	84	68	840	0	127	Y	127		123	N	55		370	N	127	175	
Leroy	LF	7352	6181	84	964	4961	2	253	N			735	Y			2205	N	253	988	
Mattaband 1	MT1	859	857	100	0	844	2	12	Y	12		86	N	12	74	258	N	12	246	
Miliyeaup	Mp	3966	3901	98	1005	2782	0	115	Y	115		397	Y			1190	N	115	70	
Nillup	N	10356	9852	95	2202	7249	0	401	N			1036	Y			3107	N	401	504	
Nillup	Nd	1211	1157	96	38	971	0	149	Y	149		121	N	83		363	N	149	176	
Nillup	Nw	4965	4476	90	781	3472	0	223	N			496	Y			1489	N	223	485	
Pemberton	PM1	2006	1883	94	0	1873	0	10	Y	10		201	N	10	191	602	N	10	592	
Quagering	Q	673	655	97	238	406	0	11	N			67	Y			202	Y			
Scott	Sd	29276	14083	48	5812	1854	976	5441	N			2928	Y			8783	N	2970		
Scott	Sd2	72	60	83	53	0	0	7	Y	7		7	Y			22	Y			
Scott	Swd	8769	6475	74	4587	556	182	1150	N			877	Y			2631	Y			

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation and Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation							
			Remaining Extent		Protection (DEC CONS)	DEC SF	DEC OTHER	LNA			10% target		Suggested Actions for 10% Target		30% Target		Suggested Actions for 30% Target	
			Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)			Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Scott Scarp	SS	894	881	99	481	124	0	277	Y	277	89	Y			268	Y		
Sidcup	SC	48	48	100	36	9	0	3	Y	3	5	Y			14	Y		
Southampton	SP	392	193	49	0	0	8	185	Y	185	39	N	39		118	N	118	
Telerah	TL	10385	9797	94	5594	4160	3	40	N		1039	Y			3116	Y		
Warren	WA	2503	2282	91	865	1356	0	62	N		250	Y			751	Y		
Wheatley	WH1	4896	4352	89	71	3971	100	210	N*	210	490	N	210	209	1469	N	210	1188
Wheatley	WH2	1543	1500	97	1	1315	60	124	Y	124	154	N	124	30	463	N	124	339
Wishart	WS2	2085	1854	89	310	1356	27	161	Y	161	208	Y			625	N	161	154
Wishart	WSv	118	15	12	0	4	0	11	Y	11	12	N	11	1	35	N	11	24
Yannah	YN1	6915	6487	94	149	6068	0	270	N		692	N	0	543	2075	N	270	1656
Yannah	YN2	3754	3586	96	61	3437	0	89	Y	89	375	N	89	226	1126	N	89	976
Total Area		293281	248893	85	77420	143808	2088	25577		6771	29328		3269	2154	87984		10657	18075

