# Contents

**Executive Summary** .............................................................................................................................. xii

1 **Introduction** ........................................................................................................................................... 1  
1.1 Overview ............................................................................................................................................... 1  
1.2 Background to the overall Strategic Assessment ............................................................................. 2  
1.3 Framework for the State assessment ............................................................................................... 3  
1.4 Current status of the State assessment ........................................................................................... 6  
1.5 Scope of assessment ....................................................................................................................... 6  
1.6 Approach and structure of this report ............................................................................................ 7  

2 **Description of the future development** ............................................................................................ 9  
2.1 Planning framework ......................................................................................................................... 9  
2.2 Avoidance during the planning phase of future development footprints .................................... 12  
2.3 Overall outcomes due to avoidance measures .............................................................................. 20  
2.4 Future development under consideration ...................................................................................... 21  
2.5 Activities not considered part of future development .................................................................. 33  

3 **Overview of existing environment** .............................................................................................. 34  
3.1 Terrestrial environment .................................................................................................................. 34  
3.2 Marine environment ....................................................................................................................... 39  
3.3 Social environment ........................................................................................................................ 40  
3.4 Climate change ............................................................................................................................... 44  

4 **Assessment approach** ..................................................................................................................... 46  
4.1 Identification of relevant factors ...................................................................................................... 46  
4.2 General impact assessment methodology ...................................................................................... 50  
4.3 Specific approach for species and ecological communities .......................................................... 54  
4.4 Overarching commitments ............................................................................................................. 56  

5 **Impacts to flora and vegetation** ..................................................................................................... 59  
5.1 Key findings ...................................................................................................................................... 59  
5.2 EPA objective ................................................................................................................................. 59  
5.3 Environmental policy and guidance .............................................................................................. 59  
5.4 Existing environment ...................................................................................................................... 60  
5.5 Current management arrangements ............................................................................................... 62  
5.6 Avoidance to date ............................................................................................................................ 72  
5.7 Analysis of potential impacts .......................................................................................................... 74
9.4 Existing environment ................................................................. 245
9.5 Current management arrangements ........................................... 248
9.6 Avoidance to date ...................................................................... 251
9.7 Potential impacts ......................................................................... 252
9.8 Impact analysis .......................................................................... 253
9.9 Mitigation and management ....................................................... 260
9.10 Summary of outcome for EPA objective ................................... 263

10 Impacts to marine environmental quality ..................................... 264
10.1 Key findings .............................................................................. 264
10.2 EPA objective ........................................................................... 264
10.3 Environmental policy and guidance .......................................... 265
10.4 Existing environment ................................................................. 265
10.5 Current management arrangements ......................................... 272
10.6 Avoidance to date ..................................................................... 279
10.7 Potential impacts ....................................................................... 280
10.8 Impact analysis ......................................................................... 280
10.9 Mitigation and management ..................................................... 284
10.10 Summary of outcome against EPA objective ......................... 285

11 Environmental management framework .................................... 286
11.1 Strategic Assessment governance and implementation ............ 286
11.2 Ongoing avoidance ................................................................. 286
11.3 Mitigation of impacts ............................................................... 287
11.4 Assurance Framework ............................................................. 289
11.5 Offsets ..................................................................................... 292
11.6 Commitments ......................................................................... 292

References ...................................................................................... 293

Appendix A: Agreement .....................................................................
Appendix B: Flora and Vegetation....................................................
Appendix C: Fauna ...........................................................................
Appendix D: Conservation Status Descriptions .................................
List of Figures

Figure 1-1: Strategic assessment of the Perth and Peel regions EPA Advice Area ........................................ 4
Figure 1-2: Relationships between the major processes within the strategic assessment (from EPA 2015a) ................................................................................................................................. 5
Figure 2-1: Sub-regional framework areas ........................................................................................................ 11
Figure 2-2: State and regional planning processes (from Perth and Peel@3.5 million) ................................... 12
Figure 2-3: Reduction in urban expansion footprint as a result of avoidance process ...................................... 14
Figure 2-4: Reduction in urban and industrial development footprint for city of 3.5 million through avoidance process ........................................................................................................................................ 15
Figure 2-5: Urban footprint for the State IAR .................................................................................................. 25
Figure 2-6: Industrial footprint for the State IAR .......................................................................................... 27
Figure 2-7: Rural residential footprint for the State IAR .............................................................................. 29
Figure 2-8: Infrastructure footprint for the State IAR .................................................................................. 30
Figure 2-9: BRM footprint for the State IAR ................................................................................................ 32
Figure 3-1: IBRA bioregions of the Advice Area .......................................................................................... 37
Figure 3-2: Hydrology and landforms of the Advice Area ............................................................................ 38
Figure 5-1: Major terrestrial conservation reserves in the Advice Area ....................................................... 65
Figure 5-2: RSNAs in the Advice Area ......................................................................................................... 66
Figure 5-3: Geomorphic wetlands of the Swan Coastal Plain wetland mapping in the Advice Area .......... 70
Figure 5-4: Protection levels (1-7) for RSNAs in the Advice Area ................................................................. 76
Figure 5-5: Potential impacts to RSNAs in the Advice Area ....................................................................... 77
Figure 5-6: Protection levels (1-7) for CCWs and REWs in the Advice Area ................................................ 82
Figure 5-7: Potential impacts to CCWs in the Advice Area ........................................................................ 84
Figure 5-8: Potential impacts to REWs in the Advice Area ....................................................................... 85
Figure 5-9: Vegetation complexes within the Advice Area ........................................................................... 92
Figure 5-10: Vegetation complexes legend .................................................................................................. 93
Figure 5-11: Potential impacts to vegetation complexes <30 per cent in the Advice Area ......................... 94
Figure 5-12: Threatened and Priority ecological communities in the Advice Area (Category 1 and 2) .......... 104
Figure 5-13: Relative levels of protection for *Banksia attenuata* and/or *Eucalyptus marginata* woodlands occurrences. Numbers indicate total area in each level of protection. ....................................................... 109

Figure 5-14: Relative levels of protection for *Banksia attenuata* woodland over species rich dense shrublands occurrences. Numbers indicate total area in each level of protection. ....................................................... 110

Figure 5-15: Relative levels of protection for *Eucalyptus calophylla* - *Eucalyptus marginata* woodlands occurrences. Numbers indicate total area in each level of protection. ....................................................... 111

Figure 5-16: Relative levels of protection for *Melaleuca huegelli* - *Melaleuca acerosa* shrublands on limestone ridges occurrences. Numbers indicate total area in each level of protection. ....................................................... 112

Figure 5-17: Potential impacts to Threatened and Priority ecological communities. .............................................................. 116

Figure 5-18: Threatened and Priority flora in the Advice Area (Category 1 and 2). ............................................................. 124

Figure 5-19: Potential impacts to known records of *Austrostipa jacobsiana* within the Advice Area. ................................ 129

Figure 5-20: Potential impacts to known populations of *Eremophila glabra* subsp. *chlorella* within the Advice Area. ......................................................................................................................... 130

Figure 5-21: Potential impacts to known populations of *Synaphea* sp. Pinjarra Plain within the Advice Area. ......................................................................................................................... 131

Figure 5-22: Potential impacts to known populations of *Synaphea* sp. Serpentine within the Advice Area. ......................................................................................................................... 132

Figure 5-23: Potential impacts to known records of Priority 1 and 2 flora within the Advice Area (Category 1 and 2). ......................................................................................................................... 139

Figure 7-1: Waterways of the Advice Area and their catchments. .......................................................................................... 166

Figure 7-2: Risk mapping for acid sulfate soils in the Advice Area. .......................................................................................... 172

Figure 7-3: Location on Ministerial criteria sites within the Advice Area. .......................................................................................... 180

Figure 7-4: Public Drinking Water Source Areas in the Advice Area. .......................................................................................... 183

Figure 7-5: Swan Canning River system management boundaries. .......................................................................................... 188

Figure 7-6: Difference in groundwater levels in the Superficial aquifer under 2030 land use compared to current land use (median climate). .......................................................................................... 197

Figure 7-7: Difference in groundwater levels in the Superficial aquifer under 2030 land use compared to current land use with no change in distribution of pines (median climate). .......................................................................................... 198

Figure 7-8: Difference in groundwater levels in the Superficial aquifer under 2030 land use compared to current levels (median climate). .......................................................................................... 199

Figure 7-9: Difference in groundwater levels in the Superficial aquifer under 2030 land use compared to current levels (dry climate). .......................................................................................... 200

Figure 7-10: Intersection of development footprint with 100 year ARI floodplain areas. .......................................................... 206
Figure 7-11: Eutrophication risk mapping for urban, industrial and rural residential expansion areas (data provided by DoW) ................................................................. 210

Figure 7-12: Potential impacts to Jandakot and Gnangara UWPCA’s from the development footprint 216

Figure 9-1: High risk tree canopy Central sub-region ................................................................. 257

Figure 9-2: Medium risk tree canopy Central sub-region ............................................................. 258

Figure 9-3: Low risk tree canopy Central sub-region ................................................................. 259

Figure 9-4: The Green Network (from Directions 2031, DoP and WAPC 2010) .......................... 262

Figure 10-1: State marine parks and fish habitat protection areas adjacent to and within the Advice Area .................................................................................................................. 275

Figure 10-2: High value benthic habitat areas within and adjacent to the Strategic Advice Area .... 276

Figure 10-3: Cockburn Sound ecological protection levels .......................................................... 277

Figure 10-4: Proposed development footprints with Cockburn Sound SEP .............................. 283

Figure 11-1: Assurance framework ......................................................................................... 290
List of Tables

Table 1-1: Current status of the IAR and EPA’s Strategic Advice ............................................................. 6
Table 1-2 Structure of the IAR .................................................................................................................... 8
Table 2-1: Summary of outcomes of key avoidance measures ............................................................... 21
Table 3-1: Projected effects of climate change in the Perth and Peel regions to 2030 and the relative confidence of those changes occurring .................................................................................................... 45
Table 4-1: Environmental factors relevant to the State IAR ..................................................................... 46
Table 4-2: Consideration of EPA factors within the document................................................................. 50
Table 4-3: Threatened and Priority species and communities assessment categories ............................. 55
Table 4-4: Criteria for assigning Threatened and Priority species and communities to categories ...... 56
Table 4-5: Overarching commitments and explanations .......................................................................... 57
Table 5-1: Wetland management categories ........................................................................................... 69
Table 5-2: Potential impacts to RSNAs in the Advice Area before and after consideration of further likely avoidance ................................................................................................................. 79
Table 5-3: Potential impacts to wetlands in the Advice Area before and after consideration of further likely avoidance ................................................................................................................. 86
Table 5-4: Overall impacts to vegetation complexes in the Advice Area before and after consideration of further likely avoidance ................................................................................................................. 89
Table 5-5: Potential impacts to vegetation complexes with <30 per cent of their pre-European extent remaining in the Advice Area ................................................................................................................. 95
Table 5-6: Area of vegetation complexes in IUCN I-IV areas and RSNAs in the Advice Area and potential retention through future likely avoidance (only vegetation complexes with <30 per cent of their pre-European extent remaining included) ................................................................................................................. 100
Table 5-7: Potential impacts to TECs in the Advice Area before and after consideration of further likely avoidance ................................................................................................................. 114
Table 5-8: Potential impacts to PECs in the Advice Area before and after consideration of further likely avoidance ................................................................................................................. 115
Table 5-9: Potential impacts to Threatened flora in the Advice Area before and after consideration of further likely avoidance ................................................................................................................. 128
Table 5-10: Potential impacts to Priority flora in the Advice Area before and after consideration of further likely avoidance ................................................................................................................. 135
Table 7-1: Existing allocation plans within the Advice Area ..................................................................... 177
Table 7-2: Data and assumptions relevant to the PRAMS modelling undertaken by DoW ................... 194
Table 7-3: Indicative water availability within the Advice Area to the north of the Swan River (data from DoW) ...................................................................................................................................................... 201

Table 7-4: Indicative water availability within the Advice Area to the south of the Swan River (data from DoW) ...................................................................................................................................................... 202

Table 7-5: Areas of existing land uses in proposed urban and industrial expansion areas........... 208

Table 8-1: Key existing management measures for identified threats to air quality ...................... 237

Table 8-2: Summary of NEPMs for ambient air quality and air toxics .............................................. 238

Table 9-1: Potential determinants of health relevant to the strategic assessment ............................. 246

Table 9-2: Important landscape features identified within the Strategic Advice Area ..................... 247

Table 9-3: Key features of Surface and Urban Heat Islands ................................................................. 254

Table 9-4: Area of urban tree canopy in central sub-region and intersection with infill footprint ........ 256

Table 10-1: Environmental quality objectives identified in *Environmental Values and Objectives for Perth’s Coastal Waters (EPA 2000b)* ........................................................................................................ 270

Table 10-2: Area in hectares of footprints within the Cockburn SEP boundary ............................... 282
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BoM</td>
<td>Bureau of Meteorology</td>
</tr>
<tr>
<td>ARI</td>
<td>Average Return Interval</td>
</tr>
<tr>
<td>BRM</td>
<td>Basic raw materials</td>
</tr>
<tr>
<td>BUWM</td>
<td>Better Urban Water Management</td>
</tr>
<tr>
<td>CCW</td>
<td>Conservation category wetlands</td>
</tr>
<tr>
<td>DER</td>
<td>Department of Environment Regulation</td>
</tr>
<tr>
<td>DMP</td>
<td>Department of Mines and Petroleum</td>
</tr>
<tr>
<td>DoE</td>
<td>Department of the Environment</td>
</tr>
<tr>
<td>DoP</td>
<td>Department of Planning</td>
</tr>
<tr>
<td>DoW</td>
<td>Department of Water</td>
</tr>
<tr>
<td>DPC</td>
<td>Department of the Premier and Cabinet</td>
</tr>
<tr>
<td>DWMS</td>
<td>District Water Management Strategy</td>
</tr>
<tr>
<td>EAG</td>
<td>Environmental Assessment Guideline</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental impact assessment</td>
</tr>
<tr>
<td>EP</td>
<td>Environmental Protection</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Authority</td>
</tr>
<tr>
<td>EPBC</td>
<td>Environment Protection and Biodiversity Conservation</td>
</tr>
<tr>
<td>EOQ</td>
<td>Environmental Quality Objectives</td>
</tr>
<tr>
<td>EV</td>
<td>Environmental Values</td>
</tr>
<tr>
<td>EWP</td>
<td>Environmental water provision</td>
</tr>
<tr>
<td>EWR</td>
<td>Ecological water requirement</td>
</tr>
<tr>
<td>FHPA</td>
<td>Fish Habitat Protection Areas</td>
</tr>
<tr>
<td>IAR</td>
<td>Impact Assessment Report</td>
</tr>
<tr>
<td>IAWG</td>
<td>Infrastructure agency working group</td>
</tr>
<tr>
<td>IBRA</td>
<td>Interim Biogeographic Regionalisation of Australia</td>
</tr>
<tr>
<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
</tr>
<tr>
<td>MBO</td>
<td>Monosulfidic black ooze</td>
</tr>
<tr>
<td>MNES</td>
<td>Matters of national environmental significance</td>
</tr>
<tr>
<td>MRS</td>
<td>Metropolitan Region Scheme</td>
</tr>
<tr>
<td>NEPM</td>
<td>National Environment Protection Measures</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
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<tr>
<td>OEPA</td>
<td>Office of the Environmental Protection Authority</td>
</tr>
<tr>
<td>PDWSA</td>
<td>Public drinking water source areas</td>
</tr>
<tr>
<td>PEC</td>
<td>Priority ecological community</td>
</tr>
<tr>
<td>PRAMS</td>
<td>Perth regional aquifer modelling system</td>
</tr>
<tr>
<td>PRS</td>
<td>Peel Region Scheme</td>
</tr>
<tr>
<td>REW</td>
<td>Resource enhancement wetlands</td>
</tr>
<tr>
<td>RSNA</td>
<td>Regionally significant natural areas</td>
</tr>
<tr>
<td>SEP</td>
<td>State Environmental Policy</td>
</tr>
<tr>
<td>SGS</td>
<td>Significant Geological Supply</td>
</tr>
<tr>
<td>SPP</td>
<td>State Planning Policy</td>
</tr>
<tr>
<td>SRT</td>
<td>Swan River Trust</td>
</tr>
<tr>
<td>TEC</td>
<td>Threatened ecological community</td>
</tr>
<tr>
<td>UWPCA</td>
<td>Underground water pollution control areas</td>
</tr>
<tr>
<td>VKT</td>
<td>Vehicle kilometres travelled</td>
</tr>
<tr>
<td>WA</td>
<td>Western Australia</td>
</tr>
<tr>
<td>WALGA</td>
<td>Water Corporation and WA Local Government Association</td>
</tr>
<tr>
<td>WAPC</td>
<td>Western Australian Planning Commission</td>
</tr>
<tr>
<td>WQIP</td>
<td>Water Quality Improvement Plan</td>
</tr>
<tr>
<td>WSUD</td>
<td>Water Sensitive Urban Design</td>
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EXECUTIVE SUMMARY

Western Australia has a population of over 2.5 million people, of which 1.65 million live in the Perth and Peel regions. By 2050, it is expected that the regions will support a population of more than 3.5 million.

The Perth and Peel regions form part of an internationally recognised biodiversity hotspot and support a number of significant environmental values. Many of these values are unique to the area, rare or threatened. The regions also host a substantial network of regional open space that is among the largest of any metropolitan area in Australia, and is central to our regional identity and sense of place.

New thinking in regards to future urban form is required to respond to the challenges of significant population growth while retaining liveability and the cultural and natural values that make our region special. The Western Australian Government has recognised that a strategic approach to long-term planning of both development and environmental management is needed to achieve a sustainable balance between development and conservation. Central to this has been the decision (reflected in Directions 2031 and Beyond and the subsequent planning frameworks of Perth and Peel@3.5million) to focus future growth in a more efficient urban form rather than continuing the urban sprawl that has characterised growth to date.

