Perth and Peel Green Growth Plan for 3.5 million

Strategic Assessment of the Perth and Peel Regions

Draft EPBC Act Strategic Impact Assessment Report

Executive Summary

December 2015
Acknowledgements
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Executive Summary

INTRODUCTION

The Western Australian Government is planning for the future development of the Perth and Peel regions to accommodate a population of 3.5 million. The area supports significant environmental values and is part of an internationally recognised biodiversity hotspot. It contains 91 key matters of national environmental significance (MNES) listed under the Commonwealth's Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). These include threatened plants and animals, threatened ecological communities, wetlands, migratory shorebirds, and heritage sites.

The Western Australian Government is conducting a Strategic Assessment of the Perth and Peel Regions (the strategic assessment) that examines the planned development across the area shown in Figure 1. It is comprised of the following elements:

1. Development of a Strategic Conservation Plan for the Perth and Peel regions that establishes the long-term conservation and development outcomes for the area.

The purpose of the EPBC Act strategic assessment is to:

- Significantly reduce the need for project by project assessment under the EPBC Act in the Perth and Peel regions.
- Deliver an effective long term and strategic response to key environmental issues in the Perth and Peel regions, for example, Carnaby’s cockatoo and water quality in the Peel Harvey estuary.
- Provide greater certainty to industry as to which areas can be developed and what the obligations will be in terms of mitigation, including environmental offsets.
- Provide greater certainty in terms of long term land supply to meet the needs of a city of 3.5 million.

This document is the Impact Assessment Report of the Strategic Conservation Plan under Part 10 of the EPBC Act. It has been prepared to inform the Commonwealth Minister for the Environment on the likely extent and significance of impacts to MNES from planned development so that a decision can be made whether to endorse the Strategic Conservation Plan and provide subsequent approval of the planned development.
Figure 1: Strategic Assessment Area
The Strategic Conservation Plan

The Strategic Conservation Plan sets out a framework of conservation outcomes, objectives and commitments to protect MNES, and defines development activities and a Conservation Program that fit within this framework to deliver the goals of the strategic assessment. It also establishes the formal plan for endorsement by the Commonwealth Minister for the Environment under Section 10 of the EPBC Act.

The Strategic Conservation Plan provides for the following development activities (known as classes of action):

- urban and industrial development;
- rural residential development;
- infrastructure development;
- extraction of basic raw materials (BRM); and
- harvesting of pines.

Each development activity is described in an action plan (Action Plans A to E respectively) and set out for Commonwealth approval.

In addition, the Strategic Conservation Plan establishes a set of value-specific and over-arching conservation commitments for MNES (Action Plan F), a set of commitments for State environmental factors (Action Plan G), a Conservation Program that seeks to set aside, protect and manage appropriate land for conservation (Action Plan H), and an Assurance Program that sets out how implementation will be monitored (Action Plan I).

METHODOLOGY

The methodology for the impact assessment was designed to specifically address the requirements of the EPBC Act and the Terms of Reference for the strategic assessment. To do this it aimed to provide:

- an understanding of the values of the Perth and Peel region for MNES;
- an understanding of the likely impacts to these values from each of the classes of action (as well as within a cumulative context);
- guidance about the appropriate avoidance, mitigation and offset measures; and
- clarity about the long term outcomes of the Strategic Conservation Plan.

The four key elements to the methodology are summarised below.

Identification and categorisation of MNES

The first step in the process involved identifying all potential MNES and categorising them according to their level of reliance on habitat within the Strategic Assessment Area (see Table 1). This initial filter ensured that an appropriate level of analysis was applied to each MNES. World/National Heritage Places and Ramsar sites occurring within the Strategic Assessment Area were automatically considered as having a high reliance.

Detailed impact assessment was carried out for the 91 MNES identified as having a high or moderate reliance (Categories 1 and 2) on the Strategic Assessment Area.
Table 1: MNES assessment categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>MNES within this category meet a set of criteria which indicates a <strong>high reliance</strong> on habitat within the strategic assessment area.</td>
</tr>
<tr>
<td>Category 2</td>
<td>MNES within this category meet a set of criteria which indicates a <strong>moderate reliance</strong> on habitat within the strategic assessment area.</td>
</tr>
<tr>
<td>Category 3</td>
<td>MNES within this category meet a set of criteria which indicates a <strong>low reliance</strong> on habitat within the strategic assessment area.</td>
</tr>
<tr>
<td>Category 4</td>
<td>MNES within this category are <strong>not considered to rely on habitat</strong> within the strategic assessment area.</td>
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</table>

Use of an adequate information base

The assessment assembled and relied upon a robust set of baseline information to understand the environmental values of the Perth and Peel regions. By comparing this baseline data against a detailed description and spatial understanding of the classes of action, it was possible to identify and assess the nature and extent of potential impacts to these values over the life of the Strategic Conservation Plan.

Several Western Australian Government agencies hold comprehensive datasets of the various relevant values and provided the majority of the environmental data used in this report. In addition, new baseline mapping for numerous MNES was developed to support the impact analysis.

The data is considered to be appropriate for the strategic assessment and provides an adequate basis to understand values and assess impacts. However, there is a level of uncertainty (particularly at fine scales) that needs to be addressed through the implementation processes of the Strategic Conservation Plan.

Use of a conservation outcomes framework

The assessment is framed around conservation outcomes for MNES. This approach provides clarity about what will be delivered through the Strategic Conservation Plan and helps to define appropriate avoidance, mitigation and offset measures as the assessment progresses.

The framework was developed around a three-tiered hierarchy that provides a line of sight from the highest level legislative obligations of the EPBC Act to the more detailed outcomes for specific MNES.

The three levels of the conservation outcomes framework (see Figure 2) are:

1. Conservation outcomes: These statements describe the overall outcomes that need to be achieved in implementing the Strategic Conservation Plan. They provide a broad framework for the assessment and address the key statutory requirements for approval under the EPBC Act.
   
   Outcome statements were developed for:
   
   a. World and National Heritage;
   
   b. wetlands of international importance (Ramsar);
   
   c. listed threatened species and ecological communities; and
   
   d. listed migratory species.
2. **Conservation objectives:** Specific and detailed conservation objectives were developed that deliver on the broader outcome statements on an individual MNES basis. These were developed for all Category 1 and 2 threatened species, ecological communities, migratory shorebirds, Ramsar wetlands and World and National Heritage sites. They reflect the conservation status of each matter and how it is represented at a site-specific and regional level.

