## Environmental impact assessment process timelines

<table>
<thead>
<tr>
<th>Date</th>
<th>Progress stages</th>
<th>Time (weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25/7/2012</td>
<td>EPA decides to assess – level of assessment set</td>
<td></td>
</tr>
<tr>
<td>19/8/2013</td>
<td>Environmental Scoping Document released for public review</td>
<td>55</td>
</tr>
<tr>
<td>16/9/2013</td>
<td>Public review period for Environmental Scoping Document closed</td>
<td>4</td>
</tr>
<tr>
<td>28/11/2013</td>
<td>EPA approved Environmental Scoping Document</td>
<td>10</td>
</tr>
<tr>
<td>16/3/2016</td>
<td>EPA accepted Environmental Review Document</td>
<td>120</td>
</tr>
<tr>
<td>21/3/2016</td>
<td>Environmental Review Document released for public review</td>
<td>4 days</td>
</tr>
<tr>
<td>13/6/2016</td>
<td>Public review period for Environmental Review Document closed</td>
<td>12</td>
</tr>
<tr>
<td>11/1/2017</td>
<td>EPA accepted Proponent Response to Submissions</td>
<td>30</td>
</tr>
<tr>
<td>17/5/2018</td>
<td>EPA completed its assessment</td>
<td>70</td>
</tr>
<tr>
<td>27/6/2018</td>
<td>EPA provided report to the Minister for Environment</td>
<td>6</td>
</tr>
<tr>
<td>9/7/2018</td>
<td>EPA report published</td>
<td>2</td>
</tr>
<tr>
<td>23/7/2018</td>
<td>Close of appeals period</td>
<td>2</td>
</tr>
</tbody>
</table>

Timelines for an assessment may vary according to the complexity of the proposal and are usually agreed with the proponent soon after the EPA decides to assess the proposal and records the level of assessment.

In this case, the Environmental Protection Authority met its agreed timeline objective of 12 weeks from the time the last information was provided by the proponent to the completion of the assessment and provision of a recommendation to the Minister for Environment.

Dr Tom Hatton  
Chairman  

27 June 2018  

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Summary

This report provides the Minister for Environment with the outcomes of the Environmental Protection Authority’s (EPA’s) environmental impact assessment of the Pilbara Expansion Strategic Proposal which identifies future iron ore mining and associated mining infrastructure developments in the Pilbara by BHP Billiton Iron Ore Pty Ltd.

Proposal

The proponent, BHP Billiton Iron Ore Pty Ltd (BHP), proposes to develop iron ore mining and associated mining infrastructure in the Pilbara. The proposal identifies all new iron ore mine developments, as well as expansion of existing mines within the Strategic Proposal project boundary (Figure 1).

Activities included in the proposal include mining operations, rail, overburden storage areas, dams (tailings and turkey-nest style) and associated mine infrastructure.

Background and context

On 6 July 2012 the proponent referred the proposal to the EPA. On 25 July 2012 the EPA decided to assess the proposal and set the level of assessment at Public Environmental Review (12 weeks), Strategic Proposal: proponent prepared Environmental Scoping Document (ESD) (ESD public review period: four weeks). The EPA approved the ESD for the proposal on 28 November 2013. The Environmental Review Document (ERD) was released for public review from 21 March 2016 to 13 June 2016. A total of 10 submissions were received on the ERD.

The proposal was assessed separately under the Environment Protection and Biodiversity Conservation Act 1999 (Cth) through an agreement between the Australian Government and BHP Billiton Iron Ore Pty Ltd.

Public submissions

Key issues raised in the submissions included:

- The scale of the Strategic Proposal’s impacts, including the cumulative impacts on biodiversity and water across the Pilbara.
- The veracity and accuracy of the information in the Public Environmental Review document and its suitability for use in assessing the Strategic Proposal.
- How future proposals would be managed to reduce the impacts on the environment.
- Management of mine closure and rehabilitation.

The proponent addressed the issues raised in the Response to Submissions document (Pilbara Expansion Public Environmental Review Strategic Proposal supplementary report, December 2016).

Key environmental factors and relevant principles

The EPA identified the following key environmental factors (see Section 4) during the course of its assessment:
1. **Flora and Vegetation** – impacts on flora and vegetation as a result of clearing, including increased cumulative impacts associated with other proposals.

2. **Terrestrial Fauna** – clearing of fauna habitat, including habitat for conservation significant fauna species.

3. **Subterranean Fauna** – loss of habitat for subterranean fauna species as a result of disturbance for mining and abstraction of groundwater.

4. **Hydrological Processes and Inland Waters Environmental Quality** – changes to hydrological regimes and water quality as a result of water abstraction, use, and disposal of excess water.

5. **Social Surroundings** – potential impacts on sites of Aboriginal heritage significance and areas where traditional cultural activities are undertaken.

6. **Air Quality** – increased emissions of greenhouse gases and particulates associated with dust.

7. **Landforms** – disturbance of landforms as result of the construction of future proposals.

8. **Terrestrial Environmental Quality** – potential for discharge of pollutants to the environment, including from mine closure activities.

In identifying the key environmental factors, the EPA had regard to the object and principles set out in section 4A of the *Environmental Protection Act 1986* (EP Act). The EPA considered that all of the principles were relevant to this assessment (see Section 4):

1. Precautionary principle
2. Principle of intergenerational equity
3. Principle of the conservation of biological diversity and ecological integrity
4. Principles relating to improved valuation, pricing and incentive mechanisms
5. Principle of waste minimisation.

**Assessment**

The EPA has taken the following into account in its assessment of the proposal as a whole:

- the impacts on all the key environmental factors
- the EPA’s confidence in the proponent’s proposed mitigation measures
- the relevant EP Act principles and the EPA’s objectives for the key environmental factors
- the EPA’s view that the impacts on the key environmental factors are manageable, provided the recommended conditions are imposed.
Conclusion and recommendations

That the Minister for Environment notes:

1. That the proposal assessed is a Strategic Proposal which identifies future iron ore mining and associated mining infrastructure developments in the Pilbara by BHP Billiton Iron Ore Pty Ltd.

2. The key environmental factors identified by the EPA in the course of its assessment are Flora and Vegetation; Terrestrial Fauna; Subterranean Fauna; Hydrological Processes and Inland Waters Environmental Quality; Social Surroundings; Air Quality; Landforms; and Terrestrial Environmental Quality—each of which is set out in Section 4.

3. The EPA recommends that:
   a) the future proposals identified in the strategic proposal, as detailed in section 2 of this Report, may be implemented; and
   b) the implementation of the future proposals should be subject to the applicable conditions and procedures set out in Appendix 3, so as to ensure the future proposals meet the environmental objectives discussed in this Report.

4. The EPA have concluded that the environmental objectives for the key environmental factors identified in this Report are likely to be achieved provided the recommended conditions and procedures set out in Appendix 3 are imposed and complied with in the implementation of the relevant future proposal.

5. That guidance is also provided by the EPA, in the draft Ministerial Statement, to ensure the proponent is aware of the EPA’s expectation that draft environmental management plans and a report on rehabilitation success in the Pilbara are included with any request to declare a derived proposal.
1. Introduction

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for Environment on the outcomes of the EPA’s environmental impact assessment of the strategic proposal by BHP Billiton Iron Ore Pty Ltd. The proposal identifies future iron ore mining and associated mining infrastructure developments in the Pilbara.