In light of the significant projected population growth over the coming decades, the Western Australian Ministers for Planning and Environment and the Commonwealth Minister for the Environment agreed in July 2011 to undertake a strategic assessment of the Perth and Peel regions of Western Australia. The Strategic Assessment is the largest undertaking of its kind in Australia, setting a benchmark for streamlining urban-based environmental approvals processes and strengthening land use planning and management with a central objective of ensuring that matters of state and national environmental significance are protected, as our city grows.

The purpose of the Strategic Assessment is to:

- significantly reduce the need for project by project assessment under the Environment Protection and Biodiversity Conservation Act 1999 (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;
- 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; and
- provide greater certainty in terms of long term land supply to meet the needs of a city of 3.5 million.

The Strategic Assessment addresses the impact on matters of national environmental significance (MNES) and other State environmental values from the future development of the Perth and Peel regions, including urban, industrial, rural-residential and infrastructure development and basic raw materials extraction.

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.
3. Parallel consideration of impacts to State environmental matters under the Environmental Protection Act 1986 (the EP Act).
The Strategic Conservation Plan (separate to this document) establishes both long-term certainty for development and conservation outcomes for the Perth and Peel regions and builds on many years of planning, policy reform, and conservation work. A conservation program is provided that will deliver significant improvements to the protection and management of both State biodiversity and environmental values, and Commonwealth MNES. Key outcomes include:

- Significant upfront avoidance of environmental values, including avoidance of over 16,000 ha of impacts to native vegetation, and a system for further avoidance over the life of the plan.
- Expansion of the conservation reserves network in the Perth and Peel regions and surrounds, with new conservation land totalling around 170,000 ha.
- Delivery of environmental programs to protect threatened species in partnership with local government, community groups and landholders.
- Streamlined environmental approvals to support an efficient urban form.
- Certainty about the pattern for growth within the Perth and Peel regions.
- Significant sequential land use and co-location of infrastructure corridors to minimise environmental impacts.

The Strategic Conservation Plan is supported by nine action plans that detail the implementation processes for how development will proceed, how conservation actions will occur, and how monitoring and reporting will happen. The substantial ‘upfront’ avoidance of impacts to environmental values achieved during the refinement of future development expansion areas was critical in the Strategic Assessment and is documented in the Action Plans that accompany the Strategic Conservation Plans.

This document is the Impact Assessment Report (IAR) addressing environmental matters relevant to the State and it has been prepared to assist the Western Australian Environmental Protection Authority (the EPA) to provide strategic advice to the Western Australian Minister for Environment under section 16(e) of the EP Act. The IAR presents an environmental review and impact assessment of the planned future development of the Perth and Peel region subject to the Strategic Assessment. Management measures for key environmental factors have been identified and included in the assessment. This IAR should be read in conjunction with the Strategic Conservation Plan for the Perth and Peel regions, and the strategic impact assessment report on MNES (the Commonwealth IAR). In particular, threatened species and communities that are protected under Commonwealth legislation are dealt with substantively in those reports rather than this IAR.

The Strategic Conservation Plan provides for the following development activities:

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

The EPA has advised that it will provide advice on a sub-set of the activities provided for in the Strategic Conservation Plan. In a general sense, this serves to exclude areas with existing urban or industrial zoning which may have been referred and assessed by the EPA previously. The EPA will not provide advice on the harvesting of pines.

The boundary within which the EPA will provide advice covers the extent of the Metropolitan Region Scheme (MRS) and Peel Region Scheme (PRS). This differs to the subject area of the Commonwealth
IAR, which extends to the north of the MRS boundary to include additional pine plantations (to capture an important food source for Carnaby’s cockatoo).

**Methodology and scope**

A spatial approach to the examination of impacts was undertaken wherever possible using a 'development footprint' methodology whereby the spatial extent of each future development area (e.g. urban footprint) was imposed over the spatial extent of important environmental values (e.g. projected distribution of threatened species), with the resultant 'intersect' comprising the potential direct impact. The footprint approach resolves potential impacts at a scale appropriate to the strategic nature of the assessment. Where this was not possible, qualitative methodologies were employed, particularly when examining non-clearing related impacts that will likely arise to accommodate a projected population increase to 3.5 million people and their associated lifestyles (e.g. potential impacts from increased traffic).

The scope of the strategic assessment does not include point source discharges of pollutants or emissions, port infrastructure fisheries or aquaculture activities.

Environmental Assessment Guideline No. 8 (EPA 2015b) identifies the environmental factors relevant to environmental impacts assessment, grouped into themes. Scoping of the environmental factors conducted through the assessment indicated that detailed impact analysis (at the strategic scale) was not warranted for the following factors: Landforms; Terrestrial Environmental Quality; Heritage; Benthic communities; Marine Fauna; and Coastal processes. The environmental factors (grouped by theme) subject to detailed assessment, are set out in Table E1.

<table>
<thead>
<tr>
<th>EPA factor theme</th>
<th>Factors</th>
</tr>
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<tbody>
<tr>
<td>Land</td>
<td>Flora and vegetation</td>
</tr>
<tr>
<td></td>
<td>Fauna (includes subterranean fauna)</td>
</tr>
<tr>
<td>Water</td>
<td>Hydrological processes and Inland waters environmental quality</td>
</tr>
<tr>
<td>Air</td>
<td>Air quality and atmospheric gases</td>
</tr>
<tr>
<td>People</td>
<td>Human health and Amenity</td>
</tr>
<tr>
<td>Sea</td>
<td>Marine environmental quality</td>
</tr>
</tbody>
</table>

For each environmental factor, potential impacts were initially examined against relevant existing management arrangements (delivered through legislation, policy and programs) and avoidance achieved to date (during planning of the future development footprints). Potential impacts that were entirely avoided or sufficiently reduced in magnitude were not carried forward for further analysis. Significant potential impacts were analysed (spatially were possible) and specific mitigation measures applied as set out in Action Plan G of the Strategic Conservation Plan. Where significant residual impacts are likely, the need for offsets was identified and these are set out in Action Plan H of the Strategic Conservation Plan, noting that offsets are intended to deliver significant co-benefits to state environmental values and MNES. The assessment concludes with an overall statement of the outcome against the EPA's objective for each environmental factor.
Avoidance of potential impacts

Avoidance of impacts to environmental values has been a key feature of the Strategic Assessment. There are three key components to this:

- Avoidance through the planning phase for the classes of action.
- Avoidance through the impact assessment phase.
- 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 environmental factors. 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 process for avoidance around infrastructure design.
- Implementing a range of detailed commitments that avoid impacts at a site level.

Ongoing likely avoidance of impacts over the life of the Strategic Conservation Plan will be achieved through the processes of statutory planning implemented through the Planning and Development Act 2005 (P&D Act). Based on estimates by the Department of Planning (DoP), future likely avoidance to flora and vegetation has been quantitatively estimated. Future avoidance through statutory planning will occur within an overarching assurance framework for the Strategic Conservation Plan to confirm continued alignment with the conservation outcomes to be achieved by the Plan and ensure Action Plans and supporting processes are updated and improved as necessary.

Final location and alignment of infrastructure will also be subject to a future process of refinement following detailed planning and design to further avoid and minimise impacts to State and Commonwealth environmental values.

Overarching commitments to mitigate impacts

A number of over-arching commitments have been provided for in Action Plan G of the Strategic Conservation Plan, with significant consequences for the factors being assessed. These are listed in Table E2 along with an explanation of their relevance to the assessment of impacts.
<table>
<thead>
<tr>
<th>Over-arching commitments</th>
<th>Benefit</th>
</tr>
</thead>
</table>
| Implement environmental assessment and management measures, controls and standards for all development to reduce direct and indirect impacts. This will include, but is not limited to, controls on vegetation clearing, water quality and use, stormwater, dust, noise, emissions, public access. This process will involve:  
  • ensuring controls / conditions placed on existing approvals continue to be implemented; and  
  • ensuring that new proposals that are approved incorporate at a minimum the existing standards and expectations for control / mitigation / management of direct and indirect impacts. | Within Action Plan G, commitments have generally been provided where they represent a change or improvement to existing processes. They do not list the full extent of controls and standards that will be expected to continue to apply to all new developments, which are covered by this over-arching commitment.  
Ministerial conditions or other controls applying to existing approvals continue to apply.                                                                 |
| Implement the conservation program including:  
  • incorporation of new sites into the conservation reserve system;  
  • continued implementation of the Bush Forever Program;  
  • implementation of an ongoing offsets program to address residual impacts to MNES and State factors;  
  • improving the management and protection of significant environmental values which have already been identified for retention;  
  • establishment of the Peel Regional Park and marine management area; and  
  • protecting selected Peel Regionally Significant Natural Areas for conservation. | Action Plan H of the Strategic Conservation Plan provides for the implementation of a conservation program. The conservation program comprises a range of conservation actions that will be implemented over the life of the Strategic Conservation Plan to improve environmental outcomes within the Perth and Peel regions and to offset significant residual impacts arising from planned development.  
This is the primary mechanism for delivery of offsets.                                                                 |
| Protect environmental values within selected BRM Exclusion Areas through Action Plan H.                                                                                                                                                                                                 | Avoidance of around 13,000 ha of remnant vegetation and associated values has been achieved through the identification of exclusion areas through a master planning process for BRM. Priority sites will be protected as part of the conservation program. |
| For urban, industrial and rural residential development, undertake and implement statutory planning to achieve the specific commitments for MNES and State factors. As described in Action Plan A and B this will:  
  • have due regard for the planning undertaken during preparation of the Strategic Conservation Plan for urban and industrial expansion sites and new rural residential zones;  
  • consider additional opportunities for retention of native vegetation, fauna habitat and wetlands; and  
  • be informed by previous EPA advice and Ministerial Statement conditions, or in the absence of this, detailed investigations, within existing zoned urban and industrial areas. | A process for future avoidance will be undertaken within Urban, Industrial and Rural residential footprints. Indicative estimates by DoP suggest this could result in avoidance of a further 2,200 ha of remnant vegetation and associated values within expansion areas alone. Further area would be avoided within existing zoned areas. |
Over-arching commitments

<table>
<thead>
<tr>
<th>Over-arching commitments</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implement the infrastructure impact assessment process (which includes planning, avoidance, mitigation, and offsets) to achieve the outcomes and objectives for MNES and State factors.</td>
<td>The final location and alignment of infrastructure will be subject to a future process of refinement to further avoid and minimise impacts to environmental values.</td>
</tr>
</tbody>
</table>

### Outcomes of the impact assessment

#### Flora and vegetation

The Advice Area has been subject to a high degree of disturbance as a result of land development, establishment of services and infrastructure, and clearing for agriculture. Over the past 180 years, cumulative impacts to the biodiversity of the Swan Coastal Plain have been significant.

The primary potential impact to flora and vegetation values in the Advice Area is future clearing associated with the development footprints. A quantitative analysis has been undertaken to determine the potential impact of clearing. Approximately 9,800 ha of native vegetation is intersected by the proposed development footprints. This is a substantially smaller area than originally conceived, as a result of avoidance achieved during the footprint planning phase for urban, industrial and rural residential expansion areas; master planning of BRM; and application of co-location principals for infrastructure. An overall reduction in native vegetation intersected by development footprints of more than 16,400 ha (62 per cent) has been achieved to date through avoidance measures.

Following this substantial avoidance, environmental values that have the potential to be impacted within the development footprints include: Regionally Significant Natural Areas (3,304 ha); Conservation category wetlands (461 occurrences), vegetation complexes <30 per cent remaining (5,752 ha), Threatened ecological communities (92 ha), and Threatened flora species (10 records/populations).

Estimates have been made of further likely avoidance through statutory planning in urban, industrial and rural residential expansion areas, with the expected outcome to be avoidance of a further 1,261 ha of Regionally Significant Natural Areas, 125 Conservation category wetlands, 2,094 ha of vegetation complexes <30 per cent remaining, 24 ha of Threatened ecological communities and one Threatened flora species population. No estimate has been made for areas of urban consolidation activity in the Central sub-region, where further avoidance and minimisation is expected to be achieved. Further avoidance and minimisation should also be achieved through refinement of the infrastructure development footprint.

Specific impacts have been identified that warrant consideration during future detailed planning and application of future avoidance and mitigation, relating to:

- Clearing within Regionally Significant Natural Areas, particularly where there is potential for fragmentation from proposed infrastructure.
- Disturbance of Conservation category wetlands.
- Clearing of vegetation that could result in a reduction in the extent of identified vegetation complexes below critical thresholds.
- Potential disturbance of State listed Threatened flora species and Threatened ecological communities.
Conservation significant flora species will benefit generally from commitments for protection of regionally significant natural areas, wetlands and conservation significant ecological communities. In addition, specific commitments have been made to protect important occurrences and maintain the long-term viability of the conservation significant species and communities affected by the footprints. In the case of priority flora species, given the paucity of information available, a survey and research program will be developed and implemented, to gain a better understanding of the potential importance of the Perth-Peel area to priority flora species in order to inform management and conservation planning.

The commitments included in Action Plan G of the Strategic Conservation Plan to ensure the EPA objective for flora and vegetation is achieved also include offsets to transfer at least 170,000 ha into the formal conservation reserve system and provide for revegetation and replanting programs in conservation reserves, Regionally Significant Natural Areas, open space and other retained areas.

**Fauna**

Terrestrial fauna diversity and abundance in the Advice Area has significantly declined since European settlement and the urbanisation of the Perth and Peel regions, primarily due to habitat loss and competition from introduced species. The key potential impact to terrestrial fauna as a result of the proposed development is further direct loss of habitat. Retention of large, relatively intact areas of remnant native vegetation and maintenance of connectivity between these habitats will be critical to maintaining viable fauna populations.

The proposed development footprints result in the potential clearing of approximately 9,800 ha of native vegetation, representative of terrestrial fauna habitat. This is a substantially (62%) smaller area than originally conceived, as a result of avoidance achieved to date. Future likely avoidance through statutory planning and through the refinement of infrastructure locations is expected to further reduce requirements for clearing of terrestrial fauna habitat which should also function to reduce additional fragmentation within an already highly cleared landscape.

Apart from those threatened fauna species addressed under the Commonwealth IAR, one Wildlife Conservation Act (WC Act) listed threatened species (Carter's Freshwater Mussel, *Westralunio carteri*) was identified to be reliant on the Advice Area. Mitigation and management for this species will be delivered under the general measures described for Water factors.

A number of Priority fauna species that are poorly understood are likely to occur in the Advice Area however, prediction of impacts to these species is not yet feasible due to significant gaps in knowledge. There is however, opportunity to address these gaps over the life of the Strategic Conservation Plan and respond within the frameworks established, and commitments to additional survey and research are made. Additionally, the proposed retention of relatively large, intact remnant vegetation containing a variety of fauna habitat types and maintaining connectivity is expected to provide important conservation benefits to these fauna species.

For subterranean fauna there is potential for some indirect and cumulative impacts mainly relating to reliance on groundwater and the potential for issues relating to increased visitation to Yanchep National Park. Impacts to subterranean fauna, including the Threatened Crystal Cave Crangonyctoid, will be mitigated through maintenance of groundwater regimes, and a range of commitments relating to the Aquatic Root Mat TEC described in the Commonwealth IAR and a proposed expansion of Yanchep National Park.

Important co-benefits for terrestrial fauna will continue to be provided by existing controls on native vegetation clearing, planning overlays controlling development in sensitive habitats, and many recovery actions outlined in species’ and communities’ recovery plans operative in the Advice Area.
A number of additional commitments are made to ensure the EPA objective for terrestrial fauna is achieved including offsets to transfer 170,000 ha of fauna habitat into the formal conservation reserve system, and revegetation and replanting programs to improve habitat connectivity and ecological linkages.

**Hydrological processes and Inland waters environmental quality**

Key threats to hydrological regimes and inland water environmental quality resulting from the proposed future development relate to the likely increased demand for water, altered hydrological regimes, nutrient export and increased contamination risk.

Impacts have been assessed qualitatively, with the exception of groundwater levels in the Superficial aquifer. Future groundwater levels have been modelled by Department of Water based on proposed land use changes. Additionally, a relative risk assessment for nutrient export has been undertaken for all urban, industrial and rural residential expansion areas, in order to identify particular areas that may be associated with a high risk of eutrophication to receiving environments.

Many of the potential impacts can be adequately managed through existing processes. Particularly critical in maintaining or improving hydrological regimes are allocation and licencing processes and the continued implementation of the Better Urban Water Management framework. A commitment has been made to update Better Urban Water Management to ensure the framework remains robust and fit-for purpose. Water allocation plans and associated licensing will continue to be used to protect water dependent environmental values. These use the best available knowledge to set water availability, retaining the flexibility to respond to new information such as improved climate predictions or new understanding of environmental water requirements.

In addition to these mechanisms, the hydrological regime of wetlands within the Advice Area will be protected from impacts from the future proposed development through management of wetlands water levels through plans and strategies prepared under Better Urban Water Management and hydrological investigations for wetlands within 50 metres of major road or rail projects. It is recognised, however, that the most significant risks to hydrology of wetlands in the Advice Area result from a drying climate and in some areas consideration may need to be given to acceptable rates of groundwater decline.

Increased recharge associated with land use changes may represent an opportunity to balance falling groundwater levels resulting from reduced rainfall. This will depend on identification of suitable alternative supplies for irrigation of Public Open Space in areas where there is limited groundwater availability. The Department of Water will work with planning agencies and developers to address this need and will be guided by development of a Perth-Peel Regional Water Supply Strategy.

In relation to inland water environmental quality, an increase in nutrient loads to sensitive receptors, including the Swan Canning and Peel-Harvey River systems, from development of new urban, industrial and rural residential areas is a key threat. A commitment has been made to ensure that appropriate mitigation measures are identified prior to rezoning in specific high risk areas through the process described in Better Urban Water Management.

It is recognised, however, that ‘legacy issues’ are a dominant factors in the health of these systems, particularly relating to water quality. A package of commitments has been provided to address both legacy water quality issues as well as future risks to the system from the proposed development.