3. **Conservation commitments:** A set of conservation commitments was also defined as a product of the impact assessment for all Category 1 and 2 MNES. They comprise the management measures and strategies (e.g. avoidance measures, establishment of reserves, management of reserves, offsets) that will be delivered under the Strategic Conservation Plan.

They are the key actions that will deliver the conservation outcomes and objectives. MNES commitments are detailed in Action Plan F and commitments for State environmental factors are detailed in Action Plan G.
Systematic assessment approach for key MNES

The key MNES (Categories 1 and 2) were subject to a comprehensive impact analysis. This analysis occurred on an individual MNES basis and worked systematically through an assessment of the baseline values, threats, objectives, impacts, avoidance, mitigation, offsets and commitments for each matter.

**Direct impacts**

The greatest focus of the analysis across all MNES was on direct impacts associated with habitat loss. This was considered appropriate given that habitat availability within the Strategic Assessment Area is one of the most important factors for continued use and long-term viability of populations or occurrences within the area.

Direct impacts were assessed based on the intersection of the class of action footprints with the baseline mapping developed for all Category 1 and 2 MNES. The analysis considered the following:

- the extent or scale of loss in terms of hectares, number of occurrences or individuals within a population (as appropriate);
- the distribution of impacts, including whether they were broadly distributed or localised; and
- whether the impacts were discrete or contributed to the loss of other habitat areas through fragmentation or breaks in habitat connectivity (where relevant).

For some MNES, finer scale information was able to be generated as part of the impact assessment. A process was developed for threatened flora, ecological communities and migratory species to analyse values against seven levels of protection (or ongoing risk) providing context to the significance of predicted impacts and assisting in identifying opportunities for improved conservation outcomes. The levels refer to the comparative level of protection or development risk that an area is subject to, based on aspects such as land ownership, purpose, zoning and inclusion in the class of action footprints. The seven levels are:

- **Levels 1-4**: This includes land that is sympathetic to conservation. It broadly includes protected areas (Level 1), Bush Forever sites (Level 2), and areas of regional open space and public open space (Levels 3 & 4). Areas within Level 4 are considered to be at higher risk than Level 1.
- **Level 5**: This includes areas that sit outside land that is sympathetic to conservation (Levels 1-4) and that are unlikely to be developed.
- **Levels 6 & 7**: This includes State owned (Level 6) and privately owned (Level 7) land that occurs within the various classes of action.

**Indirect impacts**

The approach to addressing indirect impacts generally involved the following:

- identification of the indirect impacts relevant to groups of MNES, for instance, groups of listed threatened flora rather than individual flora species or populations;
- using a qualitative, rather than quantitative, approach to understanding indirect impacts; and
- dealing with indirect impacts through ongoing planning, approval and implementation processes and through the management of protected areas.
Relevant indirect impacts have been identified and discussed for individual MNES where they are notable or represent an exception to the impacts identified at the group level. For instance, indirect impacts associated with edge effects (such as weed incursion and disturbance) are relevant to the assessment for all threatened ecological communities, while impacts to groundwater will only be relevant to those communities that are groundwater dependent.

The use of a qualitative approach to describe indirect impacts is considered appropriate at this strategic level. Detailed quantitative methods for understanding indirect impacts are practical and necessary at a site level, for example, modelling noise, air quality or ground water impacts from a proposed mine. This type of information cannot be generated at the geographic and temporal scale of this assessment and current stage of planning.

Instead, the assessment defers to Western Australia’s ongoing planning, approval and implementation processes which apply at the site level to obtain this detailed information and define suitable, best practice measures for managing indirect impacts.

DELIVERY OF CONSERVATION OUTCOMES UNDER THE STRATEGIC CONSERVATION PLAN

The Strategic Conservation Plan aims to protect MNES in three ways: avoidance, mitigation, and through a Conservation Program.

Avoidance

Avoidance of impacts to environmental values has been a key feature of the strategic assessment. There are three major components to this:

- avoidance through the planning phase for the classes of action;
- avoidance through the impact assessment phase; and
- ongoing avoidance over the life of the Strategic Conservation Plan.

The combination of these measures has and will result in substantial avoidance of potential impacts to State and Commonwealth environmental matters. Measures that are particularly significant include:

- reducing the area of proposed urban expansion by more than a half and increasing the proportion of urban infill;
- pursuing potential urban expansion areas that are mostly on cleared land;
- reducing the area of industrial expansion;
- focusing proposed urban and industrial expansion areas that require less fill (i.e. avoiding low lying areas such as East Keralup) and consequently reducing BRM requirements;
- pursuing opportunities for future avoidance through the statutory planning process;
- limiting growth of new rural residential areas and restricting clearing within them;
- strategically locating BRM nodes and undertaking detailed master planning to avoid impacts;
- co-locating infrastructure corridors and establishing future processes for avoidance around infrastructure design; and
- implementing a range of detailed commitments that avoid impacts at a site level.
A summary of the results of the avoidance measures (that can be quantified at this point) are provided in Table 2 in relation to remnant vegetation.

**Table 2: Summary of key avoidance measures (to the nearest 100 ha)**

<table>
<thead>
<tr>
<th>Avoidance measure</th>
<th>Area of remnant vegetation avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td>During planning and assessment</td>
<td></td>
</tr>
<tr>
<td>Refining urban and industrial footprint (EIA 1 to 3)</td>
<td>3,400 ha</td>
</tr>
<tr>
<td>No further rural residential expansion proposed</td>
<td>Unable to assess</td>
</tr>
<tr>
<td>Master planning for BRM</td>
<td>13,000 ha</td>
</tr>
<tr>
<td>Replacement of pines</td>
<td>Nil</td>
</tr>
<tr>
<td>Further avoidance</td>
<td></td>
</tr>
<tr>
<td>Minimum further avoidance within urban, industrial and rural residential classes of action</td>
<td>&gt;3,000 ha</td>
</tr>
<tr>
<td>Further avoidance within the infrastructure class of action through processes described in Action Plan C</td>
<td>To be determined</td>
</tr>
</tbody>
</table>

**Mitigation**

Mitigation of impacts to State and Commonwealth values incorporates:

- application of various management measures to address potential indirect impacts to be applied:
  - in further planning and design of future development;
  - for implementation during development activities; and
  - for ongoing implementation; and
- rehabilitation of land to rectify direct impacts from various classes of action and restore ecological function and values as much as practicable over time.