The EPA has prepared this report in accordance with section 44 of the Environmental Protection Act 1986 (EP Act). This section of the Act requires the EPA to prepare a report on the outcome of its assessment of a proposal and provide this assessment report to the Minister for Environment. The report must set out:

- what the EPA considers to be the key environmental factors identified in the course of the assessment
- the EPA’s recommendations as to whether or not the future proposals identified in the strategic proposal may be implemented and, if the EPA recommends that implementation be allowed, the conditions and procedures to which implementation should be subject.

The EPA may also include any other information, advice and recommendations in the assessment report as it thinks fit.

On 6 July 2012 the proponent referred the proposal to the EPA. On 25 July 2012 the EPA decided to assess the proposal and set the level of assessment at Public Environmental Review (12 weeks), Strategic Proposal: proponent prepared Environmental Scoping Document (ESD) (ESD public review period: four weeks). The EPA approved the ESD for the proposal on 28 November 2013. The Environmental Review Document (ERD) was released for public review from 21 March 2016 to 13 June 2016.

1.1 EPA procedures

The EPA introduced a new suite of environmental impact assessment procedures on 13 December 2016. The EPA approved the ERD under the 2012 Administrative Procedures.

The EPA followed the procedures in the Environmental Impact Assessment (Part IV Divisions 1 and 2) administrative procedures 2016 and the Environmental Impact Assessment (Part IV Divisions 1 and 2) procedures manual 2016, to the extent that it was appropriate and practicable. The EPA consulted the proponent on the application of the current procedures to its assessment of the proposal.
2. The proposal

2.1 Proposal summary

The proponent, BHP Billiton Iron Ore Pty Ltd (BHP), proposes to develop iron ore mining and associated mining infrastructure in the Pilbara. The strategic proposal identifies all new iron ore mine developments on tenements in which BHP currently has an interest, as well as expansion of existing mines within the Strategic Proposal project boundary (Figure 1).

The proposal is considered a strategic proposal because it identifies future proposals that, if implemented, are likely to have a significant effect on the environment.

Activities included in the strategic proposal include mining operations, rail, overburden storage areas, dams (tailings and turkey-nest style) and associated mine infrastructure.

The key characteristics of the proposal are summarised in Tables 1 and 2 below. A detailed description of the proposal is provided in Section 2 of the ERD (BHP Billiton Iron Ore 2016a).

Table 1: Summary of the Strategic Proposal

<table>
<thead>
<tr>
<th>Proposal title</th>
<th>Pilbara Expansion – Strategic Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short description</td>
<td>This Strategic Proposal identifies future iron ore mining and associated activities and operations within the project boundary delineated in Figure 1.</td>
</tr>
</tbody>
</table>

Table 2: Location and proposed extent of physical and operational elements

<table>
<thead>
<tr>
<th>Column 1 developments</th>
<th>Column 2 location</th>
<th>Column 3 Description of limits/extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron ore mines and associated activities and operations, being new mining operations at:</td>
<td>Within mining tenements and any other interest in land, including amendments to these tenements and interests, or the future acquisition of related tenements or interests, held by BHP or its Associates within</td>
<td>1. Clearing (as defined in s51A of the Environmental Protection Act 1986), caused by or likely to be caused by all future proposals identified in Column 1 of Table 2, shall not exceed 98 500 hectares</td>
</tr>
<tr>
<td>• Caramulla</td>
<td></td>
<td>2. Planned, designed and managed (demonstrated in the referral of future proposal and draft management plans</td>
</tr>
<tr>
<td>• Coondiner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Gurinbiddy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Jinidi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Marillana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mindy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Ministers North</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mudlark</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- Munjina/Upper Marillana
- Ophthalmia/Prairie Down
- Rocklea
- Roy Hill
- Tandanya

and future expansions to new mining operations listed above and existing mining operations at:
- Jimblebar
- Mining Area C
- Newman
- Yandi.

the Project Boundary and as identified in Figures 1 and 2.

Associated Activities and Operations may be located on tenements and any other interests in land currently held by BHP or its Associates or, which will be acquired in the future, and located within the Project Boundary as identified in Figures 1 and 2.

submitted at the time of referral of future proposals) to ensure:

a. Cumulative impacts to key environmental factors are minimised through use, where practicable, of existing mine infrastructure, rail, road and associated developments and do not exceed cumulative impact limit of 98 500 ha specified above

b. The environmental objectives specified in the relevant conditions will be met

c. Scientifically verifiable estimates of the likely success of future rehabilitation have been made
Figure 1: Project boundary and BHP Billiton Iron Ore tenements
Figure 2: Future proposals identified in the Strategic Proposal
2.2 Changes to the proposal during assessment

BHP submitted a request for EPA consent for a change to the proposal during assessment on 5 August 2015. The nature of the change was to include the proposed Jinidi Iron Ore Mine in the Strategic Proposal. This also resulted in the termination of the EPA’s assessment of the Jinidi Iron Ore Mine. Tables 1 and 2 above include this change.

The Chairman, as a delegate of the EPA, concluded that the change was unlikely to significantly increase any impact of the proposal on the environment and gave consent under section 43A of the EP Act to the change on 19 October 2015.

BHP submitted a further request for EPA consent for a change to the proposal during assessment on 26 February 2016. The nature of the change was to remove the Mining Area C – Southern Flank Proposal from the Strategic Proposal’s scope so that this proposal could be progressed as a separate assessment (EPA Assessment no. 2085). Tables 1 and 2 above include this change.

The Chairman, as a delegate of the EPA, concluded that the change was unlikely to significantly increase any impact of the proposal on the environment and gave consent under section 43A of the EP Act to the change on 16 March 2016.

BHP submitted a final request for EPA consent to the change the proposal on 7 June 2018 following the condition consultation process. The change was requested to ensure that there are no discrepancies between the proposal that was referred in 2012, described in the public environmental review document in 2016, and that assessed and reported on by the EPA in this report.

The EPA consented to the change as the change represented a clarification of the proposal description and does not include any additional disturbance. The change does not alter the cumulative impacts associated with the proposal.

Tables 1 and 2 above are consistent with the proposal description in the section 43A application.

2.3 Context to the Strategic Proposal assessment

Strategic proposals

The Pilbara Expansion proposal is considered a strategic proposal because it identifies future proposals which, if implemented, are likely to have a significant effect on the environment.

The EPA believes that assessment of strategic proposals strengthens the environmental impact assessment process through early consideration of environmental issues at the project planning stage and formal consideration of the cumulative impacts of multiple proposals.

In assessing the Pilbara Expansion as a strategic proposal, the EPA is able to consider the cumulative impacts of future proposals by the proponent, rather
than assessing impacts on a case-by-case basis as individual iron ore mines are proposed.

BHP may refer a future proposal to the EPA and request that the proposal be declared a derived proposal under the Pilbara Expansion Strategic Proposal. After receipt of the referral and the request, the referral is advertised for public comment. The EPA can only consider public comment in the context of its decision on whether or not to declare the proposal to be a derived proposal.

After considering public comment and the proposal documentation, the EPA then considers whether or not to declare the referred proposal to be a derived proposal. To do so, the EP Act requires that:

- the referred proposal was identified in the strategic proposal, and
- the strategic proposal Ministerial Statement provides that the referred proposal may be implemented, subject to any conditions.