The Western Australian Government is committed to a whole-of-catchment approach to nutrient management for the Swan Canning and Peel-Harvey systems which will see the implementation of targeted actions guided by Water Quality Improvement Plans.
For the Peel-Harvey system, a Water Quality task force will be established to act as a coordinating body to oversee roles, responsibilities and actions relating to protection of the environmental values of the Peel-Harvey system and a planning mechanism is proposed to prevent high nutrient export activities on soils with a low phosphorus retention capacity. A number of additional commitments relating to the Peel-Harvey system are provided for in Action Plan F of the Strategic Conservation Plan, including the establishment of the Peel Regional Park and expansion of Yalgorup National Park and the implementation of a monitoring program including limits of acceptable change.

Specific nutrient management measures proposed to address eutrophication issues for the Swan Canning and Peel-Harvey systems include targeted mandatory soil testing on the coastal plain, drainage intervention in the Peel-Harvey catchment, continuation of bagged fertiliser regulations, promotion of the use of soil amendments and improving the knowledge and tools available for decision making.

Any intensification of land-use is linked to an increased risk of contamination and this will be the case where land-use change is proposed within the Advice Area. This risk will be managed through existing processes which can require conditions on certain developments and provide mechanisms for the management of contaminated sites and acid sulfate soils. In the case of sensitive P1 areas of the Gnangara Public Drinking Water Source Area, acceptability will be determined through a transparent analysis of land and water factors.

Modernised legislation will help ensure that the EPA’s objectives for hydrological regimes and inland water environmental quality can continue to be met into the future as development within the Advice Area takes place.

**Air quality and atmospheric gases**

Monitoring indicates that Perth air quality is good, with occasional exceedances of national standards caused by major wildfires which along with wood fire burning for heating and vehicle emissions, are the main causes of detrimental air quality. Key impacts to air quality from future development relate to industrial and transport pollutant emissions in the context of overall airshed capacity, and the effects of dust emissions.

The inclusion of passenger light and heavy rail infrastructure combined with urban consolidation supports a more compact urban form for a larger population, and the expected improved uptake of public transport will lead to avoidance of air emissions from vehicles on roads. In support of this, a commitment has been made to continue to implement and support behaviour change and awareness programs in order to encourage increased uptake of active travel and public transport. The Western Australian Government will develop and implement long-term integrated transport planning for the Perth and Peel region that ensures transport and land use planning strategies are complementary in identifying measures to reduce traffic congestion and improve air quality.

Existing permitting and planning measures to manage air quality are generally adequate but need broader spatial coverage and implementation, with mitigation proposed that would expand air quality monitoring, extend the application of the Perth Air Quality Management Plan to the Peel region, and determine and implement a buffer policy to separate emissions sources in industrial areas from sensitive land uses such as residential areas. These mitigation actions will serve to improve the knowledge of the current state of air quality and, along with an update to the Perth Emissions Inventory, will inform strategic land use planning.

An assessment framework for determining cumulative air emissions from proposed industrial areas within the Perth and Peel regions will be developed to facilitate future consideration of the acceptability of air quality impacts.
No specific airshed modelling under future growth scenarios has been undertaken and specific modelling for individual activities (e.g. industrial facilities, wastewater treatment plants) is beyond the scope of the strategic assessment. A quantitative determination of the impacts to air quality has therefore not been possible. However, the proposed mitigation and management measures put forward in Action Plan G of the Strategic Conservation Plan address key gaps in current management measures for air quality in the Perth and Peel region. Combined with avoidance already achieved, implementation of these measures will mean that the EPA's objective for Air Quality can be met over time.

**Human health and Amenity**

Key impacts to human health and amenity relate to noise and odour, the loss of urban tree canopy resulting in enhanced urban heat island effect, and increased mosquito and mosquito borne diseases. Removal of East Keralup from the development footprint avoids potentially substantial health and amenity risks from mosquitos.

Enhanced urban heat island effect, combined with future climate change is a significant potential impact on health and amenity, particularly in respect of the central sub-region where considerable urban consolidation is proposed. Mitigation is provided that will see further investigation of urban heat island vulnerabilities to enable improved understanding and management of the issue. This would include investigation of barriers to minimising heat island effect through design and where such barriers exist, how they might be remedied.

Green space and tree canopy cover are recognised as key components of future development both in relation to minimising the urban heat island effect as well as contributing to health and amenity in a variety of other ways. A commitment has been made to develop a framework for maintaining or enhancing a network of green space and tree canopy cover in order to support these values. Monitoring and reporting of urban tree canopy cover will support local governments to track and evaluate effectiveness of the framework and associated activities.

Noise and odour impacts are proposed to be mitigated through determination and implementation of buffers around strategic industrial areas and development of further policy to guide implementation.

A quantitative determination of the impacts to human health and amenity has not been possible however, the proposed mitigation and management measures put forward in Action Plan G will ensure a strategic approach to the buffers necessary to mitigate noise and odour impacts, and establish an adaptive response to the urban heat island effect. Combined with substantial avoidance already achieved, implementation of these measures will mean that the EPA's objectives for Human Health and Amenity can be met over time.

**Marine environmental quality**

The footprints identified for future development in the Advice Area avoid the marine environment entirely and the activities being considered under the Strategic Assessment will not have any direct impact on the marine environment. Increased nutrient and contaminant movement from land based activities into the marine environment via surface water / stormwater and groundwater inflow and aerial deposition, is the key risk identified.

A quantitative determination of the impacts has not been possible, particularly given that impacts will be cumulative, with other more direct impacts resulting from future developments and activities that are not covered under the strategic assessment.

Existing processes and policies will contribute to reducing the risk of pollutants ending up in the marine environment. Commitments presented in relation to Air and Water factors, including updates to Better
Urban Water Management and expansion of the air quality monitoring network and Management Plan, will also strengthen the protection of marine environmental quality.

The Environmental Quality Management Framework described in Environmental Assessment Guideline 15 (EPA 2015) provides a structure through which to determine whether environmental quality objectives are being met. Cockburn Sound is currently the only location where the Environment Quality Management Framework has been fully implemented through the development of water quality criteria and implementation of a Management Plan to guide adaptive management.

Potential impacts to marine environmental quality are particularly pertinent for Cockburn Sound, which due to its semi-enclosed nature and limited flushing, along with historical industrial discharges and the high intensity land-uses within its catchment, has experienced perhaps the most significant water quality issues of any area along the coast of the Advice Area. Industrial expansion within the Cockburn Sound catchment presents the greatest risk to additional nutrient and contaminant inputs to the Sound (additional urban and rural residential development being minimal), however the exact impact to marine environmental quality from activities is difficult to predict at this stage of planning and needs to be seen within the context of the cumulative effects of all direct and indirect contaminant sources entering the marine environment.

Strengthening the Cockburn Sound State Environmental Policy is proposed as the best way to ensure future adaptive management can address his uncertainty. A commitment is made to update the policy to improve adaptive management, monitoring and reporting requirements, to ensure protection of the values of Cockburn Sound.

Outside of Cockburn Sound, a commitment has been made to facilitate the development of marine environmental quality criteria across the broader Perth and Peel coastal regions through a review and extension of the framework established by Perth’s Coastal Waters: Environmental Values and Objectives (EPA 2000). This would provide the means to identify and then manage key areas of uncertainty identified in the impact assessment, and to inform environmental impact assessment and ongoing management programs for the entire Advice Area coastal region.

Full implementation of this framework will provide appropriate environmental protection outcomes for marine environmental quality and will mean that the EPA’s objective for marine environmental quality can be met in the future, as development within the Advice Area takes place.

**Ongoing environmental management**

The outcomes of the strategic assessment and in particular the Strategic Conservation Plan will be implemented over a long period (30 + years). An environmental management framework has therefore been developed to drive the implementation of commitments, adapt them as new information becomes available, and to monitor and report on progress.

The responsibility for implementing the commitments to mitigate impacts to environmental factors contained in Action Plan G of the Strategic Conservation Plan lies with the Western Australian Government. Implementation will be coordinated by an over-arching Executive body reporting to a select group of State Government Ministers. This body will facilitate partnerships with local government associations, government and non-government service providers, developers, landowners, Noongar groups and other community representatives to effectively deliver the Strategic Conservation Plan. It will have responsibility for the implementation, review and revision of the Action Plans of the Strategic Conservation Plan including the governance framework.

These arrangements will be supported by an assurance framework, ensuring that the Action Plans that are part of the Strategic Conservation Plan are delivered and the outcomes, objectives and
commitments for both State and Commonwealth values are achieved. The assurance framework comprises a monitoring program, compliance program, annual reporting, five yearly review, and dispute resolution. Monitoring and compliance outcomes will provide input to annual reporting and five-yearly review to ensure Action Plans and supporting processes are updated and improved as necessary.
1 INTRODUCTION

1.1 OVERVIEW

The Western Australian Government is planning for the future development of the Perth and Peel regions to accommodate a population of 3.5 million. Planning to achieve this objective has been outlined originally in Directions 2031 and Beyond\(^1\) followed by the more recent Perth and Peel@3.5 million (draft) and associated strategic land use planning frameworks\(^2\).

A strategic assessment of this planned future development has been conducted, comprising 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.
3. Parallel consideration of State (Western Australian) environmental matters under the Environmental Protection Act 1986 (EP Act).

This document is the Impact Assessment Report (IAR) addressing environmental matters relevant to the State. The IAR has been prepared to assist the Western Australian Environmental Protection Authority (the EPA) to provide strategic advice to the Western Australian Minister for Environment under section 16(e) of the EP Act. The IAR presents an environmental review and impact assessment of the planned future development of the Perth and Peel region subject to the Strategic Assessment. Management measures for key environmental factors have been identified and included in the assessment.

This IAR should be read in conjunction with the other two key documents: the Strategic Conservation Plan for the Perth and Peel regions, and the Strategic Impact Assessment Report on MNES (the Commonwealth IAR). Threatened species and communities and other relevant matters that are protected under Commonwealth legislation are dealt with substantively in those reports rather than this IAR.

\(^1\) A high level spatial framework and strategic plan that establishes a vision for future growth of the regions.

\(^2\) Perth and Peel@3.5 million (draft) is series of detailed draft planning frameworks presenting long-term growth strategy for land use and infrastructure for the Perth and Peel regions released for public consultation.
1.2 BACKGROUND TO THE OVERALL STRATEGIC ASSESSMENT

Significant growth is projected for the Perth and Peel regions over the coming decades. Based on current projections, the estimated population of the Perth and Peel regions is expected to reach 3.5 million by 2050.

The Western Australian Government is planning for the future development and population growth of the Perth and Peel regions. Directions 2031 and Beyond, a high level spatial framework and strategic plan, established a vision for future growth of the regions. To realise the vision encapsulated in Directions 2031 and Beyond, and the State Planning Strategy 2050, the Western Australian Planning Commission (WAPC), through the Department of Planning (DoP) has created a series of detailed draft planning frameworks with a unified, long-term growth strategy for land use and infrastructure for the Perth and Peel regions. This series, titled Perth and Peel@3.5 million, has recently been subject to public consultation.

It is recognised that Perth and Peel regions support significant environmental values. Important environmental, social and economic benefits may also be derived from implementing Directions 2031 and Beyond and the subsequent planning frameworks of Perth and Peel@3.5 million. The Western Australian Government wishes to secure greater certainty around the environmental acceptability of this future development for an expanded population, and achieve strategic solutions to regional conservation needs. To this end, the Strategic Assessment of Perth and Peel Regions (the Strategic Assessment) has been initiated.

In July 2011, the Western Australian Ministers for Planning and Environment and the Commonwealth Minister for the Environment agreed to undertake a Strategic Assessment of the Perth and Peel regions of Western Australia (see Appendix A).

The strategic assessment process is being led by the Department of the Premier and Cabinet (DPC) in partnership with the Commonwealth Department of the Environment (DoE). At a State level, DPC is working closely on the Strategic Assessment with DoP, Department of Parks and Wildlife (Parks and Wildlife), Department of Water (DoW), Department of Environment Regulation (DER), Department of Mines and Petroleum (DMP) and the Office of the Environmental Protection Authority (OEPA).

The key objectives of the Strategic Assessment are to:

- significantly reduce the need for project by project assessment under the EP Act and the EPBC Act in the Perth and Peel region;
- deliver an effective long term and strategic response to key environmental issues in the Perth and Peel region, for example, Carnaby’s cockatoo and water quality in the Peel-Harvey Estuary;
- provide certainty for conservation of key environmental values;
- 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; and
- provide greater certainty in terms of long term land supply to meet the needs of a city of 3.5 million.
The strategic assessment provides the opportunity to avoid, mitigate and offset the impact of future development at a strategic scale and consequently achieve long term environmental and conservation outcomes. An outcome of this process will be the implementation of a long term and strategic response to MNES and state environmental values, in place of the fragmented approach of developing offsets on a project by project basis.

The strategic assessment looks beyond medium term population growth, and examines the environmental impacts of the Perth and Peel regions growing to 3.5 million and how these impacts can be avoided, mitigated or managed. The assessment focuses on the potential impacts from future:

- urban, industrial and rural residential development;
- infrastructure development;
- extraction of basic raw materials; and
- in the case of the Commonwealth assessment only, harvesting of pines.

The Commonwealth (EPBC Act) and State interests in the Strategic Assessment are dealt with in separate impact assessment reports and have different spatial extent. The area relevant to the State IAR (the Advice Area) is shown in (Figure 1-1).

1.3 FRAMEWORK FOR THE STATE ASSESSMENT

This IAR addresses environmental matters relevant to the State and has been prepared to assist the EPA to provide Strategic Advice to the Western Australian Minister for Environment under section 16(e) of the EP Act. Under these provisions the EPA functions to provide advice to the WA Minister for Environment on environmental matters generally, and on any matter referred by the Minister.

The EPA has been asked by the Minister to provide advice in relation to:

- the strategic environmental implications of the proposed future development for a city of 3.5 million people as outlined in the draft sub-regional planning frameworks developed by DoP and WAPC; and
- the policy and guidance that can be used to optimise subsequent approval processes to ensure environmental outcomes are delivered in the most efficient and timely manner.

Outcomes of Strategic Advice under section 16(e) processes are aimed at influencing State Government decision making rather than assessing the actions of individual proponents and developments. The EPA will provide advice to the Minister on whether it believes environmental objectives can be met in delivery of future development to accommodate an expanded Perth-Peel population through the measures set out Directions 2031 and sub-regional structure planning. The section 16(e) process is distinct from the assessment of strategic and derived proposals envisaged under Part IV of the EP Act; however, the flexibility afforded to section 16(e) means that the EPA's advice can be used to optimise subsequent approval processes to achieve similar ends.
In November 2013 the EPA wrote to DoP providing an Environmental Scoping Document for the finalisation of the sub-regional structure plans. As the future development subject to strategic assessment is articulated through the sub-regional structure plans, the EPA’s Environmental Scoping Document has been used to guide the preparation of the State IAR.

The EPA issued interim strategic advice on 7 August 2015 (EPA 2015a). This interim advice provided direction on key environmental issues and threats identified by EPA in relation to planning for a city of 3.5 million. This interim advice has also guided the preparation of the State IAR.

Following public review of the State IAR, the Strategic Conservation Plan (with its various associated Action Plans and the Commonwealth IAR), it will be finalised and the EPA will issue its final advice. The final advice will determine the acceptability of the impacts identified through the State IAR, as well as the State’s proposed avoidance, mitigation and management measures.

The overall relationship between the Commonwealth IAR, State IAR, the EPA’s section 16(e) advice and the key strategic planning processes is shown in Figure 1-2.
1.4 CURRENT STATUS OF THE STATE ASSESSMENT

The current status for the preparation of this IAR and the EPA’s Strategic Advice is shown in Table 1.1.

Table 1.1: Current status of the IAR and EPA’s Strategic Advice

<table>
<thead>
<tr>
<th>Process step</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Agreement between the Australian Government and Western Australian Government to undertake a comprehensive strategic assessment of the Perth and Peel Regions of Western Australia.</td>
<td>Completed in July 2011. See Appendix A of the Commonwealth report for a copy of the agreement.</td>
</tr>
<tr>
<td>• Sub-regional planning frameworks for Perth and Peel region</td>
<td>Released May 2015 for public comment until 31 July 2015.</td>
</tr>
<tr>
<td>• Interim section 16(e) strategic advice (EPA)</td>
<td>Released August 2015</td>
</tr>
<tr>
<td>• Preparation of the draft Strategic Conservation Plan and associated Action Plans.</td>
<td>Completed</td>
</tr>
<tr>
<td>• Preparation of the draft State IAR</td>
<td>Completed</td>
</tr>
<tr>
<td>• Public comment period for Strategic Conservation Plan and State IAR</td>
<td>Current</td>
</tr>
<tr>
<td>• Revision of the Strategic Conservation Plan based on public comments (EPBC Act provisions).</td>
<td></td>
</tr>
<tr>
<td>• Finalised sub-regional structure plans</td>
<td></td>
</tr>
<tr>
<td>• Finalisation of the Strategic Impact Assessment Report</td>
<td></td>
</tr>
<tr>
<td>• EPA Final Strategic Advice (section 16(e))</td>
<td></td>
</tr>
<tr>
<td>• Endorsement of the Strategic Conservation Plan (EPBC Act provisions).</td>
<td></td>
</tr>
<tr>
<td>• WA Government response to Strategic Advice with agreed commitments</td>
<td></td>
</tr>
<tr>
<td>• Implementation of the Strategic Conservation Plan and agreed commitments</td>
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</tr>
</tbody>
</table>

1.5 SCOPE OF ASSESSMENT

Through the Environmental Scoping Document and interim strategic advice, the EPA provided guidance on the scope of activities to be considered in this IAR. The basis for this scope is the following ‘classes of action’ agreed upon between the State and the Commonwealth in the Strategic Assessment Terms of Reference:

- Urban.
- Industrial.
- Rural residential.
- Infrastructure.
- Basic raw materials.
Within these classes of action, the EPA has identified a narrower suite of activities on which it wishes to provide advice. In a general sense, this serves to exclude areas with existing urban or industrial zoning which may have been referred and assessed by the EPA previously. More detail on the activities which have been considered in the State IAR is provided in Section 2.4. These activities are referred to throughout this document as ‘footprints’ or future/planned development. For example, the ‘Urban footprint’ or future urban development under the State IAR is a sub-set of the activities considered by the Commonwealth in the Urban class of action (Urban CoA) (as described in the Strategic Conservation Plan and associated Action Plans).