**Conservation Program**

The Strategic Conservation Plan includes a Conservation Program that will deliver significant improvements to the protection and management of both State biodiversity and environmental values, and MNES. It is described in detail in Action Plan H and incorporates:

- expanding the conservation reserve system;
- implementing on-ground management;
- protecting wetlands and improving water quality; and
- improving knowledge of State and Commonwealth environmental matters.
Expanding the conservation reserve system

One of the key measures arising out of the Strategic Conservation Plan is the commitment for an additional 170,000 hectares of areas that contain significant environmental values to be added to the conservation reserve system (both within and outside the Strategic Assessment Area). This package of sites provides an important contribution to achieving the conservation outcomes and objectives, including by providing environmental offsets for significant residual impacts of the classes of action.

The additional 170,000 hectares of environmentally significant areas will include establishing secure tenure, ownership and management arrangements for Bush Forever sites, establishing the Peel Regional Park (including related land purchase, reservation and management arrangements and a minimum of 116,000 hectares of Carnaby's cockatoo habitat.

The 170,000 hectares will be implemented in two phases:

- Phase 1 – implementation of an initial package following the endorsement of the Strategic Conservation Plan, of approximately 80,000 hectares of new conservation reserves from Crown land and State owned freehold land within and adjacent to the Perth and Peel regions; and
- Phase 2 – creation of a further 18,000 hectares of new conservation reserves and conservation areas in every five year period from the commencement of the Strategic Conservation Plan to a total of 90,000 hectares, including approximately 20,000 hectares of proposed acquisitions.

The initial package of sites consists of the following:

- establishment of Melaleuca Nature Reserve, and new conservation reserves at Ningana Bushland (Bush Forever site 289) and the Wilbinga to Yanchep National Park link (Bush Forever sites 284 and 396);
- establishment of the Seabird Conservation Park;
- establishment of nature reserves in the North East Gingin area, including initial components between Booranarring Nature Reserve north to Moore River; and
- establishment of the initial components of Julimar Conservation Park;
- establishment of new conservation reserves to support Peel Regional Park;
- expansion of Yalgurup National Park, and Nine Mile Lake Nature Reserve;
- expansion of Avon Valley National Park, and Beelu National Park;
- expansion of Forrestdale Lake Nature Reserve;
- expansion of Canning River Regional Park and Jandakot Regional Park;
- expansion of Yanchep National Park, Neerabup National Park, Yeal Nature Reserve, Maralla Nature Reserve, and Wilbinga Conservation Park; and
- improved tenure arrangements for metropolitan regional parks, and improved protection and management of select State owned Bush Forever sites through conversion to conservation reserve.

Implementing on-ground management

On-ground management measures are an important component of the Conservation Program. They are critical for managing key threatening processes, and maintaining or improving the condition of reserves.
Management actions will include activities such as:

- revegetation (re-establishment of native vegetation in degraded areas) and rehabilitation (repair of ecosystem processes) in conservation areas focused on improving habitat quality for multiple species and restoring or improving habitat connectivity and ecological linkages across the landscape;
- replanting projects (e.g. urban forest project) to increase the occurrence of plant species able to be used by Carnaby's cockatoo for feeding and roosting and to increase tree canopy cover across developed areas;
- management to address threats such as weeds, disease, uncontrolled access, fire and/or feral animals for the purpose of improving habitat condition and quality; and
- ongoing management of conservation reserves that have been protected as offsets so that they can contribute to the State’s conservation reserve system and increase their conservation value for MNES and State environmental values.

**Protecting wetlands and improving water quality**

The Strategic Conservation Plan (across both the State and MNES commitments) provides a strong focus on the protection of wetlands. This incorporates the following measures:

- Continued protection of Conservation Category Wetlands. This will include development of a new wetland buffer policy to be implemented through the land use planning process.
- Review of all Resource Enhancement Category Wetlands to determine which can be protected and managed for the purpose of improving their condition and upgrading their status to a Conservation Category wetland.
- A package of measures to improve the health of the Peel Harvey and Swan Canning systems. This will include a focus on reducing nutrient inflows into those systems through:
  - implementing targeted mandatory soil testing for nutrients and fertiliser levels;
  - reporting fertiliser use;
  - facilitating the greater uptake of soil products to reduce nutrient runoff and leaching, and improve water holding capacity on poor soils;
  - improving regulation of agricultural point sources;
  - drainage intervention programs;
  - continuing bagged fertiliser regulation;
  - revegetation of waterways and catchments flowing into the Peel Harvey Estuary; and
  - improving the monitoring and reporting on the health of the system.

**Improving knowledge of State and Commonwealth environmental matters**

The final element of the Conservation Program is a package of research and monitoring programs to improve knowledge of MNES and State environmental values.

There are a number of specific commitments for research and monitoring, as well as a broader monitoring program included in Action Plan I.
Delivering environmental outcomes through the land planning process

In addition to the expansion of the reserve system, other specific commitments with respect to MNES and State environmental values will be met through the land planning process. For further information see Action Plans A and B. Detailed planning and design of urban, industrial and rural residential areas will designate areas supporting important environmental values for retention. For further information regarding the related commitments see Action Plans F and G and part D of this report.

MNES IMPACT ASSESSMENT

The 91 MNES subject to detailed assessment included:

- Fourteen listed fauna species including the iconic Carnaby's cockatoo and Western Ringtail Possum. Three of these species (the Western Swamp Tortoise and two species of native bee) are found only from the Strategic Assessment Area.
- Thirty-five listed flora species (eight of which are found only from the Strategic Assessment Area), including a number of native orchids.
- Ten threatened ecological communities including two thrombolite communities. Four of these ecological communities are found only within the Strategic Assessment Area.
- Three internationally recognised wetlands (under the Ramsar convention) including the ecologically, economically and socially important Peel-Yalgorup system of wetlands.
- Twenty-nine migratory shorebird species (two of which are also listed as critically endangered and included in the fauna species above).
- Two nationally listed heritage sites including the former Fremantle Prison World Heritage Place.

Conservation outcomes

The conservation outcomes that framed the assessment for these MNES are shown in Table 3 below.

The Strategic Conservation Plan aims to deliver these high level outcomes as well as specific conservation objectives for each of the MNES.