The EPA may refuse to declare the referred proposal to be a derived proposal if it considers that:

- the environmental issues raised by the referred proposal were not adequately assessed when the strategic proposal was assessed
- there is significant new or additional information that justifies the reassessment of the issues raised by the referred proposal, or
- there has been a significant change in the relevant environmental factors since the strategic proposal was assessed.

Environmental values of the Pilbara

The project boundary for the Strategic Proposal extends across three biogeographic regions – Pilbara, Gascoyne and Little Sandy Desert. The Pilbara bioregion forms 77.9 per cent of the project boundary.

The Pilbara bioregion, as defined by the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway & Cresswell 1995) covers about 179 000 square kilometres (km²) and is characterised by ancient and striking landscapes in an arid setting. The Pilbara bioregion (hereafter ‘the Pilbara’) consists of four subregions: Fortescue, Hamersley, Chichester and Roebourne (Figure 3).

The Pilbara has a diverse range of habitats, including mangroves, grassland savannahs, mountain ranges, gorges, wetlands and tropical woodlands. It is an area of very high biodiversity value, possessing high species richness, and many endemic flora and fauna species. It has 150 conservation significant flora species, the greatest reptile diversity in Western Australia and contains the richest known groundwater fauna diversity in Australia. The region is identified as one of only 15 national biodiversity hotspots (Department of Environment and Energy 2017).

Flora in the Pilbara is dominated by arid and tropical plant species with rainforest species persisting in localised habitats. During the past 25 years the number of known plant species from the Pilbara has increased by more than 55 per cent to about 1700 species (van Leeuwen 2012). One hundred and fifty
species are of conservation significance, the majority of which are still poorly known, with further survey required to evaluate their correct status.

Two Threatened Ecological Communities (TECs) – *Themeda* grasslands on cracking clays (Hamersley Station, Pilbara) and Ethel Gorge aquifer stygobiont community – and 42 Priority Ecological Communities (PECs) are currently listed in the Pilbara (Department of Parks and Wildlife 2016). The Public Environmental Review (PER) document identifies that both of the TECs and eight of the 42 PECs are within the project boundary (BHP 2016a).

The rich diversity of fauna in the Pilbara is still being described, with new species of vertebrates and large numbers of terrestrial and aquatic invertebrates frequently being discovered. The CSIRO has noted that no mammal species are endemic to the Pilbara, although a small number are almost so, including the Pilbara leaf-nosed bat, western pebble mound mouse, little red kaluta, Rothschild’s rock wallaby, the Pilbara ningaui and two species of the planigale marsupial (Carwadine et al. 2014). The high reptile diversity includes the greatest number of gecko species in Australia, as well as high numbers of goannas, dragons and skink species. Terrestrial invertebrates show high levels of diversity and endemism, with 375 species of ground-dwelling spiders (Durrant et al. 2010) and 429 beetle species (Guthrie et al. 2010). Several small reptiles are endemic to the Pilbara and the range of one of Australia’s largest reptiles, the Pilbara olive python, extends only just outside the region (Carwadine et al. 2014).

The Pilbara has the richest-known subterranean faunal diversity in Australia with localised endemism. About 350 species of stygofauna were collected during surveys undertaken between 2002 and 2009 (Eberhard et al. 2009), with modelled estimates of 500–550 species considered to be substantially underestimated (Halse et al. 2014).

Although the Pilbara is in the arid zone it has an abundance of wetlands, ranging from springs and river pools to salt marshes, claypans and rockpools. Aquatic invertebrates show high diversity for an arid zone with about one-fifth of all species encountered currently believed to be endemic to the region (Pinder et al. 2010). This high richness is considered to reflect the abundance of consistently fresh, permanent water maintained by freshwater aquifers. Of particular importance are the many groups of rare species that are restricted to a limited range of springs and spring-fed pools, including those at Millstream Chichester National Park and Karijini National Park. Five wetlands in the Pilbara are recognised as being of National Significance (McKenzie et al. 2009).

The Pilbara also holds immense cultural value and has the most abundant collection of rock art engravings in the world (Carwadine et al. 2014). Aboriginal people have inhabited the Pilbara for more than 40 000 years and have strong spiritual, physical and cultural connections to Country. About 31 different Aboriginal language groups exist in the region. Much of the Pilbara is covered by Native Title claims or determinations under the *Native Title Act 1993*. 
A key focus of the EPA’s assessment has been to ensure that the Strategic Proposal will not significantly impact on these important regional environmental values.
Figure 3: The Pilbara bioregion and subregions
Land use in the Pilbara

Various land uses, including mining and pastoral leases (as well as infrastructure developments, tourism and historic land changes due to European settlement), result in threats to the environmental values of the Pilbara, which may be individual (site-specific) or cumulative or both. Cumulative impacts may occur when:

- individual impacts may not be considered significant, but if added to past, present or future actions, may result in collectively significant impacts taking place over a period of time, or
- individual actions may be significant, but may be larger where there are cumulative effects.

Since the 1960s, the Pilbara’s economy has been driven by the extraction of iron ore and offshore petroleum and natural gas reserves. In addition, about 60 per cent of the Pilbara’s area is used by the commercial cattle grazing industry. The region is almost exclusively crown land, with freehold land generally concentrated along the coastline. Layered over the crown land are various land uses that overlap one another. These include mining tenements, pastoral leases, formal conservation reserves, proposed conservation areas, Aboriginal reserves and unallocated crown land (Table 3, Figure 4).

In addition to the land area taken up by mining tenements, there exists a supporting network of rail and road infrastructure: this connects mine sites with ports on the Pilbara coast.

Table 3: Land use in the Pilbara region

<table>
<thead>
<tr>
<th>Area type</th>
<th>Area (hectares)*</th>
<th>Percentage of Pilbara IBRA region (17 831 900 ha total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining tenements (2016)</td>
<td>11 439 700</td>
<td>64.2</td>
</tr>
<tr>
<td>Pastoral leases (2015)</td>
<td>10 924 700</td>
<td>61.3</td>
</tr>
<tr>
<td>Pastoral lease exclusion zones (2015)</td>
<td>365 620</td>
<td>2.1</td>
</tr>
<tr>
<td>Formal conservation reserve (2016)</td>
<td>1 135 950</td>
<td>6.4</td>
</tr>
<tr>
<td>Other DBCA managed land (2016)</td>
<td>669 513</td>
<td>3.8</td>
</tr>
<tr>
<td>Unallocated crown land (not managed by DBCA (2017)</td>
<td>3 658 410</td>
<td>20.5</td>
</tr>
<tr>
<td>Aboriginal reserve (2017)</td>
<td>725 728</td>
<td>4.1</td>
</tr>
</tbody>
</table>

* various tenure types overlap one another

---

1 In Western Australia, the following categories under the Conservation and Land Management Act 1984 (CALM Act) are considered part of the National Reserve System (NRS): national park, nature reserve and conservation park. Section 5(1)(g) and 5(1)(h) reserves under the CALM Act may be part of the NRS, depending on their statutory purpose. Collectively, these categories comprise ‘protected areas’ under the formal conservation reserve system.
Figure 4: The Pilbara IBRA region and subregions, conservation reserves and mining tenements
Conservation reserve

At present, formal conservation reserve land in the Pilbara consists of three national parks (Karijini, Millstream-Chichester and Murujuga), three nature reserves (Mungarooona Range, Great Sandy Islands and the Dampier Archipelago) and one conservation park (Cane River). Of these, Karijini National Park and Mungarooona Range Nature Reserve are within the project boundary. The Strategic Proposal description (Table 2) specifically excludes any development within Karijini National Park, while Mungarooona Range Nature Reserve is not near any existing BHP mining tenement and not considered likely to be impacted by the Strategic Proposal.