The EPA has advised that they will not provide advice on the Pines class of action (Pines CoA) being considered under the Commonwealth assessment. The harvesting and removal of pines that is being assessed in regards to its impacts to Carnaby’s cockatoo in the Commonwealth IAR is considered already approved by the State and is therefore not within the scope of the State IAR. The implications of pines removal in regards to water management on the Gnangara Mound will be part of the EPA’s consideration when looking at future impacts to water resources from an increase in population to 3.5 million. Due to this difference, the boundary within which the EPA will provide advice is limited to the Metropolitan Region Scheme (MRS) and Peel Region Scheme (PRS) boundary only. This differs to the subject area of the Commonwealth strategic assessment, which extends to the north of the MRS boundary to include additional pine plantations (Figure 1-1).

Cumulative impacts resulting from other reasonably foreseeable future proposals extending beyond the above footprints have been considered in this assessment. The influence of climate change projections on potential impacts has been included in the assessment where relevant through quantitative and qualitative analysis using climate projections for the south-west region. The approach taken for this is explained further in Section 3.4.2 and addressed in relevant impact chapters.

Consistent with the EPA’s scoping advice, the scale of spatial analysis appropriate for a strategic assessment, and the level of detail on future activities available at this level of planning, point source discharges of pollution or emissions and some other activities have not been included in the IAR. These exclusions are detailed in Section 2.5.

1.6 APPROACH AND STRUCTURE OF THIS REPORT

This IAR has been prepared to assist the EPA to provide Strategic Advice to the State Minister for Environment under section 16(e) of the EP Act. The purpose of the IAR is to present an environmental review of the future development to support an increase to 3.5 million people, including impact assessment and proposed management measures for key environmental factors, consistent with the Environmental Scoping Document prepared by the EPA. The intent of this process is to provide clarity and certainty regarding acceptable outcomes for State environmental values within the Perth and Peel regions. The approach also provides opportunities to minimise duplication of approval requirements for individual development projects and a framework for provision of strategic conservation and environmental outcomes across the Perth and Peel regions.

The State IAR outlines the direct, indirect and cumulative environmental impacts and the State’s proposed avoidance, mitigation and management measures to minimise the environmental impact of the future development within the region. The impacts and measures to minimise impacts are outlined as they relate to the EPA’s environmental factors and objectives.
The structure of this IAR is presented in Table 1-2.

Table 1-2 Structure of the IAR

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
<td>Overview of the proposal, proponent and purpose and scope of the IAR and relationships with the Commonwealth IAR.</td>
</tr>
<tr>
<td>2. Description of future development</td>
<td>The background, context and approach to the planning underlying development of sub-regional structure planning and description of the future development under consideration.</td>
</tr>
<tr>
<td>3. Existing environment</td>
<td>Overview of the existing environment of the Advice Area.</td>
</tr>
<tr>
<td>5. to 10. Assessment of potential impacts</td>
<td>Assessment of the potential environmental impacts of the proposal on the identified environmental factors, including management measures and predicted outcomes.</td>
</tr>
<tr>
<td>11. Environmental management framework</td>
<td>Description of the proposed environmental management framework, including implementation and governance.</td>
</tr>
</tbody>
</table>
2 DESCRIPTION OF THE FUTURE DEVELOPMENT

2.1 PLANNING FRAMEWORK

2.1.1 Directions 2031 and Beyond

In 2010, the Western Australian State Government released Directions 2031 and Beyond (Directions 2031), a high level strategic plan and associated spatial framework to guide development policy and planning. Directions 2031 addressed population growth scenarios for the Perth and Peel regions over a 20 year timeframe with a focus to accommodate an additional half a million people by 2031 and a population of 3.5 million after 2050.

Specifically, Directions 2031 set future direction on:

1. Sustainable resource (land, water, energy) use in the context of a growing population.
2. The location of development, land use patterns and transport arrangements.
3. Areas requiring protection to retain high quality natural environments and resources.
4. Infrastructure requirements to support the predicted growth.

Five strategic themes of the plan were developed. These themes include a city that is liveable, prosperous, accessible, sustainable and responsible, and elements of environmental protection and conservation have been in-built into the objectives and strategies that support these themes.

Direction 2031 is also underpinned by three structural elements that form the spatial framework of the plan. This includes an activity centres network, a movement network and a green network. The green network is designed to support biodiversity, preserve natural amenity and protect valuable natural resources. It includes an array of parks, Bush Forever areas, wetlands, reserves, state forests and conservation areas.

2.1.2 Sub-regional Planning Framework

In order to implement the objectives of Directions 2031, a suite of documents have been subsequently developed under the banner of Perth and Peel@3.5 million, an overarching document that builds on the vision set out in Directions 2031. It is supported by four sub-regional planning frameworks that define the spatial plan of the Perth and Peel regions for the next 35 to 40 years.

- North-west sub-regional planning framework.
- North-east sub-regional planning framework.
- Central sub-regional planning framework.
- Southern Metropolitan Peel sub-regional planning framework.

The draft frameworks provide guidance on where sustainable development should occur over the next 35 to 40 years to ensure the impact of urban growth on areas of environmental significance is minimised; to protect our heritage; while maximising the benefits of available land and existing
infrastructure. A more detailed description of the future development footprints flowing from the sub-regional planning frameworks is provided in Section 2.4 and the boundaries of the sub-regions are shown in Figure 2-1.

Upon completion of the public review phase, the sub-regional planning frameworks will be finalised. These frameworks will be recognised under the State Planning Framework (State Planning Policy No.1) and taken into account when preparing and reviewing strategies, policies and plans. They will provide guidance to government agencies and local governments on land use, land development, environmental protection, infrastructure investment and the delivery of physical and social infrastructure.

Importantly when finalised, the sub-regional planning frameworks will guide the MRS and the PRS. These are the statutory planning schemes for the Perth and Peel regions and principal statutory mechanisms for implementing future strategic land use and infrastructure proposals. They provide for land (and water) acquisition for public purposes such as regional open space, public uses and infrastructure. Local government planning (including local planning schemes) is required to be consistent with the broad land uses under the MRS and PRS.

This IAR has used the boundaries of the MRS and PRS to define the spatial extent (the Advice Area) of the impact assessment.

The overall framework for State and regional planning is described in Figure 2-2.
Figure 2-1: Sub-regional framework areas

Legend
- Advice Area
- Central sub-region
- North-east sub-region
- North-west sub-region
- South Metropolitan Peel sub-regions

Datum/Projection: GDA 1994 MGA Zone 50
Data Source: DoP
Prepared by: SM Date: 17/11/2015
2.2 AVOIDANCE DURING THE PLANNING PHASE OF FUTURE DEVELOPMENT FOOTPRINTS

Development of the Strategic Conservation Plan has offered the opportunity to undertake significant avoidance of impacts to environmental factors. Planning at the scale of the Advice Area enables holistic consideration of avoidance measures in the context of the overall landscape and regional values. This is often not practical through a site by site development process at the local scale.

This section provides a description of avoidance processes conducted during the footprint planning phase and the general benefits they will provide for environmental factors.

It is considered that the final development footprint provides a sustainable urban form for Perth and Peel in keeping with the aspirations of Directions 2031 to accommodate the forecasted 1.86 million additional people who will require 802,534 dwellings in the next 40 to 50 years. It will produce a connected city urban form outcome, which promotes a balance between greenfield and infill development whilst protecting and enhancing the natural environment.

Avoidance through the planning phase of the Strategic Conservation Plan has occurred across each of the future development footprints for the activities being considered by the EPA.

2.2.1 Urban and Industrial development

Following the release of Directions 2031 and the draft central and outer metropolitan sub-regional strategies 2010, DoP commenced the production of draft sub-regional frameworks for the Perth and Peel regions. To provide a uniform basis for the draft frameworks and the need to meet the aspirations of Directions 2031, there was a need to create an urban footprint for a city of 3.5 million people. Directions 2031 was based on a 25 year land supply outlook (to the year 2035) and not for a city of this
size. The subsequent Outer metropolitan Perth and Peel sub-regional strategy contained a draft plan to meet a land supply timeframe of 25 years (identifying 10,300 ha of urban expansion areas), and estimated (but did not spatially define) that a total of 20,300 ha of land would be needed to accommodate 3.5 million.

The challenge has been to retain the liveability of Perth and Peel and to identify the optimal location of new urban and industrial development whilst having regard to environmental values, existing planning policy aspirations, housing affordability considerations, the cost of maintaining or extending infrastructure, the avoidance of externalities such as pollution and the need to produce a consolidated urban form with more space intensive housing located close to work places, public transport, shops and community services.

The initial planning of the development footprint required to accommodate a population of 3.5 million building on the draft 25 year land supply urban expansion plan resulted in a total of approximately 27,000 ha of urban expansion land identified as being suitable for more detailed analysis. Following the creation of this footprint, DoP undertook further scenario planning to consider what urban form outcome would most closely align to Directions 2031 aspirations, namely, developing Perth and Peel into a denser and more diverse city predicated on assumed savings to Government and the community from a more compact urban form. This resulted in three new scenarios, these being the dispersed, semi-polycentric and polycentric cities. This was subsequently used as a basis to develop additional urban footprint options initially by DoP and then through a systematic and detailed footprint planning process supported by State and Commonwealth agencies as part of the Strategic Assessment project (Figure 2-3).

The initial footprint reflected a modified version of the dispersed city growth option. It provided a starting point and enabled an examination of the environmental and planning implications for the footprint. This analysis became known as EIA 1 (Environmental Impact Assessment 1). A total of 71 urban expansion precincts were included in EIA 1 and it was identified as potentially accommodating a population of approximately 3.95 million people or a total capacity of 1.5 million dwellings. The environmental impact and planning assessment for this footprint showed that it was environmentally compromised (in terms of impacting significantly on State and Commonwealth values) and that from a planning point of view was unsustainable. It was recognised that it did not reconcile completely with Directions 2031 aspirations, which promotes a compact and connected urban form.

EIA 1 was then successively refined by strategically employing infill and other land allocation options so as to shift towards the preferred connected city growth option. At each successive refinement, analysis of future dwelling supply was conducted to evaluate the capability of the footprint to deliver the required housing supply for 3.5 million people. This included a shift in approach in identifying suitable urban expansion precincts such as to identify growth areas displaying medium to high urban values, creating a logical and efficient extension of the existing urban form and to remove urban growth precincts that were compromised from a planning and environmental perspective. Subsequent key milestones in this process were termed EIA 2 and EIA 3 (Figure 2-3).

The EIA 3 option had a number of iterations and incorporated a footprint planning process that considered the potential impacts to environmental factors and the measures that could be put in place to protect/avoid these assets. Footprint boundaries were adjusted to avoid environmental assets and to incorporate land that is better suited for development or might provide an improved development footprint. During this process, approximately 4,000 ha of rural land previously earmarked for urban and industrial expansion area was excluded due to conflicts with conservation significant fauna values, principally, Carnaby’s cockatoo habitat.
The footprint was subsequently further refined to develop the final EIA 3 development footprint for 3.5 million, which is the basis for the draft sub-regional frameworks and the subject of this assessment.

The final development footprint has a capacity of 3.7 million people and urban expansion areas account for approximately 11,121 ha compared to 25,696 ha for EIA 1 (Figure 2-4). In terms of the source of additional dwelling supply, the majority of capacity will be sourced from infill development (47 per cent), followed by undeveloped urban and urban deferred land (36 per cent) and lastly urban expansion (now only 17 per cent compared to 34 per cent for EIA 1). This shows that over the course of its development, the quantity of urban expansion land in the development footprint has been halved.

Areas of industrial expansion were originally derived from the Economic and Employment Land Strategy 2012 which focused on land for general and light industrial needs within the boundaries of the Perth and Peel regions as defined by Regional Schemes. There has been a minor reduction (7 per cent) in the quantum of industrial land (from 12,392 in EIA1 to 11,532 ha in the final EIA 3 footprint) through rationalisation in the footprint planning phase using relevant environmental and planning constraints (Figure 2-4).

The described process is estimated to have avoided large areas of remnant vegetation and habitat reducing the potential maximum clearing for urban and industrial expansion areas from 6,148 to 2,735 ha.

Figure 2-3: Reduction in urban expansion footprint as a result of avoidance process
Figure 2-4: Reduction in urban and industrial development footprint for a city of 3.5 million through avoidance process
East Keralup

Consideration of the urban footprint during the review phases of EIA 3 and finalised footprint also involved re-consideration of the proposed East Keralup development. This was a proposed large scale urban development centred on 3000 ha of land at Keralup purchased by the Western Australian Government in 1991 to provide future housing opportunities in the south west corridor (10 km to the north-east of Mandurah). A master planning exercise for future development was undertaken by the then Department of Housing and Works in 2007 and this was subject to separate section 16(e) advice by the EPA in 2008. The EPA indicated in its advice that there were significant issues concerning the management of water quality and drainage within East Keralup and the potential impact on water quality in the Peel Harvey catchment that would be caused by drainage from East Keralup (EPA 2008a).

The Western Australian Government made a decision to remove the East Keralup element of the future urban development footprint in favour of urban development at Gnangara and Pinjar.

2.2.2 Rural residential development

The identification of rural residential land within the Perth and Peel regions has been considered in the context of State Planning Policy No. 2.5 Land Use Planning in Rural Areas (SPP 2.5), which includes specific policy provisions relating to the Perth metropolitan and Peel regions and states that opportunities for rural living within Perth and Peel region may remain static or even decrease.

Rural residential lots are residential in nature and provide alternative lifestyle and housing opportunities, and may also provide a transition between urban and rural areas. However, this form of residential development places additional demand on community and service infrastructure that is difficult to meet. In planning for the provision of dwelling supply to accommodate a future Perth Peel population, no additional provision for rural residential supply has been accommodated beyond that which is already supported.

The key principles of SPP 2.5 in relation to the consideration of rural residential/rural living proposals within Perth and Peel include (but are not limited to):

- the provision of additional rural living proposals by exception;
- proximity to existing urban areas with access to services, facilities and amenities;
- avoidance of priority agricultural land and the introduction of land use conflict;
- proposals being guided by existing land supply and take-up and population projections and avoidance of areas required for urban expansion;
- the avoidance of areas of extreme bushfire risk and any lesser risk being managed without adversely affecting the natural environment; and
- protection of significant biodiversity values and promotion of good environmental, landscape and water management outcomes.

As with future urban and industrial footprints, proposed rural residential development has been subject to preliminary footprint planning, identifying areas supporting environmental values likely to be retained.

Areas of proposed rural residential development were identified on the basis of endorsed or draft strategies or other planning documents, as well as some minor optimisation of existing areas. These
areas were then subject to a further review of potential risks or impacts to significant environmental values (both State and Commonwealth values) as well as the extent of rural residential land currently provided for or proposed.

As part of the identification of future rural residential development to be included in the future development footprint for the Strategic Assessment, a review was undertaken of potential risks or impacts to significant environmental values (both State and Commonwealth values). This review led to the reduction in areas for future rural residential development, consistent with the provisions of SPP 2.5.

A key issue identified in this review was the potential cumulative risk to the water quality of the Peel Harvey Estuary from future rural residential development within its catchment. DoW has modelled the potential nitrogen and phosphorus inputs that would result from the rural residential areas identified within the Peel Harvey catchment (but not yet re-zoned) and estimated that the identified developments could result in an additional 86,981 kg/year of nitrogen inputs and 27,987 kg/year of phosphorous inputs. Four proposed sites resulted in the majority of the estimated increase in nutrient inputs (86,052 kg/year nitrogen and 21,208 kg/year phosphorous). In consideration of these potential impacts, and of other strategic planning considerations, such as the existing supply of rural residential land in the area, and the efficient provision of services and amenities, these sites were excluded from the rural residential future development footprint.

2.2.3 Basic raw materials extraction

Planning for the basic raw materials (BRM) future development footprint has incorporated two key avoidance steps:

1. Strategic location of areas for BRM extraction.
2. Detailed master planning within the nodes to avoid significant environmental impacts.

Location of BRM extraction areas

One of the key outcomes of planning for the BRM future development footprint was the identification of Significant Geological Supply (SGS) nodes. These nodes are groupings of strategically-located BRM resources that are sufficiently large to supply the development outlined in the Strategic Conservation Plan.

Identification of the nodes was driven by the following factors:

- resource size;
- resource quality;
- environmental and planning considerations; and
- proximity to the main areas of development in the Advice Area.

This approach resulted in consolidated planning for BRM extraction and the avoidance of ad hoc development of BRM resources across the Advice Area. Importantly, most of the SGS nodes already contain clusters of operating quarries.

In addition to the SGS nodes, a number of existing or planned BRM extraction operations are included in the proposed development. Whilst smaller in size, and hence most likely duration, these quarries provide important local supplies of BRM and in some cases provide for specific market niche products.
**BRM master planning**

**SGS nodes**

Within the SGS nodes, detailed master planning was undertaken. This was a collaborative exercise between the relevant State agencies (the DPC, DER, Parks and Wildlife, DoP, DMP and the OEPA). It aimed to take a balanced approach to the allocation of areas for development and protection of environmental values.

The master planning process for SGS nodes looked at where BRM resources could be maximised in a strategic context based upon:

- location and geology;
- existing extraction impacts;
- consolidation of larger areas of vegetation that supported multiple environmental values;
- retention of ecological corridors; and
- previous environmental and extraction-related approvals.

The potential for offsetting the residual environmental impacts was also a consideration where extraction, and resulting clearing of native vegetation, was considered necessary, such as in the Wanneroo Limestone Node.

Master planning achieved significant avoidance of native vegetation and values in most SGS nodes. A total of 13,000 ha or 40 per cent of the original 32,288 ha extent of the SGS nodes was avoided and excluded from the class of action.