Table 3: Conservation outcomes for Category 1 and 2 MNES

<table>
<thead>
<tr>
<th>MNES</th>
<th>Conservation outcome</th>
<th>Number of applicable Category 1 &amp; 2 MNES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed threatened species and ecological communities</td>
<td>The viability and conservation status of listed threatened species and ecological communities in the Perth and Peel regions is maintained, and where possible improved, with measures and actions consistent with any approved Commonwealth recovery plans, threat abatement plans or conservation advice.</td>
<td>- 14 threatened fauna species</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 35 threatened flora species</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 10 threatened ecological communities</td>
</tr>
</tbody>
</table>
### Conservation outcome

<table>
<thead>
<tr>
<th>MNES</th>
<th>Conservation outcome</th>
<th>Number of applicable Category 1 &amp; 2 MNES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed migratory species</td>
<td>The values of the Perth and Peel regions to listed migratory species are maintained, and where possible improved, with measures and actions consistent with Australia’s international obligations.</td>
<td>• 29 migratory shorebirds*</td>
</tr>
<tr>
<td>Wetlands of international importance</td>
<td>The ecological character of wetlands of international importance within the Perth and Peel regions is maintained, with measures and actions consistent with Australia’s international obligations.</td>
<td>• Three Ramsar wetlands</td>
</tr>
<tr>
<td>World and National Heritage</td>
<td>The values of World and National Heritage places within the Perth and Peel regions are maintained, with measures and actions consistent with Australia’s international obligations or relevant National Heritage commitments.</td>
<td>• One site listed as both World and National Heritage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• One National Heritage site</td>
</tr>
</tbody>
</table>

* Two of the migratory shorebirds are also listed threatened species

### Climate change and key threatening processes

The potential implications of climate change and other key threatening processes (e.g. feral predators, dieback caused by *Phytophthora*) are critical to understand given the landscape spatial scale and long time frames of the strategic assessment.

#### Climate change

One of the key threats to biodiversity and ecosystem function in Australia is climate change. It is occurring at a greater rate than previous changes in climate, and the impacts of this are already apparent (Steffen et. al. 2009).

South-west Western Australia has been experiencing a significant decline in rainfall since 1970. Temperatures have also increased, with the average temperature increasing by 1.1°C over the past century (between 1910 and 2013) (CSIRO & BoM 2015). Future predictions suggest that this region will experience further increases in average temperatures and decreases in average annual rainfall (Isaac et. al. 2009).

These predicted changes will put further pressure on biodiversity, particularly MNES such as threatened species and ecological communities which are already under pressure from other natural and human-induced stressors.

A climate change vulnerability assessment was conducted for the 91 key MNES. The assessment indicated that:

- All 10 threatened ecological communities within the Strategic Assessment Area are at high risk to climate change impacts.
• One threatened fauna species (Australian Painted Snipe) was considered to be at low risk to climate change impacts, three were considered to be at moderate risk (Australasian Bittern, Woylie and Chuditch), and ten were considered to be at high risk.

• All 35 threatened flora species are considered to be at high risk to climate change impacts.

• Migratory shorebirds and the three Ramsar sites are vulnerable to the risks of climate change.

These results, which indicate a high level of risk to climate change impacts for threatened species and ecological communities, are not unexpected. The life-history traits that make species and ecological communities susceptible to climate change effects, mirror traits which often contribute to a species or community becoming listed under the EPBC Act.

In addition to a range of Western Australian Government policies and strategies that are relevant to climate change and biodiversity, the Strategic Conservation Plan aims to address the issue through:

• building resilience across ecosystems; and

• ensuring the results of environmental monitoring are used to guide future management decisions. This may include revision of conservation commitments to respond to climate change factors to better achieve the conservation objectives.

**Key threatening processes**

Management of key threatening processes is complex and requires integrated approaches across Government (Commonwealth, State and Local), private landholders, natural resource management organisations, and commercial entities.

Each of the key threatening processes is currently addressed to varying degrees across the Strategic Assessment Area. It will be critical over the life of the Strategic Conservation Plan for management of these processes to continue and to address emerging issues as they arise.

The Strategic Conservation Plan will provide two main outcomes for improving the landscape scale management of key threatening processes (included as a commitment in Action Plan F and a key component of the Conservation Program in Action Plan H). They are:

• Major expansions to the conservation network that will be subject to ongoing management. This includes incorporation of 170,000 ha of sites into the conservation reserve system.

• Funding for management of conservation reserves across the Strategic Assessment Area.

In addition to these landscape scale approaches, it will be important that site-specific controls continue to be applied to projects that may exacerbate a threatening process. For example, controls are needed to minimise the risks of spreading disease such as *Phytophthora* and beak and feather disease. Where relevant, these controls form part of the ongoing planning and approvals process for projects and will continue to be applied over the life of the Strategic Conservation Plan.

**Threatened fauna**

Fourteen threatened fauna species were identified for detailed impact assessment. Two of these are critically endangered migratory shorebirds and were assessed with the other 27 migratory shorebirds in Chapter 20.
The remaining twelve fauna species include three species that are endemic to the Strategic Assessment Area (the Western Swamp Tortoise and two species of native bee), three cockatoo species (including Carnaby’s cockatoo), and the Western Ringtail Possum. Carnaby's cockatoo is discussed in Chapter 15, and impacts to the other 11 species are assessed in Chapter 16.

**Carnaby's cockatoo**

Carnaby's cockatoo is an iconic species that only occurs in the south-west of Western Australia. The species is in decline and is recognised as a critical issue for the strategic assessment.

**Carnaby’s cockatoo within the Strategic Assessment Area**

While representing just 3.7% of the mapped distribution of the species, it is estimated that the Strategic Assessment Area supports around 20% of the total population (estimated to be 8,000 birds in the Perth and Peel regions).

The Strategic Assessment Area is primarily used for feeding and roosting during the non-breeding season, although a relatively small number of confirmed and possible nesting sites have been recorded in the area. Carnaby’s cockatoo forage on a range of feeding resources across the Swan Coastal Plain and Jarrah Forest IBRA regions, which include both native and non-native species.

Carnaby’s cockatoo has undergone a significant historical decline, primarily due to the loss of breeding habitat in the Wheatbelt. The estimated current subpopulation within the Strategic Assessment Area is in decline and, not considering future changes in habitat availability, mitigation and offsets proposed under the Strategic Conservation Plan, this is predicted to continue based on existing subpopulation dynamics (Finn et al 2014; Williams et al. in prep (a)) .