This equates to only 6.4 per cent (Table 4) of the Pilbara biogeographic region, well below the 17 per cent recognised internationally for biodiversity protection (Government of Western Australia 2016) and does not adequately represent the range of diversity present within each IBRA subregion.

Only 0.6 per cent of the Fortescue subregion is captured in formal conservation reserves by very small portions of the Millstream-Chichester and Karijini national parks.

The Department of Biodiversity, Conservation and Attractions (DBCA) manages several areas of ex-pastoral leases – as unallocated crown land (UCL) – for the purpose of conservation. After the 2015 renewal of pastoral leases in Western Australia, a further 365 620 ha of land in the Pilbara was acquired from previous pastoral leases for inclusion in the conservation reserve. Once formalised, this will increase the Pilbara’s protected area to 10.2 per cent of the region and provide a significant percentage increase to the Fortescue subregion in particular (Table Table 4).

Table 4: Formal conservation reserves and DBCA-managed land in the Pilbara region

<table>
<thead>
<tr>
<th>IBRA subregion</th>
<th>Formal conservation reserve</th>
<th>DBCA-managed UCL (incl. 2015 pastoral lease exclusions)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (ha)</td>
<td>%</td>
<td>Area (ha)</td>
</tr>
<tr>
<td>Chichester</td>
<td>330 706</td>
<td>3.9</td>
<td>218 635</td>
</tr>
<tr>
<td>Fortescue</td>
<td>10 771</td>
<td>0.6</td>
<td>182 768</td>
</tr>
<tr>
<td>Hamersley</td>
<td>725 348</td>
<td>12.9</td>
<td>191 467</td>
</tr>
<tr>
<td>Roebourne</td>
<td>69 127</td>
<td>3.7</td>
<td>76 643</td>
</tr>
<tr>
<td>Pilbara Total</td>
<td>1 135 950</td>
<td>6.4</td>
<td>669 513</td>
</tr>
</tbody>
</table>
It is important to note that many of the pastoral lease exclusion zones may have compromised values due to the impacts of pastoralism and mining activities: significant resources may be required to manage the degradation.

With so many competing land uses, major constraints apply to any further allocation of land for conservation. Further, portions of existing (and proposed) Pilbara conservation reserves have mining tenements within their boundaries.
Figure 5: Conservation reserve, DBCA-managed unallocated crown land and 2015 pastoral lease exclusions
Threats to environmental values in the Pilbara

Land use changes including vegetation clearing, cessation of traditional burning practices and invasive species proliferation have resulted in landscape-scale impacts in the Pilbara. Although direct land clearing is the most immediate pressure, ongoing degradation can lead to similar outcomes.

In addition to the associated pressures and threats mentioned above, the cumulative impacts from mining activities and other approved developments in the region need to be considered and actively managed to protect the Pilbara’s environmental values. Key threats to the region’s environmental values are discussed below (note that this is not an exhaustive list).

Clearing of native vegetation

Clearing of native vegetation has the direct and immediate effect of removing native flora and fauna and their habitat. Clearing of large areas can fragment natural landscapes – changing the ecological function of ecosystems, and exposing plant and animal communities to other pressures. The combined effects of many smaller clearing activities over time can also have landscape-scale impacts.

The past decade has seen an increase in the scale, rate and pattern of clearing for mining and infrastructure development in the Pilbara. Although no data is readily available for clearing between 1960 and 1997, records since then show the amount of clearing approved under the EP Act is more than 300,000 ha (to December 2016). The BHP Strategic Proposal adds a further 98,500 ha of clearing (Figure 6); however, this should be considered in the context of the total land area within the project boundary (7,650,074 ha). The additional 98,500 ha equates to about 1.29 per cent of the project boundary area.

The actual amount of clearing is higher than indicated in Figure 6, as these figures do not include:

- clearing undertaken before 1997
- clearing undertaken before the introduction of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 and not assessed under Part IV
- clearing that is exempt under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, or
- clearing undertaken under State Agreements that have not been subject to Part IV or Part V EP Act approval.
Figure 6: Native vegetation clearing approved in the Pilbara since 1997
The environmental impact of vegetation clearing has been exacerbated by the lack of successful rehabilitation of mines in the Pilbara. Although mining has been occurring in the Pilbara for more than 60 years, there is limited evidence that proponents have successfully rehabilitated any areas subject to large-scale mining. The importance of rehabilitation for each key environmental factor is discussed in the assessment of each factor where relevant.

Physical and biological challenges for the Pilbara region include harsh temperatures, unpredictable rainfall, limited topsoil, hostile waste materials and, in some cases, poorly understood seed ecology. Other issues have been identified, such as uncertainty about the expectations of regulators, a perception of few incentives to close and rehabilitate mines, and a reluctance to share knowledge between companies (DMP 2016).

**Invasive plants**

Established weeds of the Pilbara (103 taxa) equate to 6.3 per cent of the region’s total flora species (Keighery 2010). Nineteen of these are newly recorded since surveys in 2004. Of the 103 species of invasive plants recorded, 14 affect the region at a landscape scale, altering fire patterns, modifying soil characteristics or directly competing with native species. The most common of these is buffel grass (*Cenchrus ciliaris*), which is estimated to affect some 3434 km² of the Pilbara. A further 21 species significantly affect particular habitats such as wetlands and islands. Sixteen additional species are considered to be potential threats (Keighery 2010). Development activities can increase the spread of weeds through modification of landscapes and movement of soil.

**Introduced fauna**

Impacts from feral herbivores (such as donkeys, horses, goats and cattle) include compaction and erosion of soil, eutrophication and sedimentation of waterways, loss of grazing-sensitive plant species, reduction of native grass biomass, introduced weed species, and trampling of seedlings and mature plants.

Feral carnivores including cats and foxes are responsible for the range reductions and population declines of many native animals across the Pilbara (Carwadine et al. 2014). Cane toads also have the potential to significantly impact on native fauna species should they become established in the Pilbara.

**Fire regimes**

Aboriginal burning practices in the Pilbara once created a mosaic of burnt and unburnt patches, regulating fuel loads and mitigating the threat of large, intense fires (Carwadine et al. 2014). When fires are too frequent or intense, negative ecosystem impacts occur, such as loss of understorey biodiversity (Carwadine et al. 2014). Alteration of fire regimes is the most widespread of the landscape processes that have modified Pilbara biodiversity since European settlement. Between 1993 and 2006, more than 72 per cent of the region was burnt, with about 28 per cent being burnt two or more times during this period (McKenzie et al. 2009).
Hydrological changes

Management of water is an essential component of many mining operations in the Pilbara. The mining industry is the region’s dominant water user – for mining operations, mine dewatering and other related water uses (including mine site and exploration camp irrigation and residential water uses) – accounting for almost 90 per cent (89.2 per cent in 2015) of all water abstracted or produced (DoW 2017).