Shire of Waroona

Vegetation Complex	Veg Class	Original	Remaining						Complexes that meet Regional Representation & Rarity Local Significance Criteria	LNA targets to meet Regional Representation & Rarity Local Significance Criteria	Local Representation													
		Pre-European	Remaining Extent	Protection (DEC CONS)	DEC SF	DEC OTHER	LNA	Essential	Essential	10% target		Suggested Actions for 10% target		30% Target		Suggested Actions for 30% target								
										Total (ha)	%	Assumed (ha)	(ha)	(ha)	Remaining (ha)	(ha)	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration	Area Required (ha)	Achieved	LNA Protection (ha)	Restoration
Bassendean-Central & South		3452	758	22		219	539	N*		539	345	N		345		1036	N		539		497			
Cannington		4076	248	6			248	Y		248	408	N		248	160	1223	N		248		975			
Cooke	CE	920	804	87	25	778	0	N			92	N		0	67	276	N		0		251			
Cottesloe-Central & South		2714	1915	71	911	522	482	N			271	Y				814	Y							
Dardanup		2311	52	2			52	Y		52	231	N		52	179	693	N		52		641			
Darling Scarp	DS2	1682	920	55	90	2	829	Y		829	168	N		79		505	N		415					
Darling Scarp		119	28	23			28	Y		28	12	N		12		36	N		28		8			
Dwellingup	D1	18313	16375	89	1865	10994	1212	Y		1212	1831	Y				5494	N		1212		2416			
Forrestfield		1697	214	13		4	210	Y		210	170	N		170		509	N		210		299			
Guildford		6216	302	5			302	Y		302	622	N		302	320	1865	N		302		1563			
Helena 1	He1	4257	2732	64	676	549	1392	N			426	Y				1277	N		601					
Karrakatta-Central & South		1870	637	34		357	279	N			187	N		187		561	N		279		281			
Murray 1	My1	9826	9194	94	1394	2307	704	N			983	Y				2948	N		704		850			
Not Mapped		1815	227	13	172		50				182	N		9		545	N		50		323			
Quindalup		1784	1377	77	729		648	N			178	Y				535	Y							
Serpentine River		7928	516	7		14	502	Y		502	793	N		502	291	2378	N		502		1876			
Southern River		3494	1042	30	262		779	Y		779	349	N		87		1048	N		779		7			
Swamp	S	122	119	97	59	60		N			12	Y				37	Y							
Vasse		1068	666	62	344		322	N*		322	107	Y				320	Y							
Yarragill 1	Yg1	4808	4472	93	720	3087	201	N*		201	481	Y				1442	N		201		521			
Yarragill 2	Yg2	831	783	94	176	607		N*			83	Y				249	N		0		73			
Yongarillup		3885	2472	64	1345	102	1024	N			389	Y				1166	Y							
Total Area		83188	45851	55	8767	19602	9804			5224	8319			1993	1017	24956			6122		10581			

16.2 Threatened Ecological Communities

Table 25. List of Threatened Ecological Communities found within, or in close proximity to, the South West Biodiversity Project Area (Department of Conservation and Land Management 2004b; 2006)

Community identifier	Community name	General Location (IBRA Regions)	Category of Threat and criteria met under WA criteria *	Category under C'th EPBC Act 1999	Recorded Locations within the LGAs in the SWBPA (DEC October 2006)
1. SCP20a	Banksia attenuata woodland over species rich dense shrublands	Swan Coastal Plain	EN B) ii)		
3. SCP10b	Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)	Swan Coastal Plain	CR B) ii)	EN	Busselton
4. SCP19	Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Swan Coastal Plain	CR B) ii)	EN	
5. Clifton-microbialite	Stromatolite like freshwater microbialite community of coastal brackish lakes	Swan Coastal Plain	CR B) i), CR B) ii)		Mandurah
6. Richmond-microbial	Stromatolite-like microbialite community of coastal freshwater lakes	Swan Coastal Plain	CR B) i), CR B) ii)	EN	
7. Mound Springs SCP	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	Swan Coastal Plain	CR A) i), CR A) ii), CR B) i), CR B) ii)	EN	
8. SCP20c	Shrublands and woodlands of the eastern side of the Swan Coastal Plain	Swan Coastal Plain	CR B) ii)	EN	
10. NTHIRON	Perth to Gingin Ironstone Association	Swan Coastal Plain	CR A) ii), CR B) ii), CR C)	EN	
11. MUCHEA LIMESTONE	Shrublands and woodlands on Muchea Limestone	Swan Coastal Plain	EN B) ii)	EN	Harvey
12. Augusta-microbial	Rimstone Pools and Cave Structures Formed by Microbial Activity on Marine Shorelines	Warren	EN B) ii)		Augusta-Margaret River
13. SCP30a	Callitris preissii (or Melaleuca lanceolata) forests and woodlands, Swan Coastal Plain	Swan Coastal Plain	VN B)		
14. SCP18	Shrublands on calcareous silts of the Swan Coastal Plain	Swan Coastal Plain	VN B)		Bunbury, Harvey
15. SCP02	Southern wet shrublands, Swan Coastal Plain	Swan Coastal Plain	EN B) ii)		Busselton, Capel