**Conservation objectives**

The conservation objectives for Carnaby's cockatoo are to:

- Maintain habitat for the species to ensure ongoing use of the Strategic Assessment Area including:
  - habitat within the Swan Coastal Plain IBRA region;
  - habitat within the Jarrah Forest IBRA region; and
  - key resources that provide for feeding, breeding and roosting.
- Undertake actions that address the loss of feeding habitat within areas of pine plantations.
- Undertake actions that contribute to the conservation of habitat outside of the Strategic Assessment Area.
- Maintain habitat connectivity to facilitate species movement within and outside the Strategic Assessment Area.
- Undertake research to improve knowledge about the species and inform the conservation effort.

**Key impacts associated with the classes of action**

The existing conservation network and avoidance of impacts through large scale planning have ensured that the classes of action footprints, with the exception of harvesting of pines, do not intersect with large areas of native habitat across the Strategic Assessment Area.
However, the areas that do intersect with feeding, roosting and breeding values remain significant. Key impacts relate to:

- harvesting of 24,348 ha of pine plantations, which are a high value feeding resource within the Strategic Assessment Area;
- the potential loss of up to 12,644 ha of feeding habitat within the Swan Coastal Plain IBRA region, including 9,558 ha of high quality habitat; and
- potential impacts to 52% of known roost sites, including all roosting habitat within the pine plantations.

It is anticipated that the residual loss of feeding and roosting resources as a result of future development will reduce the carrying capacity of the region and lead to a further decline in the subpopulation of Carnaby’s cockatoo within the Strategic Assessment Area. The loss of pines is expected to have the greatest impact on the species relative to all other impacts identified. This reflects both the extent of clearing and the high calorific value of the resource.

The removal of the pine plantations is likely to occur within the next ten years. The majority loss of other feeding habitat types is also expected to occur within a similar timeframe. This means that the carrying capacity or number of Carnaby’s cockatoo that can be supported within the Strategic Assessment Area will begin to stabilise after this time.

Addressing the key impacts

A substantial package of conservation commitments will be implemented which includes measures for further avoidance, mitigation and offsets and has been developed with the intent to:

- address the key impacts identified through the Strategic Assessment;
- deliver on the conservation objectives; and
- mitigate the anticipated rate of decline in the subpopulation, ensuring that the outcomes are not inconsistent with the species Recovery Plan.

The conservation commitments provide for:

- further avoidance of impacts through detailed planning of urban, industrial and rural residential areas;
- replanting 5,000 ha of pines in the Yanchep plantation area;
- revegetation and rehabilitation of land disturbed by basic raw materials extraction and infrastructure development that will not be needed for any other purpose, including replanting 1,371 ha of pines;
- the protection and likely improvement of at least 116,000 ha of Carnaby’s cockatoo feeding habitat through the creation of new reserves within and outside the Strategic Assessment Area;
- the provision of no less than 700 artificial hollows at key breeding sites from Eneabba to Ravensthorpe and rehabilitation and enhancement of known breeding sites in the Wheatbelt; and
- a comprehensive research and monitoring program targeted at improving knowledge about the species, adding value to the conservation actions and informing adaptive management.
Outcome for Carnaby's cockatoo

The precise outcome that will be delivered through the conservation commitments is difficult to measure. The commitments made to further avoid clearing of habitat will reduce the scale of direct impacts. The proposed Conservation Program is then expected to mitigate the anticipated rate of decline from the residual impacts over time. However, there will still be large areas of feeding habitat lost within the Strategic Assessment Area. The main outstanding issues relate to:

- the scale of loss of pines feeding and roosting habitat which will not be replaced; and
- the temporal gap in food availability as measures to improve condition and introduce new feeding resources are realised over time.

Despite these outstanding issues, available information indicates that the outcome for Carnaby's cockatoo is likely to be acceptable against the conservation objectives and any relevant Commonwealth approved plans for the species. However, there are a number of uncertainties that need to be addressed through ongoing monitoring, adaptive management and research to provide confidence that an acceptable outcome will be achieved.

Other fauna

The Strategic Assessment Area also provides habitat for:

- two native bee species;
- the Forest Red-tailed and Baudin's cockatoos;
- the Western Ringtail Possum, Chuditch, Woylie, and Quokka;
- the Western Swamp Tortoise; and
- the Australasian Bittern and Australian Painted Snipe.

In general, the potential for direct impacts to these species is limited. Significant areas of habitat occur within protected areas and no more than 9% of known or potential habitat for any species within the Strategic Assessment Area is at risk of direct impacts by the classes of action. For most of these species, the areas of intersection with the classes of action are much smaller as shown in Figure 3.

The design of the classes of action, implementation of species-specific and over-arching conservation commitments will ensure that:

- conservation objectives for each species will be achieved; and
- outcomes are not inconsistent with any approved Recovery Plans or Threat Abatement Plans.
Figure 3: Habitat status of fauna species (other than Carnaby’s cockatoo) within the Strategic Assessment Area

Threatened flora

Thirty-five threatened flora species in the Strategic Assessment Area were classified as Category 1 or 2 and considered for detailed impact assessment. Of these, 20 are strongly dependent on the Strategic Assessment Area (which contains over half of their known populations) and eight are found only within the Perth and Peel regions.

A total of 256 populations across the 35 species are known to be present within the Strategic Assessment Area (see Table 4).

Table 4: Summary of flora populations within the Strategic Assessment Area

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of populations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entirely or mostly protected and managed within conservation reserves</td>
<td>71</td>
</tr>
<tr>
<td>Intersecting with a class of action:</td>
<td></td>
</tr>
<tr>
<td>• Urban or industrial</td>
<td>57</td>
</tr>
<tr>
<td>• Infrastructure</td>
<td>23</td>
</tr>
<tr>
<td>• BRM</td>
<td>4</td>
</tr>
<tr>
<td>• Rural residential</td>
<td>3</td>
</tr>
</tbody>
</table>

* Some populations intersect with multiple classes of action.
Populations across 19 of the species are at risk of direct impacts including clearing in areas that are intersected by the proposed class of action. However, most of these species have been protected either through avoidance, or with conservation commitments that protect individual populations.

Potential indirect impacts to flora species include fragmentation and edge effects such as weeds, disease and disturbance; changes to surface and ground water hydrology; and altered fire regimes. These will be minimised and avoided through a range of specific and over-arching commitments set out in the Strategic Conservation Plan.