Groundwater drawdown through dewatering can negatively impact on groundwater-dependent ecosystems, leading to indirect losses of vegetation and other ecosystem values (such as loss of stygofauna habitat).

Creek diversions and disposal of excess dewater to local waterways can lead to erosion and alter the hydrological regime, changing the intermittent seasonal flowing systems to permanently flowing systems. This can change the ecology of the waterways and lead to destabilisation and erosion of banks. The quality of discharged water can also impact on ecosystems.

Pit lakes can also impact on water resources, forming hydrogeological connections with waterways or groundwater resources and altering water quality and water chemistry. Saline plumes from mine voids can extend for tens of kilometres from a pit lake (Johnson & Wright 2003).

The EPA has previously expressed its view that the potential exists for a significant environmental legacy associated with pit lakes. It has stated that further research is required to understand the short-term and long-term impacts of mine pit lakes, which in turn will help with the assessment of individual proposals and their cumulative impacts (EPA 2014).

The environmental acceptability of disposal to surface water systems depends on the ecology, hydrology and hydrogeology of the proposed disposal area. Where high volumes are likely, the potential for cumulative impacts should be considered in decision-making. Some catchment areas already have a significant quantity of dewater and surplus disposal occurring, such as in the Fortescue Marsh catchment.

Cumulative impacts (including dewatering impacts) have been addressed in the EPA’s Section 16(e) advice to the Minister for Environment in Environmental and water assessments relating to mining and mining-related activities in the Fortescue Marsh management area (EPA 2013). This advice provides a framework to guide decision-making in regard to impacts – by outlining environmental objectives and management strategies for the various areas of the marsh to enable cumulative impacts to be considered and consistently managed.

The Pilbara groundwater allocation plan (DoW 2013b) issued by the former Department of Water – now the Department of Water and Environmental Regulation (DWER) – describes the approach to managing groundwater in the Pilbara. Before issuing a licence, DWER requires proponents to define the end use of dewatering. DWER’s Strategic policy 2.09: Use of mine dewatering surplus (DoW 2013) guides proponents on how to minimise surplus dewater so that impacts on the receiving environment are minimised.
DWER is responsible for managing and licensing groundwater abstraction and assesses water availability and the impacts of dewatering on a case-by-case basis through the licensing process. The *Western Australian water in mining guideline* (DoW 2013a) provides a consistent and transparent framework for assessing mine water requirements and management across the state and aligns the water licence assessment process with other assessment processes, such as those under the *Environmental Protection Act 1986*, including consideration of cumulative impacts such as:

- other mining operations within the catchment
- other water users in the area
- proposed operations within the catchment (where publicly available information exists (e.g. public environmental reviews)
- opportunities for cooperation such as shared monitoring and data sharing between water users using the same water resource (e.g. to develop groundwater or surface water models).

The past decade has seen a steady increase in the volume of water licensed for abstraction each year (Figure 7). More than 1000 gigalitres (GL) of water is licensed to be abstracted annually in the Pilbara, with actual abstraction currently around 400 GL annually, of which approximately 20 per cent is discharged to surface water systems (DoW 2017).

Consideration of the whole-of-operation’s water needs provides a balanced approach to make use of dewater and minimise the need to dispose to surface water systems.

DWER predicts that water abstraction for mining will increase to more than 700 GL per year by 2042 under a medium growth scenario and to more than 900 GL per year under a high growth scenario (DoW 2013a).
Figure 7: Licensed water entitlements in the Pilbara groundwater area 2005–17.
Mine closure and rehabilitation

As the EPA noted in its s16e advice on the cumulative impacts of development in the Pilbara, there is limited evidence of successful rehabilitation of areas subject to large-scale mining. The EPA notes that while some success has been achieved in small-scale rehabilitation, further work is required to improve broadscale techniques so that these areas can be rehabilitated to an acceptable standard.

In its environmental factor guideline for Flora and Vegetation, the EPA reiterates that revegetation in Western Australia is challenging, particularly due to the complexities of biological diversity, climate, soils and land use.

Consistent with the Guidelines for preparing mine closure plans, the EPA will assess rehabilitation and decommissioning for proposals subject to State Agreement Acts. Most activities proposed under the Strategic Proposal occur on tenure granted under a State Agreement Act. As also stated in the guidelines, where a mine site is subject to multiple regulatory frameworks, a single mine closure plan is required that addresses Mining Act 1978 components and non-Mining Act 1978 components.

The EPA considers that consultation during mine closure planning is important, including with the Traditional Owners. BHP undertakes consultation with Traditional Owners through agreements that are already in place. BHP has stated in the Response to Submissions that “at the first opportunity we will make future Derived Proposals, management plans, and Mine Closure Plan information available for consideration by the relevant groups. This will be in advance of submission to regulatory authorities, through existing committee structures established under the Comprehensive Agreements, and will provide the opportunity for adequate consultation to occur and feedback to be sought prior to submission. Central to this engagement will be how matters of Indigenous significance are considered in mine planning and details on how the mitigation hierarchy has been applied” (BHP 2016b).

BHP has included several case studies in the PER document to describe the research it is doing to help predict the impacts and outcomes of mine closure and rehabilitation.

The EPA will require BHP to demonstrate that closure and rehabilitation of individual future proposals can be carried out in an ecologically sustainable manner.

The PER document also includes a table that gives a chronology of BHP’s rehabilitation and closure activities since 1974, when revegetation trials were first undertaken at Mt Whaleback. These activities are of a small scale, and broadscale rehabilitation remains an area of improvement. However, the information provided by the small-scale activities since 1974 contribute to the knowledge base required for successful broadscale rehabilitation.

The EPA considers it is important that a full understanding of the status of rehabilitation in the Pilbara is achieved. Consequently, the EPA has included guidance on the information related to rehabilitation that it expects to see in
any request to declare a proposal a derived proposal. Key information that the EPA considers necessary to inform future decision-making is:

- the total area of rehabilitation that is required to be undertaken across BHP’s iron ore tenure in the Pilbara
- an analysis of the historical success of rehabilitation that the proponent has undertaken in the Pilbara
- the likely success of future rehabilitation activities, taking into account scientific evidence rather than aspirational targets.

**Regional management approach**

It is a requirement of the EPA’s environmental factor guidelines that proponents demonstrate application of the mitigation hierarchy for their proposals. For a strategic proposal of this nature, where specific design of future proposals is not yet known, the EPA notes that it is difficult for the proponent to demonstrate that all practicable avoidance and minimisation measures have been taken.

However, to help demonstrate that it has applied the mitigation hierarchy to the Strategic Proposal, BHP proposes to implement a regional management approach to mitigate the impacts of its future operations. The approach involves linking regional objectives and outcomes for key environmental assets and species to an adaptive regional management approach.

The approach would require BHP to develop specific and measurable outcomes for key environmental assets, species and other biophysical elements that may be impacted by the Strategic Proposal, based on site-specific data. The outcomes would be measured against criteria (triggers and thresholds) that are developed for each derived proposal.

BHP intends to develop a subregional management plan for each key environmental factor for application across future proposals identified in the Strategic Proposal. The regional management plans would contain a suite of management measures and actions that the proponent can select from for each derived proposal – to manage the proposal to meet the objectives. These plans would contain a schedule detailing the triggers and thresholds or management actions and targets for managing the impacts of each specific derived proposal.