Community identifier	Community name	General Location (IBRA Regions)	Category of Threat and criteria met under WA criteria *	Category under C'th EPBC Act 1999	Recorded Locations within the LGAs in the SWBPA (DEC October 2006)
16. SCP3a	Corymbia calophylla - Kingia australis woodlands on heavy soils, Swan Coastal Plain	Swan Coastal Plain	CR B) ii)	EN	Capel, Murray, Waroona
17. SCP3c	Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands, Swan Coastal Plain	Swan Coastal Plain	CR B) ii)	EN	Busselton, Dardanup, Waroona
19. SCOTT IRONSTONE	Scott River Ironstone Association	Warren	EN B) i), EN B) ii)		Augusta-Margaret River, Nannup
20. SCP20b	Banksia attenuata and/or Eucalyptus marginata woodlands of the eastern side of the Swan Coastal Plain	Swan Coastal Plain	EN B) i), EN B) ii)		Harvey, Murray, Waroona
21. SCP15	Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain	Swan Coastal Plain	VN C)		Murray
22. SCP1b	Corymbia calophylla woodlands on heavy soils of the southern Swan Coastal Plain	Swan Coastal Plain	VN B)		Busselton, Capel,
23. SCP3b	Corymbia calophylla - Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain	Swan Coastal Plain	VN B)		Busselton, Harvey, Murray
24. CAVES SCP01	Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain	Swan Coastal Plain	CR B) i), CR B) ii)	EN	
25. CAVES LEEUWIN01	Aquatic Root Mat Community Number 1 of Caves of the Leeuwin Naturaliste Ridge	Warren	CR B) i), CR B) ii)	EN	Augusta-Margaret River
26. CAVES LEEUWIN02	Aquatic Root Mat Community Number 2 of Caves of the Leeuwin Naturaliste Ridge	Warren	CR B) i), CR B) ii)	EN	Augusta-Margaret River
27. CAVES LEEUWIN03	Aquatic Root Mat Community Number 3 of Caves of the Leeuwin Naturaliste Ridge	Warren	CR B) i), CR B) ii)	EN	Augusta-Margaret River
28. CAVES LEEUWIN04	Aquatic Root Mat Community Number 4 of Caves of the Leeuwin Naturaliste Ridge	Warren	CR B) i), CR B) ii)	EN	Augusta-Margaret River
30. MEELUP GRANITES	Calothamnus graniticus heaths on south west coastal granites	Warren/Jarrah Forest	VN B)		Busselton,
32. SCP07	Herb rich saline shrublands in clay pans	Swan Coastal Plain	VN B)		Bunbury, Busselton, Capel, Murray,

Community identifier	Community name	General Location (IBRA Regions)	Category of Threat and criteria met under WA criteria *	Category under C'th EPBC Act 1999	Recorded Locations within the LGAs in the SWBPA (DEC October 2006)
33. SCP08	Herb rich shrublands in clay pans	Swan Coastal Plain	VN B)		Bunbury, Dardanup, Murray, Waroona
34. SCP09	Dense shrublands on clay flats	Swan Coastal Plain	VN B)		Bunbury, Harvey, Murray, Waroona
35. SCP10a	Shrublands on dry clay flats	Swan Coastal Plain	EN B) ii)		Busselton, Capel, Murray, Waroona
62. Limestone Ridges (SCP 26a)	Melaleuca huegellii – Melaleuca acerosa (syn. M. systena) shrublands on limestone ridges (Gibson et al. 1994 type 26a)	Swan Coastal Plain	EN B) iii)		Waroona

16.3 Useful GIS datasets

The following datasets may be useful during the preparation of a Local Biodiversity Strategy. It is suggested that the relevant Agency is contacted to determine availability and usefulness of data.