The outcomes for all 35 flora species following application of existing management and new commitments are considered to be acceptable within an EPBC Act context. The design of the classes of action and implementation of conservation commitments will mean that the:

- conservation objectives for each species will be achieved; and
- outcomes are not inconsistent with any approved Recovery Plans or Threat Abatement Plans.

Notable flora species include *Caladenia huegelii* (King Spider Orchid), *Conospermum undulatum* (Wavy-Leaved Smokebush) and *Eucalyptus argutifolia* (Yanchep Mallee).

Additional information on these species follows.
**Caladenia huegelii**

Forty-three of the 50 known populations of the endangered *Caladenia huegelii* are in the Strategic Assessment Area. The conservation objectives for the species are to:

- Maintain the long-term viability of the species within the Strategic Assessment Area.
- Focus conservation efforts on larger populations with greater potential for long-term survival.
- Improve the security of tenure and management of populations within the Strategic Assessment Area.

Figure 4 below shows the outcomes for the species including the size of populations and their relative level of protection. A number of conservation commitments (identified by the coloured populations in Figure 4) are made to deliver the conservation objectives. They include commitments to:

- Protect five of the seven populations that are intersected by the classes of action. The two populations without commitments are small and are likely to no longer be present or viable.
- Protect and manage the two largest populations of the species (6 and 42).

![Figure 4: Caladenia huegelii population sizes, levels of protection, and conservation commitments](image-url)
Conospermum undulatum

All 29 known populations of the vulnerable Conospermum undulatum occur within the Strategic Assessment Area. The conservation objectives for the species are the same as for Caladenia huegelii:

- Maintain the long-term viability of the species within the Strategic Assessment Area.
- Focus conservation efforts on larger populations with greater potential for long-term survival.
- Improve the security of tenure and management of populations within the Strategic Assessment Area.

Figure 5 below shows the outcome for the species which is complex due to the number of populations and the fact that several populations occur across multiple levels of protection. Conservation commitments are made to protect all important populations of the species and to deliver the conservation objectives.

**Figure 5: Conospermum undulatum population sizes, levels of protection, and conservation commitments**
**Eucalyptus argutifolia**

Eighteen of the twenty known populations of the vulnerable *Eucalyptus argutifolia* are within the Strategic Assessment Area. The conservation objectives for the species are:

- Maintain the long-term viability of the species within the Strategic Assessment Area.
- Improve the security of tenure and management of important populations within the Strategic Assessment Area.

Figure 6 below shows the outcome for the species. Three of the four populations that are intersected by the classes of action will be impacted by BRM. These direct impacts are anticipated to result in the loss of 34 individuals of the species, and will be offset by the protection of five populations containing over 200 individuals, including two populations outside the Strategic Assessment Area.

---

**Figure 6:** *Eucalyptus argutifolia* population sizes, levels of protection, and conservation commitments
Threatened ecological communities

Ten threatened ecological communities (TECs) in the Strategic Assessment Area were classified as Category 1 and are assessed in detail in Chapter 18. All of these are highly reliant on the Strategic Assessment Area (which contains at least half of their known extent) including four TECs whose known extent occurs entirely within the Strategic Assessment Area.

The proposed classes of action intersect with occurrences of seven ecological communities, which are at risk of direct impacts including clearing. Occurrences of all ten ecological communities are at risk of indirect impacts including fragmentation, edge effects and changes to surface and ground water hydrology.

Direct impacts have generally been avoided through conservation commitments to retain known occurrences that intersect with the urban and industrial classes of action. Where known occurrences are intersected by the infrastructure class of action, conservation commitments have been made to minimise impacts through design and alignment of infrastructure projects as they are planned and constructed. Indirect impacts will be minimised and avoided through a range of specific and overarching commitments set out in the Strategic Conservation Plan.

The outcomes for all ten threatened ecological communities are considered to be acceptable within an EPBC Act context. The design of the classes of action and implementation of conservation commitments will mean that the:

- conservation objectives for each ecological community will be achieved; and
- outcomes are not inconsistent with any approved Recovery Plans or Threat Abatement Plans.

Notable ecological communities are discussed below.

Claypans of the Swan Coastal Plain

Claypans of the Swan Coastal Plain are widespread throughout the Strategic Assessment Area which contains over half the total area of this ecological community. The widespread and highly fragmented distribution of this community means that there are a large number of occurrences that intersect with a proposed class of action.

Specific conservation commitments will lead to:

- avoidance of the 53.3 ha of the ecological community that is intersected by the urban and/or industrial classes of action; and
- minimisation of impacts to the 4.8 ha that is intersected by the infrastructure class of action.

The relative levels of protection for occurrences of Claypans of the Swan Coastal Plain (prior to the application of commitments) are shown in Figure 7.
Figure 7: Relative levels of protection for Claypans of the Swan Coastal Plain occurrences

**Sedgelands in Holocene dune swales of the southern Swan Coastal Plain**

Sedgelands in Holocene dune swales of the southern Swan Coastal Plain are found only within the Strategic Assessment Area. Over 77.3 ha of this ecological community is intersected by a proposed class of action (over 30% of its total extent). In addition to over-arching conservation commitments, specific commitments have been made to protect 69.1 ha of this community, with impacts to the remaining 8.2 ha minimised through conservation commitments associated with the infrastructure class of action in Action Plan C.

The relative levels of protection for occurrences of Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (prior to the application of commitments) are shown in Figure 8 below.
Thrombolite communities at Lake Clifton and Lake Richmond

There are two iconic thrombolite TECs in the Strategic Assessment Area at Lake Clifton and Lake Richmond. Neither of these communities is intersected by a proposed class of action, and a range of over-arching commitments will ensure they are protected from indirect impacts from proposed development activity. In addition, specific conservation commitments have been made to investigate causes and possible remediation actions to address the impact of rising salinity on the Lake Clifton thrombolite community.

Ramsar wetlands

There are three internationally important wetlands (known as Ramsar wetlands) in the Strategic Assessment Area:

- Becher Point Wetlands – a collection of approximately 60 small wetlands (677 ha), 9 km south of Rockingham;
- Forrestdale and Thomsons Lakes – two lakes to the south of Perth; and
- the Peel-Yalgorup System of wetlands – a major system of wetlands spread over 26,000 ha and two catchments, 80km south of Perth. The scale and complexity of potential impacts to this system are substantial and discussed in more detail below.