The subregional management plan approach has been implemented for existing approved proposals in the Pilbara. For example, BHP has the *Eastern Pilbara water management plan*, which covers several operations that form part of a mining hub around Newman. The EPA notes that the subregional approach allows coordination and consistency of management across a number of projects within a ‘hub’.

BHP’s approach broadly aligns with the EPA’s view of how the Strategic Proposal should be managed to meet the EPA’s objectives. The EPA expects that each derived proposal would include a subregional management plan with a schedule that includes the management targets, triggers, thresholds and management actions for that derived proposal. The documentation provided with the derived proposal would show how the actions, targets,
triggers and thresholds ensured the proposal met the EPA’s objectives and the objectives in the recommended conditions.

In addition to the specific outcomes for the key assets and species in the management plan, the management measures in the regional approach would be required to minimise the impacts associated with the key environmental threats identified above, as well as any site-specific threats associated with individual future proposals.
3. Consultation

The EPA advertised the referral information for the proposal for public comment in July 2012 and received one submission. The submission requested ‘Assess – Public Environmental Review’.

The proponent consulted with government agencies and key stakeholders during preparation of the ERD. The agencies and stakeholders consulted, the issues raised and the proponent’s response are detailed in Table 86 of the proponent’s ERD (*Pilbara Expansion Public Environmental Review Strategic Proposal*, March 2016).

Five agency submissions and five public submissions were received during the public review period. The key issues raised related to:

- The scale of the Strategic Proposal’s impacts, including the cumulative impacts on biodiversity and water across the Pilbara.
- The veracity and accuracy of the information in the Public Environmental Review (PER) document and its suitability for use in assessing the Strategic Proposal.
- How future proposals would be managed to reduce the impacts on the environment.
- Management of mine closure and rehabilitation.


The EPA considers that the consultation process has been appropriate and that reasonable steps have been taken to inform the community and stakeholders about the proposed development. Further, the EPA has taken into account the relevant environmental issues identified from this process during its assessment of the proposal.
4. Key environmental factors

In undertaking its assessment of this proposal and preparing this report, the EPA had regard for the object and principles contained in s4A of the EP Act to the extent relevant to the particular matters that were considered.

The EPA considered the following information during its assessment:

- the proponent’s referral information and ERD
- public comments received on the referral, stakeholder comments received during preparation of the proponent’s documentation and public and agency comments received on the ERD
- the proponent’s response to submissions raised during the public review of the ERD
- the EPA’s own inquiries, including information gained during a site visit to the Pilbara
- the EPA’s Statement of environmental principles, factors and objectives
- the principles, policy and guidance relevant to an assessment of each key environmental factor in sections 4.1 to 4.8.

Appendix 1 of the PER document provides an analysis, by BHP, of how the EPA’s legislation, policy and guidance at the time of the release of the PER document is relevant to the Strategic Proposal.

Having regard to the above information, the EPA identified the following key environmental factors during the course of its assessment of the proposal:

- **Flora and Vegetation** – impacts on flora and vegetation as a result of clearing, including increased cumulative impacts associated with other proposals.
- **Terrestrial Fauna** – clearing of fauna habitat, including habitat for conservation significant fauna species.
- **Subterranean Fauna** – loss of habitat for subterranean fauna species as a result of disturbance for mining and abstraction of groundwater.
- **Hydrological Processes and Inland Waters Environmental Quality** – changes to hydrological regimes and water quality as a result of water abstraction, use and disposal of excess water.
- **Social Surroundings** – potential impacts on sites of Aboriginal heritage significance and areas where traditional cultural activities are undertaken.
- **Air Quality** – increased emissions of greenhouse gases and particulates associated with dust.
- **Landforms** – disturbance of landforms as result of the construction of future proposals.
- **Terrestrial Environmental Quality** – potential for discharge of pollutants to the environment, including from mine closure activities.
Having regard to the EP Act principles, the EPA considered that the following principles were particularly relevant to its assessment of the proposal:

1. **Precautionary principle** – the proponent’s investigations into the biological and physical environment have provided sufficient certainty to assess risks and identify measures to avoid or minimise impacts.

2. **Principle of intergenerational equity** – the EPA notes that the proponent has taken measures to avoid and minimise impacts; and this, together with the recommended conditions for future proposals, will ensure the environment is maintained for future generations.

3. **Principle of the conservation of biological diversity and ecological integrity** – the EPA has considered the impacts to flora and fauna species and ecological communities. It has recommended conditions to manage the impacts: these have the objective of maintaining biological diversity and ecological integrity.

4. **Principles relating to improved valuation, pricing and incentive mechanisms** – the EPA notes that the proponent would bear the cost relating to management of waste and pollution, including avoidance, containment, and rehabilitation.

5. **Principle of waste minimisation** – the EPA notes that the proponent proposes to backfill mine voids; use managed aquifer recharge in preference to surface water discharge of excess water; and apply the waste management hierarchy (i.e. avoid, reduce, reuse, recycle, recover, treat, contain and dispose) to future proposals identified in the Strategic Proposal.

Appendix 2 provides a summary of the principles and how the EPA considered these principles in its assessment.

The EPA’s assessment of the proposal’s impacts on the key environmental factors is provided in sections 4.1–4.8. These sections outline whether or not the EPA considers that the impacts on each factor are manageable.

**Changes to EPA environmental policy and guidance**

The EPA introduced a new suite of environmental guidance for environmental impact assessment on 13 December 2016. This replaced EPA policy and guidance that was in place at the time the Response to Submissions document was prepared.

In its assessment of the proposal, where relevant the EPA gave due regard to its current environmental impact assessment policy and guidance documents, unless otherwise stated. The EPA consulted the proponent on the application of the current environmental impact assessment policy and guidance documents relevant to its environmental review and the EPA’s assessment of the proposal.
4.1 Flora and Vegetation
The EPA’s environmental objective for Flora and Vegetation is ‘to protect flora and vegetation so that biological diversity and ecological integrity are maintained’.

Ecological integrity is the composition, structure, function and processes of ecosystems, and the natural range of variation of these elements.

Relevant policy and guidance
The EPA considers that the following current environmental policy and guidance is relevant to its assessment of the proposal for this factor:

- *Environmental factor guideline – Flora and Vegetation* (EPA 2016a)

The purpose of the technical guidance on flora and vegetation surveys is to ensure adequate flora and vegetation data of an appropriate standard are obtained and used in environmental impact assessment.

The flora and vegetation surveys used in the assessment of the Strategic Proposal have been undertaken for a long period of time, with BHP having undertaken 350 surveys during the past decade, including for previously approved operations. A review of each individual survey to determine its consistency with standards at the time of the survey has not been undertaken; however, these surveys are considered suitable for assessment of a strategic proposal. This is because more detailed survey information needs to be submitted as part of future proposals, to demonstrate that the future proposals meet EPA objectives before being declared as derived proposals.

The PER document states that the vegetation mapping has been undertaken consistent with *Guidance statement 51*, which was the relevant guidance for flora and vegetation surveys between its release in 2004 up until it was updated into a technical guideline in 2015 and a revised version was released in December 2016.