As a result of master planning, only about 11 per cent (or 2,070 ha) of the remaining 19,288 ha of the SGS node areas are now covered by native vegetation. However, the actual area of native vegetation clearing needing clearing approvals within the SGS nodes is less than 1,500 ha due to:

- existing State and Commonwealth environmental clearing approvals;
- the need for further avoidance in selected areas after further survey work is carried out;
- setbacks from infrastructure such as roads with associated screening buffers; and
- other potential land access issues (e.g. private land, heritage etc.).

The BRM footprint now only includes new extraction areas and expansion of existing quarries within specified locations, and is divided into these three areas:

- **Future Resource Extraction Area**: Those areas within the Spatial Plan where vegetation clearing for BRM extraction will be approved subject to compliance with required measures, including rehabilitation and offsets, under the Strategic Conservation Plan. A proposal conforming to the identified Future Resource Extraction Area will still require other statutory extraction-related approvals and other environmental approvals where applicable (e.g. buffers, works approvals, water licensing).

- **Further Investigation Area**: Those areas within the Spatial Plan where there is currently insufficient information to define either a Future Resource Extraction Area or Exclusion Area. Further investigation (including the identification of Commonwealth and State environmental...
values) is required to determine if these areas or parts of them are suitable as Future Resource Extraction Areas.

- **Exclusion Area**: Those areas within the spatial plan where, for the purpose of meeting the objectives of the Strategic Conservation Plan, there shall be no BRM resource extraction.

**Other BRM extraction areas**

Existing or planned quarries outside of SGS nodes were also subject to a master planning exercise, again balancing the avoidance of environmental factors against local BRM supply needs. The avoided areas, totalling 2,435 ha, were excluded from the future development footprint. The result is that the existing quarries outside of SGS nodes component of the future development footprint is 2,706 ha in area, down from the original 5,141 ha which was subject to master planning. Within this area, the actual area of native vegetation needing clearing approvals is less than 110 ha due to existing State and Commonwealth approvals and the possible need for further avoidance in selected areas after further survey work is carried out.

**Inter-relationship with urban and industrial expansion**

Critically, in addition to the avoidance measures outlined above, significant efforts were made through the urban and industrial planning process to avoid development in low lying areas that would require excessive BRM for fill, thus reducing the overall BRM supply requirements.

Consistent with the objectives contained in State Planning Policy No. 2.4, proposed urban expansion sites identified as having excessive fill were considered for removal or rationalisation depending on the level of commitment and degree of planning approval. This analysis highlighted the suitability of areas south of Perth and other proposed development sites in the Perth and Peel sub-region.

For example, the decision to remove East Keralup from the future planning of Perth has greatly reduced future BRM needs for the development of the city and therefore been a factor in limiting the BRM footprint. In commenting on the proposed amendments to the City of Rockingham Town Planning Scheme 2 to establish a Special Control Area in Keralup, the EPA advised that extraction of sand for landfill was a significant environmental issue in the Metropolitan region and that 25,000,000 m$^3$ of fill would be required to develop East Keralup using contemporary subdivision design and house building techniques.

**2.2.4 Infrastructure**

The planning for infrastructure is at various stages and the proposed infrastructure network is largely conceptual at this stage. The process of reducing the scale of the urban expansion footprint has significantly reduced the amount of new infrastructure required to service a city of 3.5 million. This has driven a resulting decrease in development footprint for infrastructure and reduction in impacts to environmental factors.

As part of the Strategic Assessment process, an Infrastructure Agency Working Group (IAWG) was established to coordinate the preparation of the conceptual infrastructure network to be put forward in the Strategic Conservation Plan. This involved transport, water and power agencies providing plans for future infrastructure for discussion and examination of opportunities to reduce environmental impacts. Although recognising that the alignments and locations were indicative, the bringing together of this information allowed an immediate process of identification of potential critical issues. This included intersection of corridors with Regionally Significant Natural Areas and Conservation category wetlands.
The IAWG ran a process of examining each of these occurrences, with the responsible agency proposing to change locations and alignments where it was practicable to do so.

The collation of the infrastructure planning also resulted in immediate opportunities for co-location to be identified to reduce development footprints. Co-location of infrastructure involves placing different types of compatible infrastructure in the same area or corridor such as a passenger rail down a major road reserve. The concept mainly applies to the co-location of linear infrastructure in shared corridors, though can also apply to site based infrastructure such as water treatment plants and power substations. A set of co-location principles, which establish known infrastructure incompatibilities and incompatibility mitigation options, has been developed and detailed in Action Plan C to the Strategic Conservation Plan. These principles have guided planning.

This process represents the start of the avoidance measures for infrastructure. The final locations and alignments will generally be subject to future processes of refinement following detailed planning and design to further avoid and minimise impacts to environmental values.

### 2.3 OVERALL OUTCOMES DUE TO AVOIDANCE MEASURES

The combination of these measures has resulted in substantial avoidance of potential impacts to environmental values. Avoidance outcomes that are particularly significant include:

- opting for a future city with a more compact urban form, with a focus on implementing the State's infill policies, which makes more efficient use of land and infrastructure and provides for better connected communities with improved access to services;
- selection of urban and industrial expansion areas that prioritised areas already largely cleared of native vegetation to minimise further losses of biodiversity;
- reducing BRM demand through the preferential selection of future urban and industrial sites that require less fill (i.e. avoiding low lying areas such as East Keralup);
- retention of important vegetation supporting environmental values in urban, industrial and rural residential expansion areas
- limiting growth of new rural residential areas;
- strategically locating BRM nodes and undertaking detailed master planning to avoid impacts;
- co-locating infrastructure corridors and establishing a future process for avoidance around infrastructure design; and
- implementing the 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 2-1 in relation to remnant vegetation. Of particular note, is the avoidance of 3,413 ha of remnant vegetation from the refining of the urban and industrial footprint. In comparison, the finalised footprint for urban and industrial expansion affects 2,735 ha of remnant vegetation in total (a reduction of 55 per cent).
Table 2-1: Summary of outcomes of key avoidance measures

<table>
<thead>
<tr>
<th>Avoidance measure</th>
<th>Area of remnant vegetation avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>During assessment</strong></td>
<td></td>
</tr>
<tr>
<td>Refining urban and industrial footprint (EIA 1 to 3)</td>
<td>3,413 ha</td>
</tr>
<tr>
<td>No further rural residential expansion proposed</td>
<td>Not able to be quantified</td>
</tr>
<tr>
<td>Master planning for BRM</td>
<td>13,000 ha</td>
</tr>
<tr>
<td><strong>Indicative further avoidance</strong></td>
<td></td>
</tr>
<tr>
<td>Avoidance of environmental values through future statutory planning of urban, industrial and rural residential expansion areas</td>
<td>2,200 ha</td>
</tr>
<tr>
<td>Further avoidance within the infrastructure footprint through processes described in Action Plan C</td>
<td>To be determined</td>
</tr>
</tbody>
</table>

2.4  **Future development under consideration**

The following sections detail the activities within the Urban, Industrial, Rural residential, Infrastructure and BRM classes of action on which the EPA will provide advice and on which this impact assessment has been based. These activities are defined by spatial footprints, which are displayed in Figure 2-5 to Figure 2-9.

Chapter 3 of the Strategic Conservation Plan provides further details in regards to the nature of these activities, noting the key differences in footprint between considered under the Commonwealth strategic assessment versus the section 16(e) advice. This is further expanded in each of the Action Plans prepared for the classes of action, which also include a description of the future approvals processes for these activities under the Strategic Conservation Plan.

2.4.1  **Urban footprint**

The urban component of the proposed development incorporates a small amount of existing zoned land, all new urban expansion under the sub-regional frameworks and proposed redeveloped/in-fill urban areas for a city of 3.5 million people. This will include homes and associated employment, education, shopping, commercial, health and civic facilities, light industry, as well as local recreation, open space and cultural areas. These areas will accommodate the construction and use of buildings and other infrastructure for these activities and the provision of essential local services to support these activities such as local roads and utilities.

This development captures the following Region Scheme zones and reserves:

- Urban.
- Urban Deferred.
• Central City Area.
• Regional Centre.
• Civic and Cultural.
• Public Purpose – Car Park.
• Public Purpose – High School.
• Public Purpose – Hospital.
• Public Purpose – Technical School / TAFE.
• Public Purpose – Special Use.

A more detailed description of this development is captured within Action Plan A, recognising that the scope of the assessment under the State IAR does not include already zoned but undeveloped urban areas that the EPA has previously considered. Accordingly, the scope of the State IAR is limited to:

• areas identified for future Urban not yet zoned in a region scheme (urban expansion areas);
• urban consolidation areas within the Central sub-region; and
• undeveloped land zoned Urban or Urban Deferred under the Metropolitan Region Scheme prior to 1996 (not previously assessed under the EP Act) Category 3 sites (see explanation below).

The Urban footprint for this IAR is shown in Figure 2-5. There is opportunity to retain and protect areas of vegetation and habitat within open space within this footprint and not all of this area should be assumed to be cleared. No estimates have been made for likely further avoidance in pre 1996 zoned sites or for urban consolidation activities within the Central sub-region as they have been for urban expansion areas. Processes which will apply to the future rezoning of the land and subsequent development are described in detail in Action Plan A.

**Urban expansion areas**

Urban expansion areas are those areas identified in the Sub-regional Frameworks for future urban use, not yet zoned in a region scheme.

**Urban consolidation activities**

Within the Central Sub-region, particular areas have been earmarked in the Framework documents for the following uses:

• Urban corridor
• Activity centre
• Station precinct

Land identified for one of these three uses has been included in the Urban footprint.

**Pre 1996 zoned urban**

In 1996 the EPA gained the power under the EP Act to assess schemes, enabling environmental factors to be considered at an early stage in the planning process. Notwithstanding this change, there
remains range of undeveloped sites across the Perth Peel region that were zoned Urban or Urban
defered prior to 1996 and have not been referred to or considered by the EPA.

In 2012 the EPA, in partnership with the WAPC undertook a review of these sites to identify those
where significant impact to the environment would be a likely result of future development. Through this
review sites were placed into one of three categories based on the likelihood of significant effects to the
environment.

Category 1 and 2 sites represent those where development is unlikely to have a significant effect if
developed in accordance with existing policies and guidelines. These sites, if referred, would likely be
‘not assessed’. Category 3 sites, of which 12 were identified, are those sites that if developed would be
potentially have a significant effect on the environment. It was considered that these sites, if referred
may have resulted in formal assessment. These twelve Category 3 sites are the sites EPA has advised
it wishes to be included in the scope of this impact assessment and have therefore been included in the
Urban footprint.

2.4.2 Industrial footprint

The industrial component of the proposed development provides for new areas of industrial expansion
land to be rezoned for this purpose and developed to support a city of 3.5 million people. This
incorporates areas for industrial manufacturing activity, storage and distribution of goods and
associated uses and the provision of essential local infrastructure to support these activities such as
local roads and utilities.

The development includes the following Region Scheme zones and reserves:

- Industrial (including proposed new Industrial zone areas or ‘expansion’ and ‘investigation’ sites as
  identified in the draft sub-regional frameworks); and
- Special Industrial (a single location in Kwinana).

A more detailed description of this development is captured within Action Plan A, recognising that the
scope of the assessment under the State IAR does not include already zoned but undeveloped
industrial areas that the EPA has previously considered. Accordingly, the scope of the State IAR is
limited to areas identified for future industrial development not yet zoned Industrial in a region scheme.

The Industrial footprint for this IAR is shown in Figure 2-6. There is opportunity to retain and protect
areas of vegetation and habitat within open space within this footprint and not all of this area should be
assumed to be cleared. Processes which will apply to the future rezoning of the land and subsequent
development are described in detail in Action Plan A.

2.4.3 Rural residential footprint

This component of the proposed future development provides for the allocation and development of
specified new areas of rural residential subdivision/development, including areas that are already zoned
for this purpose but not yet subdivided. Rural residential lots are generally between one and four
hectares in size and are primarily used for rural lifestyle and /or hobby farming activities.

A more detailed description of this development is captured within Action Plan B, with the associated
footprint being considered under this IAR consistent with that for the Commonwealth IAR. It should be
noted that this includes locally zoned Rural residential, including both existing undeveloped and
proposed rural residential and it is likely that it does include some rural residential that the EPA has previously considered under local planning scheme assessments or otherwise.

The Rural residential footprint for this IAR is shown in Figure 2-7. For the purpose of the impact assessment, all vegetation and habitat within this footprint is indicated as potentially being affected but this land use is sympathetic to on-site retention of environmental values and in practice a good portion of rural residential lot areas should not be cleared. A review of previously developed rural residential development indicated that some environmental values can and are retained within this land use, although increasing risks of bushfires has resulted in increased pressures to clear native vegetation, habitat fragmentation and a bias towards retention of canopy rather than the understory.

2.4.4 Infrastructure footprint

This component of the proposed future development incorporates infrastructure likely to be constructed or upgraded across the Perth and Peel regions to support an increase in population to 3.5 million. The planning for this infrastructure is at various stages and the proposed infrastructure network is largely conceptual at this stage. This includes but is not limited to the construction, upgrade and operation of the following infrastructure:

- Transport infrastructure, including that for and associated with heavy passenger rail, light passenger rail, freight rail, and major roads.
- Power infrastructure, consisting of high voltage (330 kV and 132 kV) transmission lines, substations, and terminals.
- Water infrastructure, for potable water production and supply and wastewater treatment/disposal.

A more detailed description of this development is captured within Action Plan C, with the assessed footprint being the same for both the State and Commonwealth IARs.

The conceptual infrastructure footprint for this IAR is shown in Figure 2-8 noting that the final location and alignment of infrastructure will generally be subject to a future process of refinement following detailed planning and design to further avoid and minimise impacts to State and Commonwealth environmental values. Refer to Action Plan C of the Strategic Conservation Plan for details in regards to this process.

2.4.5 BRM footprint

This development is for the extraction of basic raw materials needed for the continuing development of the Perth-Peel region to support a population of 3.5 million. It incorporates both extensions to existing operations and potential new operations at specified locations.

A more detailed description of this development is captured within Action Plan D. The BRM footprint is consistent with the footprint being assessed under the Commonwealth IAR.
Figure 2-5a (north): Urban footprint for the State IAR

**Legend**
- **Advice Area**

**Current Zoning**
- Industrial
- Parks & Recreation
- PP - Commonwealth
- Rural
- Rural - Water Protection
- State Forests
- Urban Zoned Pre 1996

**Urban Consolidation**
- Activity centre
- Station precinct
- Corridor

Datum/Projection:
- GDA 1994 MGA Zone 50

Data Source: DoP

Prepared by: SM  Date: 17/11/2015
Figure 2-6a (north): Industrial footprint for the State IAR

Legend

- Advice Area
- Current Zoning

MRS/PRS current at 28/10/2014

- PP - Commonwealth
- PP - Special Uses
- PP - Water Authority
- Parks & Recreation
- Parks & Recreation
- Rural
- State Forests
- Urban
- Urban Deferred

Datum/Projection:
GDA 1994 MGA Zone 50

Data Source: DoP

Prepared by: SM     Date: 17/11/2015

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

Data Source: DoP

Prepared by: SM     Date: 17/11/2015
Figure 2-6b (south): Industrial footprint for the State IAR

Legend
- Advice Area

Current Zoning
- MRS/PRS current at 28/10/2014
  - PP - Special Uses
  - Parks & Recreation
  - Rural
  - Urban
  - Urban Deferred

Datum/Projection:
- GDA 1994 MGA Zone 50

Data Source: DoP

Prepared by: SM     Date: 17/11/2015
Figure 2-7: Rural residential footprint for the State IAR

Legend
- Advice Area
- Rural Residential

Datum/Projection:
GDA 1994 MGA Zone 50

Data Source: DoP

Prepared by: SM  Date: 17/11/2015
Figure 2-8a (north-west): Infrastructure footprint for the State IAR

Legend
- **Advice Area**
- **Water Corp**
  - Stations/Bores
  - Pipelines
- **Western Power**
  - 132 kv and 330 kv Substations
  - Western Power - Transmission Lines
- **Wastewater Treatment Plant**
- **Roads**
  - Existing Primary Roads
  - Proposed Primary Roads
  - Proposed Secondary Roads
- **Rail**
  - Existing Rail
  - Proposed Rail
  - Proposed Rail - Heavy Rail
  - Proposed Rail - Light Rail Depot

Datum/Projection: GDA 1994 MGA Zone 50
Data Source: DoP
Prepared by: SM Date: 26/11/2015
Figure 2-8b (north-east): Infrastructure footprint for the State IAR

Legend

Advice Area
Water Corp
- Stations/Bores
- Pipelines
Western Power
- 132 kv and 330 kv Substations
- Western Power - Transmission Lines
- Wastewater Treatment Plant
Roads
- Existing Primary Roads
- Proposed Primary Roads
- Proposed Secondary Roads
Rail
- Existing Rail
- Proposed Rail
- Proposed Rail - Heavy Rail
- Proposed Rail - Light Rail Depot

Datum/Projection:
GDA 1994 MGA Zone 50

Data Source: DoP

Prepared by: SM Date: 26/11/2015
Figure 2-8d (south): Infrastructure footprint for the State IAR

Legend
- **Advice Area**
- **Water Corp**
  - Stations/Bores
  - Pipelines
- **Western Power**
  - 132 kv and 330 kv Substations
  - Transmission Lines
- **Wastewater Treatment Plant**
- **Roads**
  - Existing Primary Roads
  - Proposed Primary Roads
  - Proposed Secondary Roads
- **Rail**
  - Existing Rail
  - Proposed Rail
  - Proposed Rail - Heavy Rail
  - Proposed Rail - Light Rail Depot

Datum/Projection:
GDA 1994 MGA Zone 50
Data Source: DoP
Prepared by: SM Date: 26/11/2015
Figure 2-9: BRM footprint for the State IAR

Legend

- Advice Area
- Basic Raw Material

Datum/Projection:
GDA 1994 MGA Zone 50

Data Source: DMP

Prepared by: SM     Date: 17/11/2015
2.5 ACTIVITIES NOT CONSIDERED PART OF FUTURE DEVELOPMENT

The EPA has indicated the following issues are outside the scope of its advice:

- Point source discharges of pollutants or emissions would not be considered in its advice for sea, water and air factors. Proposals that involve point source discharges or emissions to the environment will be dealt with on a project by project basis through conventional environmental approval processes.