None of the sites will be directly impacted by the proposed classes of action. However, all three are currently affected by a range of pressures or 'legacy' issues, and may be subject to additional indirect impacts from the classes of action including changes to groundwater and/or surface water, and impacts from increased human use of, or residence around wetlands.

The Strategic Conservation Plan (and supporting action plans) provides a package of commitments for the three Ramsar sites to address both the legacy issues and future risks from the classes of action. It does this through:

- A set of State commitments in Action Plan G to address the legacy issues.
- A set of MNES commitments in Action Plan F to address the risks from the classes of actions.

The conservation outcomes for Ramsar sites are to maintain and where possible improve their ecological character in accordance with Australia’s obligations under the Ramsar Convention. This outcome is expected to be met for all three sites under the Strategic Conservation Plan.

Peel-Yalgorup System

The most important and complex set of potential impacts relate to the Peel-Yalgorup System. This site spreads over two major catchment systems and supports a wide range of ecological, social and economic values. Each major catchment is already subject to a number of pressures or legacy issues including elevated nutrient levels, decreasing inflows, increasing disturbance from human activity, and altered tidal regimes due to channel construction. Potential future pressures and risks from the classes of action include threats to water quality at a local scale, decreasing inflows, and increasing people pressures.

A range of conservation commitments are proposed to maintain and improve the condition of the Peel-Yalgorup System of wetlands. These relate to management activities and policies across the Peel Harvey and Yalgorup catchments, including establishment of the Peel Regional Park, expansion of
Yalgorup National Park, ongoing management of groundwater resources, measures to improve water quality, updating relevant planning and environmental protection policies, and monitoring of the Limits of Acceptable Change.

**Migratory shorebirds**

The Strategic Assessment Area supports 29 migratory shorebird species listed under the EPBC Act. Two of these, the Curlew Sandpiper and the Eastern Curlew, are critically endangered.

There are eighty four habitat sites for migratory shorebirds in the Strategic Assessment Area, of which 29 are considered important in an EPBC Act context. The Curlew Sandpiper is found at all of the important sites, and the Eastern Curlew at five important sites. Seventy-eight habitat sites have some level of protection, with 60 in Level 1 or Level 2 areas.

It is unlikely that direct impacts to shorebird habitat will substantially affect the area or quality of important habitat sites. The most likely direct impacts may occur due to proposed infrastructure development. Indirect impacts are also likely to affect important habitat sites and will be managed under Action Plan F.

Impacts to these species are likely to be limited and effectively mitigated by the provisions in the Strategic Conservation Plan. Most migratory shorebird habitat is avoided by proposed development, and conservation commitments relate to the management of indirect impacts.

The conservation objectives for migratory shorebirds, the Curlew Sandpiper and the Easter Curlew will be achieved through implementation of the Strategic Conservation Plan.

**World and National Heritage**

There are two World and/or National Heritage sites in the Strategic Assessment Area:

- The former Fremantle Prison which is listed as both a World and National Heritage Place.
- The Goldfields Water Supply Scheme which is listed as a National Heritage Place (this extends outside the boundary of the Strategic Assessment Area to the east).

There are no anticipated impacts to these Heritage sites from the proposed classes of action.

**Potential future MNES**

Two ecological communities are considered likely to be listed as threatened under the EPBC Act in the foreseeable future. They are:

- Banksia dominated woodlands of the Swan Coastal Plain IBRA region (Banksia Woodlands). Nominated for vulnerable listing (noting that it may be listed as endangered).
- The Community of estuarine species dependent on salt-wedge estuaries in southern Australia (Estuarine Species Community). Nominated for endangered listing.

Both ecological communities are part of the Commonwealth's current Final Priority Assessment List.

Banksia Woodlands will be subject to a range of pressures from the classes of action. Conservation measures related to Carnaby's cockatoo foraging habitat will address some of these anticipated
impacts. Despite these measures, it is expected that the classes of action will place additional pressures on the ecological community and further monitoring and adaptive management will be required.

The Estuarine Species Community, which occurs in the Swan River, is at risk from a range of indirect pressures, particularly those associated with changes to hydrological regimes and elevated nutrient levels. Conservation commitments, including measures to improve the health of the Swan Canning system in Action Plan G, are expected to adequately manage these risks and it is not expected for the classes of action to lead to additional pressures to the ecological community.

**CONCLUSION**

*Ecologically Sustainable Development (ESD)*

The Western Australian Government has recognised that the historic forms of growth for Perth are not sustainable into the future (WAPC 2015) and that it is critical for current planning processes to incorporate the principles of ESD.

The principles of the ESD as described in the EPBC Act are:

a) **Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;**

b) **if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;**

c) **the principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;**

d) **the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making; and**

e) **improved valuation, pricing and incentive mechanisms should be promoted.**

There are three key mechanisms that will deliver ESD in the Perth and Perth regions:

1. The planning frameworks underpinning *Directions 2031 and beyond* and *Perth and Peel@3.5million*.

2. The Strategic Assessment for the Perth and Peel Regions.

3. The ongoing approval process for the classes of action established under the Strategic Conservation Plan.

An overview of how the mechanisms in the Strategic Conservation Plan address these principles is provided in Table 5.
Table 5: Mechanisms to achieve ESD in the Strategic Assessment Area

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Principle (a)</th>
<th>Principle (b)</th>
<th>Principle (c)</th>
<th>Principle (d)</th>
<th>Principle (e)</th>
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<td>• Design of the classes of action</td>
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<td>X</td>
<td>X</td>
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<td>• Recognising sustainability outcomes in the Urban Values Atlas</td>
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<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>• Integrated infrastructure planning</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>• BRM policy reform</td>
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<td>X</td>
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<td>The Strategic Assessment for the Perth and Peel Regions</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>• Strategic Environmental Impact Assessment process</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Streamlining environmental approvals</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Impact avoidance</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>• Environmental protection, offsets and conservation commitments</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>• Strategic approach to key environmental issues in the Perth and Peel regions</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Climate change mitigation and adaptation</td>
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<td></td>
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<td></td>
<td>X</td>
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<tr>
<td>• The proposed conservation levy</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Monitoring, adaptive management and the assurance framework</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>The ongoing approvals process</td>
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<td>X</td>
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<td></td>
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</tr>
</tbody>
</table>

Key uncertainties

The Strategic Conservation Plan will operate until 30 June 2050 and conservation actions will continue in an ongoing way once this period ends. Long timeframes such as this are subject to an inherent level of variability and uncertainty.