The standards and information required for each survey have not changed over this time and therefore the EPA considers that the proponent has used a suitable methodology to combine numerous flora and vegetation surveys and fill gaps to map broadscale vegetation units. In addition to this, the proponent has liaised with DBCA to use all available biodiversity information within the study area.

Under the EPA’s former guidance framework, the following documents are relevant to the assessment of this proposal:

- *Cumulative environmental impacts of development in the Pilbara region* – advice under Section 16e of the EP Act (EPA 2014)
- *Mining and water assessments relating to mining and mining-related activities in the Fortescue Marsh management area* – advice under Section 16e of the EP Act (EPA 2013).
The mining and water assessments s16e advice is most relevant to the Hydrological Processes and Inland Waters Environmental Quality factors. However, it is also relevant to Flora and Vegetation to the extent that riparian vegetation and groundwater-dependent ecosystems of the Fortescue Marsh may be impacted by a proposal.

**EPA assessment**

**Flora and vegetation within the project boundary**

BHP has undertaken work to characterise the flora and vegetation within the project boundary. Biological surveys have been conducted within the project boundary to characterise the flora and vegetation, with a particular focus on BHP tenements. BHP has also liaised with DBCA to ensure it has utilised all available biodiversity data in the environmental impact assessment of the Strategic Proposal.

BHP undertook the following three studies to characterise flora and vegetation and support the assessment of the Strategic Proposal:

- Consolidated vegetation mapping – this mapping consolidated 162 datasets obtained between 2004 to 2013 from across BHP tenure to provide information on vegetation associations and condition within the project boundary.
- CSIRO modelling – vegetation community-level modelling to map levels of biodiversity significance in the Pilbara bioregion.
- Flora and fauna screening assessment – a screening assessment of the direct impacts of all proposed BHP and third-party iron ore projects (at September 2014) on mapped locations of conservation significant flora (and fauna) species within the project boundary. This assessment used data from BHP’s database and information supplied from the then Department of Parks and Wildlife in December 2015.

**Regional biodiversity values**

BHP commissioned the CSIRO to assess the spatial patterns in the distribution of biodiversity, and associated levels of biodiversity significance, across the Pilbara bioregion. This work informed the production of maps that identify areas of biodiversity significance. These maps show the potential for a given location to harbour a concentration of species narrowly distributed beyond that location, due to natural patterns of endemism and/or anthropogenic habitat degradation (i.e. either naturally or artificially restricted habitat).

The mapped areas of biodiversity significance are shown in Figure 8. The red areas on the map are considered to have high biodiversity values. Note that these values relate to fauna values as well as flora and vegetation values. Larger areas of high biodiversity values identified in Figure 8 include Fortescue Marsh, sections of Karijini National Park and an area west of Karijini National Park. Part of this area west of Karijini National Park overlaps with the ‘Themeda grasslands’ TEC and ‘Brockman Iron Cracking Clay
Communities’ PEC, and also includes an area identified for pastoral lease exclusion. Other more localised areas of high biodiversity significance can be found along the eastern edge of Karijini National Park and around Newman.

Figure 9 identifies the areas of biodiversity significance that would be impacted by the Strategic Proposal under the full development scenario. The full development scenario includes impacts on the localised areas along the eastern edge of Karijini National Park. The Strategic Proposal does not include any direct impacts on Karijini National Park and BHP does not hold any tenements within the high biodiversity area west of Karijini. Therefore the largest potential biodiversity impacts are to the area east of Karijini National Park.
Figure 8: Predicted biodiversity significance (red indicates areas of higher biodiversity significance)
Figure 9: Predicted biodiversity significance and areas of impact from the Strategic Proposal
Flora within the project boundary

Flora in the Pilbara is dominated by arid plant species, with localised habitats supporting some rainforest species (EPA 2014). Based on BHP’s records and data provided by DBCA, 128 conservation significant flora species have been recorded within the project boundary. These comprise two Threatened flora, 39 Priority 1 species, 19 Priority 2 species, 58 Priority 3 species and 10 Priority 4 species. The full list of these species is provided as an appendix to the PER document and their locations (based on their conservation category) are shown in Figure 10 below.

Of these 128 species, 51 species have been identified as being at higher risk of significant impacts from the Strategic Proposal. Higher risk is based on criteria that the Strategic Proposal would potentially impact on over 10 per cent of the known records or because all the known records are within the project boundary.

Table 20 of the PER goes through each of these 51 species to discuss the significance of the impacts. Some of the key impacts/outcomes are:

- no Threatened flora meet the criteria for ‘greater than 10 per cent’ or are found only in the development envelope
- two species are considered to be at particularly high risk from the Strategic Proposal, being *Acacia* sp. East Fortescue and *Synostemon hamersleyensis*².
- five Priority flora species are noted as being of moderate risk from the Strategic Proposal.

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² The discovery of *Synostemon hamersleyensis* was discussed in the 2015–2016 EPA annual report. It was previously known as *Sauropus* sp. Koodaideri detritals.
Figure 10: Conservation significant flora species recorded within the project boundary
Vegetation within the project boundary

In 1975 Beard undertook broadscale mapping of vegetation associations across Western Australia (Beard 1975). This mapping identified 89 vegetation associations in the Pilbara, of which 41 occur within the project boundary. Most of these vegetation associations have more than 86 per cent of their pre-European settlement extent remaining. One association is considered to be below 25 per cent of its pre-European extent (association 125 – bare areas, salt lakes) but this is not found within the project boundary and will not be impacted by the Strategic Proposal.

As noted in the comments on the Strategic Proposal, Beard's mapping is broadscale and possibly not suitable for EIA. The EPA also notes in its environmental factor guideline for Flora and Vegetation that mapping exists at this broad scale across much of the state, and that proponents need to provide the regional context to allow the EPA to assess the impacts.

To address this matter, BHP carried out more detailed vegetation association and condition mapping over 422 425 ha of BHP tenure. Areas of BHP tenure that remain to be mapped are at Roy Hill, Ministers North and parts of Ophthalmia/Prairie Downs and Newman mining hub. Detailed mapping of these areas will be required at the time of derived proposals and as noted under Vegetation condition, for the purposes of this assessment the vegetation in these areas is assumed to be in ‘Good to Excellent’ condition.

Within the project boundary this mapping has identified two TECs (‘Themeda grasslands on cracking clays’ and ‘Ethel Gorge Aquifer Stygobiont Community’) and eight PECs (six Priority 1 and two Priority 3). The characteristics of these TECs and PECs are described in more detail in Table 13 of the PER document and in DBCA’s Priority Ecological Communities for Western Australia list.

Potential impacts of the Strategic Proposal

The Strategic Proposal would involve direct impacts on flora and vegetation through disturbance of 98 500 ha of native vegetation. Indirect impacts associated with the proposal include alteration of water regimes (both surface water and groundwater) that support vegetation, the introduction and spread of weeds, and changes to fire regimes.

Flora impacts

For this assessment, flora ‘Species of Interest’ – those with the highest risk of potential impact (without mitigation) – were considered to be those species where more than 10 per cent of known Western Australian records occur within the development scenario footprints. BHP focused its assessment on the 51 conservation significant flora considered at risk. Those species considered at high and moderate risk are discussed further below.