- Assessment of port infrastructure, fisheries and aquaculture activities are also beyond the scope of its advice. Accordingly, these activities have not been considered in this IAR.

- Canal developments and artificial waterways are covered by WAPC Development Control Policy 1.8 and have also not been considered.

Additionally, this assessment is based on proposed land use changes to accommodate a projected population in the Perth and Peel region of 3.5 million people, as well as the associated resources to both allow development to proceed and to support the employment and lifestyle requirements of that population. The footprint approach employed in this IAR provides a scale or resolution to future development that is appropriate to the strategic nature of the assessment.
3 OVERVIEW OF EXISTING ENVIRONMENT

This chapter provides an overview of the environment within the Advice Area with a focus on the terrestrial, marine and social environment, and climate change. Further description of environmental values and functions associated with environmental factors relating to the terrestrial, marine and social environment can be found in the relevant impact assessment chapters (Chapters 5 to 10).

3.1 TERRESTRIAL ENVIRONMENT

The south-west of Western Australia (WA) is an ecologically unique region which has been identified as one of 35 International Biodiversity Hotspots. To qualify as a biodiversity hotspot, a region must meet two strict criteria:

- It must have at least 1,500 vascular plants as endemics, in other words a high percentage of plant life found nowhere else.
- It must have 30 per cent or less of its original natural vegetation.

The focus of biodiversity hotspot listing is therefore on those places that are irreplaceable and threatened. The south-west of WA is characterised by almost 3,000 endemic flora species and more than 80 endemic fauna species and retains 30 per cent of its original vegetation cover (Beard et al. 2000; Conservation International 2014).

The Advice Area comprising the Perth and Peel regions is situated within south-western WA and intersects both the Swan Coastal Plain and Jarrah Forest bioregions, as defined by the Interim Biogeographic Regionalisation for Australia classification system (DoE 2014a) (Figure 3-1). Within these bioregions the Advice Area covers parts of the Perth, Dandaragan Plateau and Northern Jarrah Forest sub-bioregions (DoE 2014a).

3.1.1 Climate

The climate of the Perth and Peel regions is described as Mediterranean with the area experiencing hot, dry summers and mild, wet winters. Rainfall varies significantly across the Advice Area, with the average annual rainfall for Perth being approximately 730 mm, for Mandurah in the south approximately 645 mm, and for Bickley in the east approximately 1,090 mm (BoM 2015).

The Advice Area is characterised by a winter dominated rainfall pattern with the highest rainfall recorded between the months of June to September. The average monthly maximum temperatures range between 18°C in July to 32°C in February with extreme temperatures recorded up to 44°C over the summer period (BoM 2015). Corresponding average monthly minimums range from 8°C in July to 18°C in February (BoM 2015). The region experiences strong sea breezes, particularly during summer.
3.1.2 Geology, landforms and soils

The Advice Area comprises two major landform elements (Figure 3-2):

- the Swan Coastal Plain, which dominates the coastal regions of the Advice Area; and
- the Darling Plateau which abuts the Swan Coastal Plain, and dominates the landscape to the east.

The Swan Coastal Plain consists of a series of distinct landforms (McArthur and Bettenay 1974), aligned roughly parallel with the coast. These dunal systems have formed as a series of shoreline deposits. Limestone underlies the undulating Quindalup and Spearwood dune systems running along the coast, adjoined in the east by the undulating aeolian sand plain of the Bassendean Dune System and the predominantly alluvial Pinjarra Plain (Davidson 1995).

The Darling Plateau sits at approximately 300 m above sea level and is covered by a mantle of lateritic material resulting from the weathering of underlying Archaean granite and dolerite bedrocks (Gozzard 2007). This mantle has been dissected by later drainage which in places has cut deeply into the surface. This area is also interrupted by occasional granite outcrops in the form of isolated hills and the dominant soils consist of laterite gravels. The Darling Plateau is separated from the Swan Coastal Plain by the Darling Scarp.

In the north, the Dandaragan Plateau is a wedge shaped landform of approximately 200 m elevation, situated between the Darling Scarp to the east and the Gingin Scarp to the west. It intersects a very small area (<1 per cent) of the Advice Area and is separated from the Swan Coastal Plain by the Gingin Scarp. It consists of cretaceous sedimentary rocks covered by sand and lateritic material (Gozzard 2007).

3.1.3 Hydrology

Major rivers that flow through the Advice Area towards the coast include the Swan, Canning, Serpentine, Murray and Harvey rivers; most of which have their head waters to the east, beyond the boundary of the Advice Area (Figure 3-2). The Serpentine, Murray and Harvey Rivers discharge into the Peel-Harvey Estuary which is the largest inland water body in south-western Australia (Brearley 2005 as cited in EPA 2008b).

The Swan Coastal Plain includes an extensive system of wetlands, covering over one quarter of the total land area (Hill et al. 1996). Wetlands range from intermittent through to seasonally or permanently waterlogged soils or inundated land. Many of these are sustained largely by regional or localised groundwater tables. A number of wetlands also provide important habitat to visiting migratory shorebirds.

Within the Advice Area, the following three wetlands are recognised as wetlands of international importance (Ramsar):

- Becher Point Wetlands;
- Forrestdale and Thomsons Lakes; and
- Peel-Yalgorup System.

Groundwater within the Swan Coastal Plain originates mainly from direct rainfall recharge with a small component being derived from local runoff from the Darling and Dandaragan Plateaus to the east (Davidson 1995). Several large groundwater aquifers within the Swan Coastal Plain discharge to the...
east and west (NRMMC 2006). Six distinct aquifers have been defined in the Perth region and
surrounds, which are hydraulically connected at a local scale (Davidson 1995):

- Superficial aquifer.
- Rockingham aquifer.
- Kings Park aquifer.
- Mirrabooka aquifer.
- Leederville aquifer.
- Yarragadee aquifer.

Water quality of receiving bodies within the Advice Area (including wetlands and areas of the Peel
Harvey and Swan-Canning estuaries) is influenced by surrounding land uses. Some of these important
sites have suffered from pollution events, algal blooms and fish kills resulting from several factors,
including an excess of phosphorus from rural and urban land use practices entering from the
catchments (DoE 2013a).

3.1.4 Flora and fauna

The Perth Coastal Plain (a sub-region of the Swan Coastal Plain Bioregion) is broadly dominated by
*Banksia* spp. and *Eucalyptus gomphocephala* (Tuart) woodlands on sandy soils, *Casuarina* spp.
(Sheoak) on outwash plains, and *Melaleuca* spp (Paperbark) in swampy areas (McKenzie et al. 2003).
Younger sandy areas and limestone sites are dominated by heath and/or *E. gomphocephala*
woodlands, while *E. marginata* (Jarrah) - Banksia woodlands are found on the older dune systems
(McKenzie et al. 2003). A variety of species, including *E. gomphocephala* are endemic to this region
(McKenzie et al. 2003).

A small portion of the Dandaragan Plateau (also part of the Swan Coastal Plain Bioregion) falls within
the north-eastern corner of the Advice Area and is characterised by Banksia low woodland,
*E. marginata/Corymbia calophylla* woodland, *C. calophylla* woodland and scrub-heath associations.

The Northern Jarrah Forest (a sub-region of the broader Jarrah Forest Bioregion) comprises mainly
*E. marginata/C. calophylla* forest or woodland, with a heath understory particularly on areas with
underlying granite. There are also extensive but localised sand sheets in this sub-bioregion which are
dominated by Banksia low woodlands (McKenzie et al. 2003).

South-west Western Australia provides habitat to over 500 species of vertebrates. High levels of
endemism exist, in particular in the frog and freshwater fish species. Reptilian fauna of the Advice Area
is particularly diverse and includes the Western Swamp Tortoise, one of the most endangered tortoise
or turtle species in the world (EPA 2006a). Bird species are similarly diverse and include the
endangered Carnaby’s cockatoo. The Advice Area also provides feeding and roosting habitat for large
numbers of migratory shorebirds that travel to Australia via the East Asian-Australasian flyway.
Figure 3-1: IBRA Bioregions of the Advice Area

Legend
- Advice Area
- IBRA regions
  - Avon Wheatbelt
  - Jarrah Forest
  - Swan Coastal Plain
  - IBRA subregions

Datum/Projection: GDA 1994 MGA Zone 50
Data Sources: DoE
Prepared by: SM  Date: 17/11/2015
Figure 3-2: Hydrology and Landforms of the Advice Area

Legend
- Advice Area
- Generalised landform boundaries
- Major watercourses
- Ramsar wetlands
- Wetlands

Digital elevation model
Elevation
- High: 590m
- Low: -12m

Datum/Projection:
GDA 1994 MGA Zone 50

Data Sources: DoW, DPaW

Prepared by: SM     Date: 17/11/2015
3.2  MARINE ENVIRONMENT

3.2.1  Geology and landforms

The coastline of the Advice Area incorporates a wide range of coastal landforms including beaches, dunes, estuaries, reef-protected coast and open coast (WAPC 2003a). Semi-sheltered lagoonal habitats have developed behind off-shore limestone reefs in many localities and Cockburn Sound is a major bay system situated along the coast of the Advice Area (IMCRA Technical Group 1998).

The coastal geology of the Advice Area generally comprises Quaternary coastal sand dune sequences including lithified Pleistocene calcarenites and unconsolidated Holocene calcareous sands. Sediments of the Perth coastline are comprised mainly of quartz sands of marine and terrestrial origin, and calcareous material derived from skeletal material, seagrass beds, reefs as well as shell fragments (Sanderson and Eliot 1999 as cited in Stul et al. 2006).

The Perth and surrounding coastline is primarily considered to be a low-to-moderate wave environment with a small diurnal tide range of less than 1 m (IMCRA Technical Group 1998). Coastal water quality is generally good as a result of low discharge from rivers (IMCRA Technical Group 1998).

Coastal marine ecosystems of south-west WA are heavily influenced by the Leeuwin Current, which is an offshore current that brings warmer tropical water down the western coast into the southern regions of WA. The current is highly variable on both an annual and inter-annual timescale and is typically strongest during the winter months (Feng et al. 2009). Marine species and ecosystems are heavily influenced by the variability in the strength of the current with strong currents being known to drive increased recruitment events in some species such as *Panulirus cygnus* (Western Rock Lobster) (Feng et al. 2009). During the summer months a cool northward counter-current, the Capes Current, flows near-shore and northward along the coast between Cape Leeuwin and Cape Naturaliste.

3.2.2  Marine ecosystems

The flora and fauna of the marine ecosystems adjacent to the Advice Area are strongly representative of the Southern Australian marine region in both species composition and structure. However, species common to the Indo-west Pacific are also present as a result of the influence of the Leeuwin Current, which carries tropical species south along the coast (IMCRA Technical Group 1998). Species of coral have been recorded as far south as Geographe Bay, and tropical fish species are also known to occur as far south as Rottnest Island as a result of these unique oceanographic conditions (IMCRA Technical Group 1998).

Seagrass meadows are a common component ecosystem of the Advice Area coastline and are typically well developed in less exposed areas, such as Warnboro Sound and in the inter-reef lagoons along exposed sections of the coast. Seagrass meadows in this region are highly diverse ecosystems, with up to 14 species represented, which is the highest species richness in the world (IMCRA Technical Group 1998). The tropical seagrass species *Syringodium isoetofolium* is also found at Warnbro Sound, which is 5 degrees of latitude further south than on the east coast of Australia as a result of the warmer waters associated with the Leeuwin Current (IMCRA Technical Group 1998).

The coastline of the Advice Area provides habitat for a number of endemic fauna species such as the gastropod *Camponile symbolicum*, which is considered to be a ‘living fossil’ relic of the ancient fauna of the Tertiary period (65 to 2 million years ago) (IMCRA Technical Group 1998).
The Peel-Harvey Estuary and Swan River Estuary are key structural features of the Advice Area (Figure 3-2). The Peel-Harvey Estuary is a Designated Wetland of International Importance under Ramsar (Convention on Wetlands of International Importance). In summer, both estuaries are significant nursery areas for commercial and recreational fisheries of crustacea and marine fishes and provide important feeding areas for migratory wading birds (IMCRA Technical Group 1998).

3.3 SOCIAL ENVIRONMENT

3.3.1 Cultural heritage

The Advice Area contains numerous cultural heritage values related to use of the area by both Aboriginal and European people. There are numerous areas of Aboriginal heritage value with over 500 registered Aboriginal heritage sites, and over 1,000 other heritage places (DAA 2013), comprising:

- historical sites;
- ceremonial sites;
- artefacts/scatters;
- mythological sites;
- skeletal material/burial sites;
- quarries; and
- engravings.

Two World and/or National Heritage Places are within the Advice Area. These include:

- 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. It occurs partially within the Advice Area, originating in Mundaring Weir, from where it then extends east for 560 km to Kalgoorlie (which is outside the Advice Area).

The Advice Area also contains many places of European Heritage that are listed on the State Register of Heritage Places. Places on the list are considered to represent the story of Western Australia’s history and development and include buildings, gardens, landscapes, structures (e.g. bridges), cemeteries, memorials and archaeological sites (Government of Western Australia 2015a).

3.3.2 Sub-regional profiles

Perth and the surrounding area comprises the largest city in Western Australia and represents a substantial employment, and economic growth hub for the state. The metropolitan Perth and Peel region has experienced sustained growth over the past few decades and is now home to approximately 1.9 million people. This represents almost 75 per cent of the population of Western Australia, which was estimated at 2.57 million in June 2014 (ABS 2014).

Based on current projections, the estimated population of the Perth and Peel regions is expected to reach 3.5 million by 2050, which presents substantial planning, housing and infrastructure challenges to the Western Australian government (WAPC 2010).
The metropolitan region is divided into six sub-regions (WAPC, 2010) which have been consolidated into four areas for the purposes of the Strategic Assessment (Figure 2-1):

- North West sub-region;
- North East sub-region;
- Southern Metropolitan Peel sub-region, an amalgamation of 3 sectors; and
- Central sub-region.

The following profiles provide further detail on each of the four areas.

**North West Sub-region**

The North West sub-region is covered by the Cities of Joondalup and Wanneroo. Outside of the Joondalup and Wanneroo metropolitan centres, it also covers the secondary centres of Whitfords, Warwick, Wanneroo, Clarkson, Alkimos, and Two Rocks.

The sub-regional population is expected to grow from 322,486 people in 2011 to 740,318 by 2050 (an increase of 130 per cent). There are a limited number of proposed new urban areas for potential expansion or investigation to accommodate this increase. Urban infill is expected to require 48,591 dwellings to 2050. Any new rural residential development not already identified in the framework is unlikely to be supported.

Significant population growth has occurred in this sub-region over the last 20 years due to its proximity to the ocean and access to higher order transport infrastructure. However, local employment has not kept up with the population growth and the employment self-sufficiency is currently at 49 per cent. The strategic direction for the sub-region includes community and social infrastructure required for the provision of health, education and recreation services to service a growing and ageing population. Future directions are focussed on urban consolidation adjacent to existing transport access.

The sub-region has approximately 43,005 ha (or 55 per cent) of the sub-region reserved as parks and recreation or state forest including Bush Forever sites. Protected features within the North-west sub-region include:

- a coastline that extends approximately 48 km;
- several national and regional parks that encompass wetlands and banksia woodlands; and
- a complex system of wetlands further inland.

**North East Sub-region**

The North East sub-region is covered by the City of Swan, Shire of Kalamunda and Shire of Mundaring. The sub-region includes well-established centres at Midland, Ellenbrook and industrial areas at Malaga, Forrestfield and Hazelmere, with tourism catered for in the Swan and Avon valleys.

The sub-regional population is expected to grow from 209,156 people in 2011 to 450,590 by 2050 (an increase of 115 per cent). Most future development will occur on land already zoned for urban purposes. Planning for the predicted population growth focuses on making the most efficient use of transport networks, service infrastructure, employment and key community/social facilities. Urban infill is expected to be 39,904 dwellings to 2050.
The strategic direction for the North East sub-region includes community and social infrastructure required for the provision of health, education and recreation services to service a growing and ageing population. A key focus for the sub-region will be the co-location of key community and social infrastructure to promote better use of existing infrastructure and facilities, reduce traffic and establish a sense of social cohesion.

Over 79,800 ha (or 40 per cent) of the sub-region is protected as parks and recreation or state forests reservations including Bush Forever sites. The abundance of trees in the ‘hills’ landscape is an important component of the ‘tree change’ lifestyle which attracts people to the area. The sub-region also includes landscapes with both natural and rural character including the Swan Valley vineyards and equestrian properties, the Darling Range, orchard areas contained in narrow valleys and partially vegetated grazing land across undulating terrain.

Protected features of the North East sub-region include:

- portions of the Darling Scarp, which forms a prominent backdrop to the coastal plain;
- extensive areas of jarrah forest in the Darling Range, held in state forest;
- areas of banksia woodland on the coastal plain; and
- a number of national and regional parks in the steeper valleys of the western portion of the Darling Range.

**Southern Metropolitan Peel Sub-region**

Southern Metropolitan Peel sub-region covers the Metropolitan South East, Metropolitan South West and Peel sectors. Armadale, Rockingham and Mandurah represent strategic metropolitan centres within the within the three sectors respectively. The sub-region is covered by the following local government areas:

- City of Armadale, City of Gosnells, Shire of Serpentine- Jarrahdale (South East sub-region).
- City of Cockburn, Town of Kwinana, City of Rockingham (South West sub-region).
- Shire of Murray and City of Mandurah (Peel sub-region).

Maddington, Cockburn, Kwinana and Pinjarra are secondary economic centres and Jandakot airport a centre of specialised economic activity.