Key uncertainties over the life of the Strategic Conservation Plan include:

- **Understanding the nature and scale of potential indirect impacts.** This issue is addressed through:
  - The impact assessment which:
    - identifies those MNES which are at particular risks of indirect impacts; and
    - defines conservation commitments in the Strategic Conservation Plan to address these issues.
Implementation of the Strategic Conservation Plan through:

- implementation of relevant conservation commitments (e.g. State planning, assessment and approval processes to address potential changes to groundwater as a result of development);
- ongoing management of existing and future conservation reserves in the Strategic Assessment Area to address issues such as threatening processes and edge effects to protect MNES;
- ongoing monitoring to understand if conservation outcomes and objectives have been met; and
- adaptive management of the Strategic Conservation Plan to ensure management measures are appropriately addressing the impacts of development.

- Understanding the outcomes from offsets. This issue is addressed through:
  - A focus on delivery of the conservation objectives for MNES.
  - Strong funding and governance arrangements.
  - Linking offsets to development to ensure that the pace of conservation is linked to the pace of impacts.
  - Building the ongoing application of offsets to the initial package of sites identified in the Strategic Conservation Plan that provides upfront benefits for a range of MNES.

- Assessing impacts from proposed infrastructure. This issue is addressed through:
  - An assessment process that looks at the:
    - level of potential impacts using the entire infrastructure footprint; and
    - conservation commitments required to protect MNES within these areas.
  - The application of future evaluation and approval processes for infrastructure to further avoid and minimise impacts to environmental values, including MNES.

- Potential discovery of unknown occurrences of MNES. This issue is addressed through the ongoing State based planning and approvals processes for each of the classes of action. These processes are explained in Action Plans A-E and incorporate:
  - surveys; and
  - requirements relating to further avoidance, mitigation and offsets.

- Long term influences of climate change. This issue is addressed through:
  - understanding which MNES are at particular risk of the impacts of climate change; and
  - implementation of the Conservation Program to build resilience in ecosystems and implement ongoing adaptive management.

Terms of reference and endorsement criteria

The Strategic Conservation Plan and the Impact Assessment Report have been developed to address the terms of reference for the assessment and the Commonwealth's endorsement criteria.
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## Abbreviations

<table>
<thead>
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<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATU</td>
<td>Alternate treatment units</td>
</tr>
<tr>
<td>BoM</td>
<td>Bureau of Meteorology</td>
</tr>
<tr>
<td>BRM</td>
<td>Basic Raw Material</td>
</tr>
<tr>
<td>CAR</td>
<td>Comprehensiveness, Adequacy, Representativeness</td>
</tr>
<tr>
<td>CBD</td>
<td>Central Business District</td>
</tr>
<tr>
<td>CCW</td>
<td>Conservation Class Wetland</td>
</tr>
<tr>
<td>CoA</td>
<td>Class of Action</td>
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<tr>
<td>DAFWA</td>
<td>Department of Agriculture and Food Western Australia</td>
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<td>DEC</td>
<td>Department of Environment and Conservation</td>
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<td>DER</td>
<td>Department of Environment Regulation</td>
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<td>DMP</td>
<td>Department of Mines and Petroleum</td>
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<td>Commonwealth Department of the Environment</td>
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<td>Department of Water</td>
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<td>DPaW</td>
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<td>DPC</td>
<td>Department of the Premier and Cabinet</td>
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<td>Ecological character description</td>
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<td>EPA</td>
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<td>EPBC Act</td>
<td>Commonwealth Environment Protection and Biodiversity Conservation Act 1999</td>
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<td>Erosion and Sediment Control Plan</td>
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<td>Ecologically sustainable development</td>
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<td>Finalised Priority Assessment List</td>
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<td>Groundwater Dependent Ecosystem</td>
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<td>Intergovernmental Panel on Climate Change</td>
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<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
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<td>IWSS</td>
<td>Integrated Water Supply Scheme</td>
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<td>Abbreviation</td>
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<tr>
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<td>-----------------------------------------------------------</td>
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<tr>
<td>LAC</td>
<td>Limits to Acceptable Change</td>
</tr>
<tr>
<td>m</td>
<td>metres</td>
</tr>
<tr>
<td>MAR</td>
<td>Managed aquifer recharge</td>
</tr>
<tr>
<td>mm</td>
<td>millimetres</td>
</tr>
<tr>
<td>MNES</td>
<td>Matters of National Environmental Significance</td>
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<tr>
<td>MRS</td>
<td>Metropolitan Region Scheme</td>
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<td>NERP</td>
<td>National Environmental Research Program</td>
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<td>NTU</td>
<td>Nephelometric Turbidity Unit</td>
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<td>OEPA</td>
<td>Office of the Environmental Protection Authority</td>
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<tr>
<td>PEC</td>
<td>Priority Ecological Communities</td>
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<td>PHCC</td>
<td>Peel Harvey Catchment Council</td>
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<td>PHEMC</td>
<td>Peel Harvey Estuary Management Committee</td>
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<td>PRAMS</td>
<td>Perth Regional Aquifer Modelling System</td>
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<td>PRS</td>
<td>Peel Regional Scheme</td>
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<tr>
<td>RIS</td>
<td>Ramsar Information Sheet</td>
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<tr>
<td>RSNA</td>
<td>Regionally Significant Natural Area</td>
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<tr>
<td>s. 16(e)</td>
<td>Section 16(e) of the <em>Environmental Protection Act</em> 1986</td>
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<td>SAPPR</td>
<td>Strategic Assessment of the Perth and Peel Regions</td>
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<td>SCA</td>
<td>Special Control Areas</td>
</tr>
<tr>
<td>SCP</td>
<td>Strategic Conservation Plan</td>
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<tr>
<td>TEC</td>
<td>Threatened Ecological Community</td>
</tr>
<tr>
<td>TN</td>
<td>Total nitrogen</td>
</tr>
<tr>
<td>TP</td>
<td>Total phosphorus</td>
</tr>
<tr>
<td>TSSC</td>
<td>Threatened Species Scientific Committee</td>
</tr>
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<td>WA</td>
<td>Western Australia</td>
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<td>WAPC</td>
<td>Western Australian Planning Commission</td>
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<td>WC Act</td>
<td><em>Wildlife Conservation Act</em> 1950</td>
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<td>WQIP</td>
<td>Water Quality Improvement Plan</td>
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<td>WSUD</td>
<td>Water-sensitive urban design</td>
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