Theme	Name	Agency	Contact Details
Planning	Peel Region Scheme (PRS)	Department for Planning and Infrastructure	Geographical Information Officer 9264 7827
	Greater Bunbury Region Scheme (GBRS)	Department for Planning and Infrastructure	Geographical Information Officer 9264 7827
	Town Planning Schemes (TPS)	Department for Planning and Infrastructure	Geographical Information Officer 9264 7827
Native Vegetation Administrative Boundaries	Interim Biogeographical Regions (IBRA)	Department of Environment and Conservation	Spatial Database Administrator (GIS) 9334 0350
	DEC Managed Regional Parks	Department of Environment and Conservation	Spatial Database Administrator (GIS) 9334 0350
	DEC Estate (DEC managed and owned lands)	Department of Environment and Conservation	Spatial Database Administrator (GIS) 9334 0350
Native Vegetation Extent	Native Vegetation Extent by Administrative Planning Categories	Western Australian Local Government Association	SWBP Information Coordinator 9792 7083
	Native Vegetation Extent by Peel Region Scheme Zoning	Western Australian Local Government Association	SWBP Information Coordinator 9792 7083
	Native Vegetation Extent by Greater Bunbury Region Scheme Zoning	Western Australian Local Government Association	SWBP Information Coordinator 9792 7083
	Native Vegetation Extent by Local Planning Scheme Zoning	Western Australian Local Government Association	SWBP Information Coordinator 9792 7083
	Native Vegetation Extent by Vegetation Complex	Western Australian Local Government Association	SWBP Information Coordinator 9792 7083
	Native Vegetation Extent by Ownership Category	Western Australian Local Government Association	SWBP Information Coordinator 9792 7083

Native Vegetation Rarity	Declared Rare Flora (DRF) and Priority Flora	Department of Environment and Conservation	Spatial Database Administrator (GIS) / Technical Officer, Rare Flora Database 9334 0350
	Threatened Ecological Community (TEC)	Department of Environment and Conservation	Spatial Database Administrator (GIS) / Ecologist, WA Threatened Species and Communities Unit 9334 0350
	Threatened or Poorly Reserved Plant Communities	Department of Environment and Conservation	GIS Support Analyst 6364 6500
Native Vegetation Complexes	Heddl Vegetation Complexes	Department of Environment and Conservation	GIS Support Analyst 6364 6500
	Mattiske and Havel Regional Forest Agreement (RFA) Vegetation Complexes	Department of Environment and Conservation	Spatial Database Administrator (GIS) 9334 0350
Ecological Linkages	Greater Bunbury Region Draft Regionally Significant Ecological Linkages	Department of Environment and Conservation	GIS Support Analyst 6364 6500
Local Significance	Potentially Locally Significant Natural Areas	Western Australian Local Government Association	SWBP Information Coordinator 9792 7083
	Potentially Significant Local Government Natural Areas	Western Australian Local Government Association	SWBP Information Coordinator 9792 7083
Floristic Survey Plots	DEC Flora Survey 1991-93 (Gibson <i>et al.</i> , 1994)	Department of Environment and Conservation	Spatial Database Administrator (GIS) 9334 0350
Significant Fauna	DEC Threatened Fauna and Priority Fauna	Department of Environment and Conservation	Spatial Database Administrator (GIS) / Senior Zoologist, Wildlife Branch 9334 0350
Wetlands and Streams	Geomorphic Wetland Mapping	Department of Environment and Conservation	GIS Support Analyst 6364 6500
	Hydrography	Department of Environment and Conservation	GIS Support Analyst 6364 6500
	Environmental Protection Policy Lakes 1992	Department of Environment and Conservation	GIS Support Analyst 6364 6500
Other	Environmentally Sensitive Areas (ESA's) under the Environmental Protection Act 1984	Department of Environment and Conservation	GIS Support Analyst 6364 6500
	Acid Sulfate Soil Risk Mapping for the Swan Coastal Plain	Department of Environment and Conservation	GIS Support Analyst 6364 6500

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