The sub-regional population is expected to grow from 523,406 to 1,264,400 people by 2050 (an increase of 142 per cent), influenced by affordable housing, employment and lifestyle opportunities. Infill development within established urban areas has the potential to contribute to housing diversity and respond to changing demographics and community aspirations. It is expected infill will also contribute to economies of scale and provide opportunities for more affordable living within vibrant, revitalised neighbourhoods offering diverse housing options, mixed-uses, reduced car dependency, efficient public transport and increased opportunities for social interaction.

An increase in industrial development is anticipated with expansion of existing industry likely to include the Western Trade Coast (which is Western Australia’s premier industrial area), proposed new container facilities in the Outer Harbour within Cockburn Sound (between James Point and Naval Base) and proposed intermodal freight transfer facilities within the Latitude 32 industrial area.
The future economy of the sub-region and related employment opportunities are projected to focus on manufacturing, construction, retail, healthcare and social assistance. Employment opportunities are also expected in education, training, public administration and safety. Under this scenario, employment self-sufficiency levels are projected to increase from 65 per cent to 83 per cent in the south-western sector, from 45 per cent to 61 per cent in the south-eastern sector and from 72 per cent to 79 per cent in the Peel sector.

Over 229,816 ha (or 51 per cent) of the sub-region is protected as parks and recreation, regional open space or state forest reservations, including Bush Forever sites. The sub-region has landscapes with both natural and rural character, including market gardens associated with wetlands, the adjoining limestone ridge with tuarts, portions of the coastal plain in which remnant paperbarks and she-oaks are scattered through pasture, and, in the Darling Range, orchards in narrow valleys. Protected features of the sub-region include:

- a coastline connected with the Peel–Harvey Estuary;
- lake and wetland chains and portions of limestone ridges that parallel the coast;
- linear reserves along parts of the Canning, Serpentine and Murray rivers;
- some portions of the Darling Scarp;
- extensive areas of jarrah forest in the Darling Plateau held within state forests and several national and regional parks that encompass the steeper valleys of the western portion of the Darling Plateau; and
- the coastal lake system and tuart forest south of the Peel–Harvey Estuary.

**Central Sub-region**

The central sub-region is covered by the following local government areas: Bayswater; Belmont; Canning; Fremantle; Melville; Nedlands; Perth; South Perth; Stirling; Subiaco; Peppermint Grove; Bassendean; Cambridge; Claremont; Cottesloe; East Fremantle; Mosman Park; Victoria Park; and Vincent. Stirling, Melville, Cannington and Bayswater comprise the key economic centres within the sub-region.

This sub-region is characterised by some of the state’s oldest urban development. A high level of amenity exists within the sub-region due to proximity to the Swan River, a high level of employment and range of high order jobs and services. The central sub-region is the most diverse centre of activity in the metropolitan area.

The sub-regional population is expected to grow from 782,974 people in 2011 to 1,200,000 by 2050 (an increase of 53 per cent), requiring substantial new dwellings that will need to be achieved through urban infill as no greenfield areas are available for development.

Planning for the predicted population growth focuses on making the most efficient use of transport networks, service infrastructure, employment and key community/social facilities. Intensification of development is expected to result in efficiencies in transport and service infrastructure delivery. Designing accessible, well connected and sustainable urban communities will be a focus to ensure that opportunities for local employment and access to essential services can be realised.

Important remnant natural areas remaining within the sub-region include:

- Kings Park;
• Bold Park;
• Wireless Hill;
• Lake Monger;
• Herdsman Lake; and
• Swan Canning River system.

3.4 CLIMATE CHANGE

Climate change is the long term change of average weather patterns, including averages and extremes, where these changes persist for long periods of time (Australian Academy of Science, 2010). The Earth’s global climate has varied substantially over its history, however, the last 100 years has recorded an increase in sea and atmospheric temperatures of around 1°C (BoM and CSIRO 2014).

Human activities such as burning fossil fuels, agriculture and clearing of native vegetation have resulted in large volumes of carbon dioxide and other greenhouse gases being released into the atmosphere. Warmer global temperatures and widespread melting of snow and ice, which has contributed to global sea level rise, has been attributed, in part, to changes in the concentration of greenhouse gases within the Earth’s atmosphere (DoE 2014b).

3.4.1 Climate change effects to date in the Perth and Peel regions

The effects of climate change are often considered as an issue which is applicable only to the future. However, the climate of the Perth and Peel Regions has been changing over the last fifty years, and has already resulted in conditions impacting some species and ecological communities (Climate Commission 2011).

Observations show that temperatures in south-west Western Australia have increased over the past century, with the rate of warming higher since 1960. The average temperature increased between 1910 and 2013 by around 1.1°C (CSIRO and BoM 2015). In the same period, daytime maximum temperatures and overnight minimum temperatures both also increased by the same amount (1.1°C).

With warming average temperatures come more extreme temperature events, with the average ‘hot spell’ frequency at Perth Airport (defined as one or more consecutive days of 37°C or above) increasing from 6 events per year in 1958 to 8 events per year in 2011 (IOCI 2012).

Over this same period, the south-west of WA has experienced a 20 per cent decline in autumn and winter rainfall since the 1960s, due to weakening and less frequent frontal systems (CSIRO and BoM 2007; IOCI 2012). The decline in rainfall has subsequently resulted in a substantially larger decrease in annual runoff of over 50 per cent (CSIRO 2009). Decreases in rainfall and runoff have important implications for many wetlands, species and ecological communities which are dependent on rainfall and groundwater resources.

Increased temperatures and hot spells coupled with reduced rainfall, has resulted in fire weather also becoming more severe. There has been a statistically significant increase in extreme fire weather for the Perth region (BOM, 2014). There has also been an observed six week extension of the fire season in the south-west of Western Australia.
3.4.2 Climate projections for the Perth and Peel regions to 2030

The most up-to-date and comprehensive climate change projections available for the Perth and Peel Regions have been developed by CSIRO, in collaboration with the Bureau of Meteorology (BoM) in 2014 (BoM and CSIRO 2014). The climate projections describe likely changes in key variables for Australian regions, including temperature and rainfall averages and extremes, heatwaves, fire weather, cyclones, average and extreme sea level rise and ocean acidification. This CSIRO and BoM Climate Change in Australia 2015 project delivers the first comprehensive projections developed for the whole of Australia since 2007 and builds on the recently released Intergovernmental Panel on Climate Change Fifth Assessment Report (AR5) (BoM and CSIRO 2014). The projections are based on the simulations from 41 global climate models.

A summary of key climatological changes that are projected for the Perth and Peel region to 2030 are outlined in Table 3-1.

Table 3-1: Projected effects of climate change in the Perth and Peel regions to 2030 and the relative confidence of those changes occurring

<table>
<thead>
<tr>
<th>Measure</th>
<th>Projected change</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average temperature</td>
<td>Increase in the mean, maximum and minimum temperature. The mean annual warming</td>
<td>Very high</td>
</tr>
<tr>
<td></td>
<td>(surface temperature) is around 0.5 to 1.2°C above the 1986–2005 baseline for</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2030.</td>
<td></td>
</tr>
<tr>
<td>Hottest days</td>
<td>Increase in the maximum temperature on the hottest days, the frequency of hot</td>
<td>Very high</td>
</tr>
<tr>
<td></td>
<td>days and duration of warm spells.</td>
<td></td>
</tr>
<tr>
<td>Frequency of Frost days</td>
<td>Decrease in number of frost days.</td>
<td>High</td>
</tr>
<tr>
<td>Annual rainfall</td>
<td>Decrease in rainfall under all scenarios. Declines expected to be strongest</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>during winter and spring.</td>
<td></td>
</tr>
<tr>
<td>Rainfall intensity</td>
<td>Increase in rainfall intensity.</td>
<td>Medium</td>
</tr>
<tr>
<td>Drought</td>
<td>Increase in drought periods. Driven largely by decrease in rainfall.</td>
<td>High</td>
</tr>
<tr>
<td>Evapotranspiration</td>
<td>Increase in potential evapotranspiration.</td>
<td>Medium</td>
</tr>
<tr>
<td>Soil moisture content</td>
<td>Decrease in soil moisture content expected as a result of the combination of</td>
<td>High (some scenarios)</td>
</tr>
<tr>
<td></td>
<td>increased evapotranspiration and decreased rainfall.</td>
<td></td>
</tr>
<tr>
<td>Fire weather</td>
<td>Increase in harsh fire weather expected.</td>
<td>High</td>
</tr>
<tr>
<td>Severe fire danger rating</td>
<td>Increase in the number of days with severe fire danger rating projected</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>by 12-20 per cent.</td>
<td></td>
</tr>
</tbody>
</table>
4 ASSESSMENT APPROACH

4.1 IDENTIFICATION OF RELEVANT FACTORS

Environmental Assessment Guideline No. 8 (EPA 2015b) identifies the environmental factors relevant to environmental impacts assessment, grouped into themes.

Scoping of the environmental factors addressed in this IAR considered:

- The Environmental Scoping Document for the sub-regional structure plans prepared by the EPA.
- The EPA’s interim strategic advice (EPA 2015a).
- Analysis of preliminary impacts (in respect of some factors).

Following evaluation, the relevant environmental factors addressed in this IAR are summarised in Table 4-1.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Environmental factor as per EAG No. 8</th>
<th>Factors addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>Flora and Vegetation</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Landforms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subterranean Fauna</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Terrestrial Environmental Quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terrestrial Fauna</td>
<td>✓</td>
</tr>
<tr>
<td>Water</td>
<td>Hydrological Processes</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Inland Waters Environmental Quality</td>
<td>✓</td>
</tr>
<tr>
<td>Air</td>
<td>Air Quality and Atmospheric Gases</td>
<td>✓</td>
</tr>
<tr>
<td>People</td>
<td>Amenity</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Heritage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Human Health</td>
<td>✓</td>
</tr>
<tr>
<td>Sea</td>
<td>Benthic Communities and Habitat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coastal Processes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marine Environmental Quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marine Fauna</td>
<td>✓</td>
</tr>
</tbody>
</table>

The evaluation indicated that detailed impact analysis in respect of the following environmental factors was not warranted:

- Landforms.
- Terrestrial Environmental Quality.
- Heritage.
• Benthic communities.
• Marine Fauna.
• Coastal processes.

This IAR does not therefore carry forward detailed analysis for the above environmental factors, although indirect impacts are briefly discussed where relevant. Additional context is presented below. In addition, the key marine issue associated with future development relates to marine environmental quality and the other marine factors are therefore discussed only to the extent that they are influenced by changes in environmental quality.

4.1.1 Landforms

For the purpose of environmental impact assessment, the EPA defines a landform as: "A distinctive, recognisable physical feature of the earth’s surface having a characteristic shape produced by natural processes". The defining feature is a combination of geology and morphology and a landform can be a small scale, such as a cliff or dune, or of larger scale, such as a dune field (EPA 2015c).

The Perth and Peel regions are divided into two distinct units: the Darling Plateau and the Swan Coastal Plain, separated by the Darling Scarp. There are six major landform elements of the Swan Coastal Plain that lie more or less parallel to the coast and each has a characteristic suite of soils which relate to particular vegetation complexes. From west to east they are (EPA 2015a):

• Quindalup Dunes;
• Spearwood Dunes;
• Bassendean Dunes;
• Pinjarra Plain;
• Foothills; and
• Dandaragan Plateau.

The EPA's interim advice (EPA 2015a) notes that landforms and soils, along with climate, are the contributors to the diversity of vegetation, flora and fauna in the Advice Area. Consistent with this advice, the Landform factor is addressed in the context of the flora and vegetation, and terrestrial fauna factors. The EPA did not identify any key issues relating specifically to landforms in its interim advice and consequently has not been addressed as a factor on its own.

Note also that landscapes are addressed in respect of the amenity factor. Landforms are a component of landscapes, however, the EPA makes an important distinction between the two with landscape having an intrinsically visual character, relying on features that can be seen in single view (EPA 2015c).

4.1.2 Terrestrial environmental quality

Terrestrial environmental quality underpins the capability or fitness of land to support its intended land use and provides for important values in the Perth and Peel region such as agricultural and horticultural production as well as biodiversity preservation. Land disturbance arising from activities such as vegetation clearing, excavation works and re-profiling of landscape features can significantly affect terrestrial environmental quality.
Generally terrestrial environmental quality is managed through existing processes including requirements for management plans, licencing and condition setting. The EPA, in its interim advice, did not identify any key issues for terrestrial environmental quality to be assessed at a strategic scale. Existing management and mitigation measures are therefore considered adequate and will allow for the EPA's objective for this factor to be met.

Impact and management relating to acid sulfate soils, where they may impact on inland water environmental quality, have been addressed in Chapter 7 (Impacts to Hydrological Processes and Inland Waters Environmental Quality).

4.1.3 Heritage

The EPA’s consideration of heritage values relates to historical and cultural associations which are directly related to the natural environment, falling within the definition of ‘environment’ for the purposes of the EP Act. Natural heritage features of cultural or scientific significance include landscapes, landforms, waterways, and marine or terrestrial ecosystems. Their scientific and natural heritage significance in the Perth and Peel region is discussed in other impact assessment chapters of this strategic assessment.

The Noongar Aboriginal people historically occupied the southwest of WA, and form one of the largest Aboriginal cultural blocks in Australia (SWALSC 2015a). The Noongar people hold strong ties to the natural environment and utilise natural resources in ways that ensure biodiversity is maintained (SWALSC 2015b). Landscapes and natural features also hold high significant spiritual value to the Noongar people.

Industrial and urban development is a major pressure on Aboriginal heritage in the Perth-Peel region (EPA 2007). Future development will involve development of some previously undisturbed areas and urban population growth may increase public visitation to known sites of Aboriginal cultural heritage significance. In most cases the future development footprints are not resolved to the scale of many of the individual registered sites. The intersection of future development footprints with registered (known) sites is therefore of limited value and has not been undertaken.

Many of these places that are culturally significant, used for sacred ritual or ceremony, will be protected under the *Aboriginal Heritage Act 1972* (AH Act). This legislation establishes arrangements for registration of sites as well as an approval process for activities that may impact upon them. Sites are protected even if not known at the time, survey and consultation often only occurring in response to development proposals.

The consent provisions of the AH Act can be relied upon to protect specific Aboriginal cultural sites within the Advice Area and will ensure appropriate levels of survey and management prior to and during future development. The Department of Aboriginal Affairs has responsibility for implementing the AH Act and will play a lead role in mitigation of direct impacts to Aboriginal cultural heritage sites. The Department's Due Diligence Guidelines (DAA 2013) emphasise the need for early engagement and meaningful consultation with Aboriginal people, as well as the development of heritage management strategies early in the planning process. Consultation with the relevant Aboriginal people will remain an essential cornerstone in determining the cultural significance of a site or natural feature, and the ongoing management.

Customary use of plants and animals for food, cultural practices and art can contribute to family incomes, diets and maintenance of social networks. Impacts to plant and animal species are discussed
in Chapters 5 and 6. While a specific assessment of the impacts to customary use flowing from impacts to fauna and flora is beyond the scope of this strategic assessment, the mitigation and commitments outlined in those chapters will broadly assist in ameliorating adverse changes to customary use and accordingly this aspect is not considered further.

Existing management and mitigation measures for cultural heritage are therefore considered adequate and will allow for the EPA's objective for this factor to be met. Accordingly cultural heritage is not discussed further in this assessment.

4.1.4 Benthic communities and habitat and Marine fauna

The EPA recognised in its interim strategic advice that the type of proposed development that is the subject of the Strategic Assessment is land-based and will have limited direct impact on the sea factors (EPA 2015a). Based on this recognition, direct impacts to the marine environment are not considered relevant for consideration at the strategic level of this impact assessment.

It is possible that some indirect impacts to benthic communities or marine fauna within the waters off the Advice Area could result from an increase in population and the subsequent increased pressures due to boating and recreational activities. This could relate to overfishing, human interaction or marine fauna boat strike. However by far, the most significant threat to benthic and marine fauna values from land-based activities is as a result of potential changes in marine environmental quality. Therefore, achieving the EPA's objective for marine environmental quality (including quality of water, sediments and biota) is considered key to achieving the EPA objectives for benthic communities and habitat and marine fauna.

As a result, benthic communities and habitat and marine fauna have been considered within Chapter 10 (Impacts to Marine Environmental Quality) to the extent that they may be impacted by potential changes in marine environmental quality as a result of the proposed future development. This is considered to be an appropriate level of consideration given the strategic nature of this assessment.

It should be noted that impacts to benthic communities and habitats from future siting of infrastructure are not within the scope of the Strategic Assessment.

4.1.5 Coastal processes

The community of Western Australia places a high value on the marine environment and there is an expectation that people will be able to safely recreate along the coast and enjoy the aesthetic value that beaches within the Advice Area provide. The maintenance of coastal processes is vital to ensure beaches in the Advice Area continue to function and exist in their current form for future generations to enjoy and for avoiding significant alterations to near-shore benthic habitats and communities through sediment accretion and/or erosion.

The type of proposed development being considered under the Strategic Assessment is not expected to impact directly on coastal processes. Proposed new developments are generally more than 2 km from the coastline, apart from a number of roads and urban consolidation activities which will be undertaken in existing developed areas.

Development of specific major coastal infrastructure such as port or marina developments are beyond the scope of this assessment and these activities would be subject to a separate project specific impact assessment. The construction of more minor infrastructure (also beyond the scope of this assessment), such as additional boat launching facilities, are likely to occur in response to the population growth in
the Advice Area. It will be vital to ensure coastal processes and risks are considered in the siting of boat launching facilities. This can be achieved through use of State Planning Policy 2.6 State Coastal Planning (WAPC 2013) which is the key planning policy for managing land use planning and development issues specifically as they relate to the protection and management of the coast. The existing framework can be used to ensure that any development is sited in the most appropriate locations to avoid impacts like coastal erosion, seagrass wrack accumulation and sea level rise.

4.1.6 Impact assessment sections

Apart from exceptions discussed in Sections 4.1.1 to 4.1.5, potential impacts to EPA factors as a result of the proposed future development have been considered in detail in the following chapters. Table 4-2 indicates how these factors have been grouped for consideration.

Table 4-2: Consideration of EPA factors within the document

<table>
<thead>
<tr>
<th>EPA factor theme</th>
<th>Chapter</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>5</td>
<td>Flora and Vegetation</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Fauna (includes Subterranean Fauna)</td>
</tr>
<tr>
<td>Water</td>
<td>7</td>
<td>Hydrological Processes and Inland Waters Environmental Quality</td>
</tr>
<tr>
<td>Air</td>
<td>8</td>
<td>Air Quality and Atmospheric Gases</td>
</tr>
<tr>
<td>People</td>
<td>9</td>
<td>Amenity and Human Health</td>
</tr>
<tr>
<td>Sea</td>
<td>10</td>
<td>Marine Environmental Quality</td>
</tr>
</tbody>
</table>

4.2 GENERAL IMPACT ASSESSMENT METHODOLOGY

The general structure of the impact assessment for each relevant environmental factor is:

- Key findings.
- EPA objective.
- Environmental policy and guidance.
- Existing environment.
- Current management arrangements.
- Avoidance to date.
- Potential impacts.
- Impact analysis.
- Mitigation and management.
- Proposed offsets.
- Summary of outcome for EPA objective.

The approach that has been taken for each factor within each of these sections is further discussed below.
4.2.1 Key findings

The most important findings of the assessment for each environmental factor are summarised.

4.2.2 EPA objective

The EPA has adopted a specific objective for each environmental factor and these form the basis for the impact assessment. The impact associated with the proposed future development, is assessed in regard to the extent to which it varies from the stated EPA objective(s).

4.2.3 Environmental policy and guidance

A range of policy and guidance documents have also been published in regard to specific factors to provide information regarding the EPA’s expectations, and these are noted for context to the impact assessment.

4.2.4 Existing environment

An overview of the key values of the existing environment relevant to each factor is outlined to provide context and focus for the impact assessment. This includes discussion of the important attributes/components for the factor, based on the level of background information available for that factor within the Advice Area. Key environmental values or assets have been presented in a supporting map or figure where practical.

Current threats, including climate change are examined to provide context to potential impacts deriving from future development. Climate projections for the south-west region have been reviewed and the trends considered in light of the factor being addressed, and any potential influence on the impacts associated with implementation of the sub-regional structure plans. Climate change projections are very general and it is not possible to determine impacts for each attribute/component of individual factors. Rather, climate change predictions have for the most part been considered qualitatively for each factor with the exception of hydrological processes.

Quantitative examination has been possible in respect to the maintenance of hydrological regimes of groundwater. Both median and dry future climate scenarios were used by DoW to model future groundwater levels within the Superficial aquifer under proposed future land uses. The median and dry future climate sequences were developed using DoW’s peer reviewed future climate tool (DoW 2015), built using global climate models that perform well in Western Australia (see Chapter 7 Impacts to Hydrological Processes and Inland Waters Environmental Quality, for further detail).

4.2.5 Current management arrangements

Potential impacts to each environmental factor from future development occur within the context of an existing environmental management regime established by the Western Australian Government and comprising various laws, policy and programs. These provide the ‘first line’ mitigation of potential impacts arising from future development for a larger population. This section documents the relevant existing management arrangements relating to the environmental factor. Where existing management arrangements are adequate for a relevant potential impact, that impact is not carried forward for detailed impact analysis in the following sections.
4.2.6 Avoidance to date

Environmental Protection Bulletin No. 1 (EPA 2014) establishes ‘avoidance’ of potential impacts as the first measure to be applied in the mitigation hierarchy. Substantial early avoidance was achieved through a footprint planning phase and other refinements to the footprints, as described in Section 2.2. Within the individual impact assessment chapters, this section documents how the avoidance undertaken to date process has impacted potential outcomes for each of the EPA factors. Where these avoidance measures have eliminated a potential impact, then the impact is not carried forward for consideration in subsequent detailed impact analysis.

4.2.7 Potential impacts

With consideration for the key threats to each factor, as well as the avoidance that has been undertaken to date, this section provides an outline of the potential impacts relating to the proposed future development that will be considered in the following section. Where appropriate, this section also outlines the approach taken for the analysis.

4.2.8 Impact analysis

This section provides an evaluation of potential impacts to environmental factors, as a result of the proposed future development.

The level of baseline information available for each factor varies significantly, with more specific information available for biodiversity factors than other factors, such as human health. No specific environmental surveys or investigations were undertaken to facilitate this assessment. Regional datasets were considered to be an appropriate basis for the purposes of a strategic assessment and where appropriate are referenced in the text of the relevant impact Chapter.

Depending on the attributes of each factor being assessed, some impacts are discussed broadly whilst others are critical issues that are specifically addressed. For example, it is not possible to discuss specific emissions associated with an industrial development, as the future development footprints under consideration relate to land use change and not a specific industrial project. However, a general assessment can be provided with a discussion of the policy setting and identification of requirements for future specific studies at the appropriate time, and the likely mitigation measures or other statutory decision making processes that can mitigate or regulate the potential impacts to meet EPA objectives.

Future (ongoing) avoidance through statutory planning processes is also addressed in the evaluation of potential impacts. Ongoing avoidance within the urban and industrial future development footprints will occur through implementation of statutory planning of expansion sites including the location of public open space. Proposed rural residential development areas will similarly be subject to a future planning process to define areas that should be avoided for rural residential lots and put aside in open space. Through this process it is likely that significant further avoidance will be achieved.

The final location and alignment of infrastructure is subject to a future process of refinement following detailed planning and design to further avoid and minimise impacts to environmental values. This will include consideration of opportunities to reduce development footprint through co-location of infrastructure (e.g. shared corridors).

Various literature and documentation, such as management plans for particular sites and recovery plans for individual species or communities, were considered where required to improve the impact
assessment. In some instances, specific occurrence data is insufficient to determine impacts, so an assessment of impacts on suitable habitat has been used as a surrogate.

Where spatial data was available, the impact assessment for each environmental factor was undertaken by overlaying the proposed future development footprint with baseline information of occurrence (database or spatial layers from agencies) for the relevant matter. In some cases footprints were clipped to ensure that intersects were not double-counted. For example, where a flora population intersects with a BRM area that will also become urban under sequential land use planning, clearing impacts have been attributed to the BRM extraction activity only. In other cases where impacts are cumulative, for example the impact to water quality, intersects have been reported for each of the footprints.

A qualitative assessment of impacts based on the projected population increase and infill development requirements was also made for each factor.

The availability of information for each factor determined the extent to which cumulative impacts (impacts that result from the incremental impacts of a proposal, when added to other past, present and reasonable foreseeable future proposals) were able to be considered. Quantitative cumulative impacts were primarily assessed in respect of vegetation and flora where information was available regarding pre-European extent of vegetation complexes that could be compared to impacts from the existing and proposed land use changes.

4.2.9 Mitigation and management

The section 16(e) interim strategic advice of the EPA provides guidance in regards to key issues that require attention for mitigation under the Strategic Assessment. Environment Protection Bulletin No.1 (EPA 2014) sets out the mitigation hierarchy which comprises (in order of preference and subsequent to avoidance):

- Minimise.
- Rehabilitate.
- Offset.

In addressing mitigation for each environmental factor, the above mitigation hierarchy was applied and an analysis undertaken of whether existing legislative processes, state policies and other existing procedures would be adequate to manage the identified potential impacts.

Mitigation measures were developed throughout the assessment to address identified gaps in existing management arrangements relating to significant potential impacts. These additional proposed mitigation measures are identified in Action Plan G of the Strategic Conservation Plan and key elements are discussed in this section.

Chapter 11 of the IAR (Environmental Management Framework) also provides an overview and discussion of the overarching implementation and governance framework for ensuring mitigation is applied over the lifetime of future development.

After mitigation measures are applied, this section identifies any residual impacts that may warrant further mitigation in the form of offsets. Offsets are "actions that provide environmental benefits which counterbalance the significant residual environmental impacts or risks of a proposal" (EPA 2014). An offsets framework for the Strategic Assessment has been developed by the State with the WA Environmental Offsets Policy (Government of Western Australia 2011) and WA Environmental Offsets
Guidelines (Government of Western Australia 2014) forming the basis of how offsets will be applied. Offsets are a key component of the conservation program described in Chapter 4 of the Strategic Conservation Plan with the offsets delivered under Action Plan H.

4.2.10 Summary of outcome for EPA objective

This section draws an overall conclusion on whether the EPA's objective for the environmental factor is likely to be met, based on the application of existing management measures, avoidance, specific mitigation measures and any additional offsets, to the identified impacts.

4.3 SPECIFIC APPROACH FOR SPECIES AND ECOLOGICAL COMMUNITIES

The Land Chapters of this State IAR focus broadly on impacts to regionally significant natural areas, wetlands and impacts to vegetation generally. As part of the Strategic Assessment, impacts to threatened species and ecological communities present within the Advice Area have largely been addressed within the Commonwealth IAR and this assessment is not repeated here. However, where a threatened species or community is listed by the State but is not a MNES, consideration of impacts to that species or community have been included in this State IAR. Priority species and ecological communities have also been considered.

Given the scale of the Advice Area, a large number of terrestrial fauna and flora species and communities are potentially relevant to the assessment (e.g. specific Threatened species). However, some are more relevant to a strategic assessment than others, depending on the importance of the Advice Area to each species or community in terms of the values it supports and the ecological function it provides. For example, a species which is endemic or dependent on the Advice Area for its continued survival requires more comprehensive assessment compared to one which has a much broader distribution and is only recorded from time to time within the Advice Area.

The methodology employed to prioritise and assess the relevant terrestrial fauna, flora and communities is described below.

4.3.1 General priorities and scoping

The assessment accorded priority to understanding the potential impacts and outcomes to the following groups of species and communities:

- Threatened and Priority fauna species.
- Threatened and Priority flora species.
- Threatened and Priority ecological communities.

(Priority species or ecological communities may be threatened or near threatened but are data deficient and have not yet been adequately surveyed for listing under the Wildlife Conservation Act (WC Act)).

No other species or communities were considered relevant to the assessment.

Ensuring key species and communities were identified and comprehensively assessed involved:
• Identification of all Threatened and Priority species and communities potentially present within the Advice Area.
• Categorisation of these to reflect their level of priority or relevance to the assessment.
• Use of a level of analysis in the assessment which is appropriate to each category.

The method used to identify and categorise species and communities according to this general approach is described below, and the results of this process are provided in the Impact Assessment Sections for Flora and Vegetation and Fauna (Chapters 5 and 6).

### 4.3.2 Identification of species and communities

Threatened and Priority species and communities potentially present within the Advice Area (and a 10 km buffer) were initially identified through searches of:

- NatureMap; and
- Atlas of Living Australia.

Threatened and Priority species and communities initially identified were reviewed by the Parks and Wildlife to ensure a comprehensive list could be taken forward for categorisation.

### 4.3.3 Categorisation of species and communities

Identified Threatened and Priority species and communities were assigned to one of four categories reflecting the relative importance of the Advice Area to each. These categories relate to the values (e.g. known and potential presence, habitat values) for each Threatened and Priority species and community across the Advice Area, and do not relate to the level of potential impact.

Unless otherwise specified, 'Priority species' refers to Priority 1 and 2 species only. The OEPA advised that only Priority 1 and 2 species and communities warranted explicit further assessment of impacts to flora and vegetation values within the Advice Area, on the basis of strategic importance.

Table 4-3 outlines the four categories developed for the assessment and Table 4-4 presents the criteria that were applied to assign Threatened and Priority species and communities to each category. The results of the categorisation process are provided in Chapters 5 and 6 and Appendices B and C.

#### Table 4-3: Threatened and Priority species and communities assessment categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>Threatened and Priority species and communities within this category meet a set of criteria which indicates a high reliance on habitat within the Advice Area.</td>
</tr>
<tr>
<td>Category 2</td>
<td>Threatened and Priority species and communities within this category meet a set of criteria which indicates a moderate reliance on habitat within the Advice Area.</td>
</tr>
<tr>
<td>Category 3</td>
<td>Threatened and Priority species and communities within this category meet a set of criteria which indicates a low reliance on habitat within the Advice Area.</td>
</tr>
<tr>
<td>Category 4</td>
<td>Threatened and Priority species and communities within this category are not considered to rely on habitat within the Advice Area and therefore are of least concern.</td>
</tr>
</tbody>
</table>
Table 4-4: Criteria for assigning Threatened and Priority species and communities to categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
</tr>
</thead>
</table>
| 1        | A species or community was assigned to **Category 1** where it met one of the following:  
  - the Advice Area supports more than 50 per cent of all known records of a species or habitat within the Advice Area is known to be used by more than 50 per cent of the total population of a fauna species; or  
  - the Advice Area comprises 66 per cent or more of the distribution of the species or ecological community according to Parks and Wildlife’s current distribution mapping; or  
  - there is particular public interest or concern in relation to the species or community. |
| 2        | A species or community was assigned to **Category 2** where it met one of the following:  
  - the Advice Area supports 25 per cent - 50 per cent of all known records of a species; or  
  - the Advice Area comprises 33 per cent - 66 per cent of the distribution of the species or ecological community according to the Parks and Wildlife’s current distribution mapping. |
| 3        | A species or community was assigned to **Category 3** where it met one of the following:  
  - the Advice Area supports 5 per cent - 25 per cent of all known records; or  
  - the Advice Area comprises 5 per cent - 33 per cent of the distribution of the species or community according to the Parks and Wildlife’s current distribution mapping. |
| 4        | A species or community was assigned to **Category 4** where it met all of the following:  
  - the Advice Area supports less than 5 per cent of all known records; and  
  - the Advice Area comprises less than 5 per cent of the distribution of the species or ecological community according to the Parks and Wildlife’s current distribution mapping. |

Detailed impact analyses have been undertaken in the subsequent impact assessment sections for Category 1 and 2 species and communities. Species and communities assigned to Categories 3 and 4 have been listed in the table in Appendix B, but are not considered further in this assessment as these have met a set of criteria indicating a low, or lack of reliance on potential habitat within the Advice Area. It is unlikely that these species or communities will be significantly impacted by actions of the proposed future development.

The Threatened and Priority species and communities addressed in this IAR were current at the time of writing the report.

### 4.4 OVERARCHING COMMITMENTS

Action Plan G of the Strategic Conservation Plan contains a set of five over-arching conservation commitments that provide a range of benefits across the Advice Area. These commitments relate to the avoidance, mitigation and offsetting of impacts across a range of environmental values. Where relevant, the over-arching commitments are identified in the impact assessments for each factor.

These five over-arching commitment are presented in Table 4-5, with a description of how these are expected to contribute to achieving the objectives for State environmental values.
Table 4-5: Overarching commitments and explanations

<table>
<thead>
<tr>
<th>Over-arching commitments</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Implement environmental assessment and management measures, controls and standards for all development to reduce direct and indirect impacts. This will include, but is not limited to, controls on vegetation clearing, water quality and use, stormwater, dust, noise, emissions, public access. This process will involve:</td>
<td>Within Action Plan G, commitments have been provided where they represent a change or improvement to existing processes. They do not list the full extent of controls and standards that will be expected to continue to apply to all new developments. Also, Ministerial conditions or other controls applying to existing approvals continue to apply.</td>
</tr>
<tr>
<td>- ensuring controls / conditions placed on existing approvals continue to be implemented; and</td>
<td></td>
</tr>
<tr>
<td>- ensuring that new proposals that are approved incorporate at a minimum the existing standards and expectations for control / mitigation / management of direct and indirect impacts.</td>
<td></td>
</tr>
<tr>
<td>2. Implement the conservation program including:</td>
<td>Action Plan H of the Strategic Conservation Plan provides for the implementation of a conservation program. The conservation program comprises a range of conservation actions that will be implemented over the life of the Strategic Conservation Plan to improve environmental outcomes within the Perth and Peel regions and to offset significant residual impacts arising from planned development. Further detail can be found in Action Plan H.</td>
</tr>
<tr>
<td>- incorporation of new sites into the conservation reserve system;</td>
<td></td>
</tr>
<tr>
<td>- continued implementation of the Bush Forever Program;</td>
<td></td>
</tr>
<tr>
<td>- implementation of an ongoing offsets program to address residual impacts to MNES and State factors;</td>
<td></td>
</tr>
<tr>
<td>- improving the management and protection of significant environmental values which have already been identified for retention;</td>
<td></td>
</tr>
<tr>
<td>- establishment of the Peel Regional Park and marine management area; and</td>
<td></td>
</tr>
<tr>
<td>- protecting selected Peel Regionally Significant Natural Areas for conservation.</td>
<td></td>
</tr>
<tr>
<td>3. For urban, industrial and rural residential development, undertake and implement statutory planning to achieve the specific commitments for MNES and State factors. As described in Action Plan A and B this will:</td>
<td>A process for future avoidance will be undertaken within Urban, Industrial and Rural residential footprints. Further detail is provided in Action Plans A and B.</td>
</tr>
<tr>
<td>- have due regard for the planning undertaken during preparation of the Strategic Conservation Plan for urban and industrial expansion sites and new rural residential zones;</td>
<td></td>
</tr>
<tr>
<td>- consider additional opportunities for retention of native vegetation, fauna habitat and wetlands; and</td>
<td></td>
</tr>
<tr>
<td>- be informed by previous EPA advice and Ministerial Statement conditions, or in the absence of this, detailed investigations, within existing zoned urban and industrial areas.</td>
<td></td>
</tr>
<tr>
<td>4. Protect environmental values within selected BRM Exclusion Areas through Action Plan H.</td>
<td>Avoidance to date achieved through the identification of exclusion areas through the master planning process for BRM is described in Section 2.2.3. Further detail is provided in Action Plan D.</td>
</tr>
<tr>
<td>Over-arching commitments</td>
<td>Benefit</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5. Implement the infrastructure impact assessment process (which includes planning, avoidance, mitigation, and offsets) to achieve the outcomes and objectives for MNES and State factors.</td>
<td>The final location and alignment of infrastructure is subject to a future process of refinement following detailed planning and design to further avoid and minimise impacts to environmental values. Further detail is provided in Action Plan C.</td>
</tr>
</tbody>
</table>