Acacia sp. East Fortescue (high risk)

Acacia sp. East Fortescue is a Priority 1 flora species. The EPA has previously recognised the importance of this species, with a requirement to maintain a 50 m buffer around individuals of the species when implementing
the Orebody 31 proposal (Ministerial Statement 1021), as well as for BHP to undertake a regional survey to identify more individuals. At this stage, further surveys have not identified any additional populations of this species.

The full development scenario does not include any disturbance of the currently known populations of this species adjacent to Orebody 31. As for Orebody 31, it will be necessary for management of future proposals identified in the Strategic Proposal to avoid indirect impacts, particularly dust, to this species so that the viability of the species is not threatened and biological diversity is maintained.

*Synostemon hamersleyensis* (high risk)

This species has been a species of interest in previous EPA assessments, most notably in the assessment of the Koodaideri Iron Ore and Infrastructure Project (Koodaideri Project), when it was known as *Sauropus* sp. Koodaideri detritals (Priority 1). At the time of this assessment, the species was considered likely to qualify for listing as Threatened flora with additional surveys required.

Potential significant impacts on this species are from future proposals on BHP’s Marillana tenement. At the time the PER document was prepared, this species was known from five records, comprising 28 locations within the Marillana tenement and 21 locations outside the tenement. Of the 4341 individuals recorded by Rio Tinto during its surveys for the Koodaideri Project, half occur within BHP’s Marillana tenement.

BHP has predicted the impact on *Synostemon hamersleyensis* as 50 per cent of the population under the full development scenario. This includes the predicted impacts of BHP as well as those of Rio Tinto for the Koodaideri Project.

At the time of the EPA’s assessment of the Koodaideri Project, none of the known individuals of *Synostemon hamersleyensis* were recorded in secure conservation reserves. It was predicted (by Rio Tinto) that habitat for this species occurred in Karijini National Park, however targeted surveys could not locate any additional individuals. It was also noted that the suitable habitat for this species is not fully understood. Since the EPA’s assessment, additional information about the habitat has been published (Telford & Naaykens 2015).

In a paper published in *Nuytsia* (The Journal of the Western Australian Herbarium) in 2015, it was noted that targeted surveys of 998 ha of suitable habitat had recorded 4341 individuals and that approximately 9000 ha of additional potentially suitable habitat had been identified (Telford & Naaykens 2015).

The paper also notes that the species is somewhat fire protected as it tends to be found in relatively low-fire habitats in the Pilbara and can re-sprout from rootstock following severe fires (Telford & Naaykens 2015).

In its *Report and recommendations on the Koodaideri Project* (EPA Report no. 1533), the EPA recommended that Rio Tinto undertake further regional surveys to accurately detect and document the distribution and population size of this species. This recommendation was subsequently adopted in Ministerial Statement 999 for the Koodaideri Project. Rio Tinto undertook four
surveys in 2016 as part of its regional survey requirements and identified about 4400 more individuals. The EPA notes that these surveys were not within Karijini National Park. The EPA understands that Rio Tinto was planning to undertake surveys within Karijini National Park later in 2017.

Given the increase in known occurrences of *Synostemon hamersleyensis* and the better understanding of its preferred habitat, fewer impacts on this species are likely than those predicted in the PER document for the Strategic Proposal. In addition, the lack of specificity in final disturbance associated with this Strategic Proposal means that actual impact is likely to be lower, as targeted surveys would be required in the future and project footprints are designed to avoid impacts.

**Other Priority flora**

Moderate impacts are predicted for five Priority flora species. These species are:

- *Eremophila* sp. Hamersley Range (Priority 1) – six locations of this species are known, with two locations within the BHP footprint. This species is known from the southern Hamersley Range over a 200 km area. It has not been recorded in Karijini National Park, but records exist adjacent to the national park on habitat types known to exist in the national park.

- *Josephinia* sp. Marandoo (Priority 1) – 17 locations are known of this species, with five locations predicted to be impacted under the full development scenario – two of which are located on BHP tenure. It is found in the central Hamersley Range, with a number of records in Karijini National Park. It tends to be found on clay soils, which are not usually the target for iron ore exploration in the Pilbara.

- *Oxalis* sp. Pilbara (Priority 2) – 14 locations have been recorded of this species, with eight within the full development scenario – seven of which are located on BHP tenure. Most records of this species occur in the Hamersley Range, with some records also appearing in the Gascoyne bioregion, 250 km from the nearest Pilbara record. It has been recorded on the western edge of Karijini National Park and is thought possible to occur in the Collier Range National Park, which sits outside the project boundary.

- *Isotropis parviflora* (Priority 2) – 53 locations have been identified, with impacts predicted on 27 of these locations under the full development scenario – all of which are located on BHP tenure. This species is found on the northern fringe of the Hamersley Range over a distance of 200 km. It has been recorded on either side of Karijini National Park, but not within the national park.

- *Eremophila magnifica* subsp. *magnifica* (Priority 4) – 548 locations of this species are known, with approximately 44 per cent of the total (244 locations) predicted to be impacted under the full development scenario. Of this, 142 locations are within BHP tenure. One-third of the known records are within Karijini National Park.
Given the range over which records of these species have been collected, or their presence within a conservation reserve, the EPA considers that impacts on these species can be managed to an acceptable level so that biological diversity is maintained.

As noted earlier, the largest biodiversity impacts are predicted for the area east of Karriini National Park. Concentrated development of new iron ore mines may potentially occur in this area through implementation of the Strategic Proposal. This area contains many of the conservation significant flora species shown in Figure 10, particularly Priority 3 species.

Priority 3 species are those known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. These species are considered as requiring further survey work to confirm their conservation status.

The EPA expects that when future proposals identified in the Strategic Proposal are undergoing more detailed planning, targeted surveys will be undertaken to ensure conservation significant flora species are avoided where practicable – so that biodiversity within these areas of high biodiversity significance is maintained.

**Vegetation impacts**

In the screening assessment undertaken by BHP, vegetation (and flora species) at risk were identified based on threshold levels included in the assessment. These threshold levels were based on existing accepted state and national references.

Analysis of the detailed vegetation mapping undertaken by BHP also identified several vegetation associations with restricted mapped extent or occurring largely within the full development scenario. Of the 41 vegetation associations identified within the project boundary, it is predicted that 11 would be impacted under the full development scenario. Table 17 from the PER document details the percentage impact on these 11 associations. Table 17 is reproduced below (as Table 5).
Table 5: Impacts on Beard vegetation associations

<table>
<thead>
<tr>
<th>BEARD VEGETATION ASSOCIATION</th>
<th>PRE-EUROPEAN EXTENT (ha)</th>
<th>% OF ASSOCIATION REMAINING</th>
<th>EXISTING DEVELOPMENT SCENARIO</th>
<th>REASONABLY FORESEEABLE THIRD PARTY</th>
<th>30% CONCEPTUAL DEVELOPMENT SCENARIO</th>
<th>FULL CONCEPTUAL DEVELOPMENT SCENARIO</th>
<th>PRE-EUROPEAN EXTENT REMAINING (%) AFTERT FULL CONCEPTUAL DEVELOPMENT SCENARIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>18**</td>
<td>676,557</td>
<td>99.39</td>
<td>3,434 (0.5%)</td>
<td>3,832 (0.5%)</td>
<td>20,245 (3.0%)</td>
<td>42,205 (6.2%)</td>
<td>93.15%</td>
</tr>
<tr>
<td>29**</td>
<td>1,133,220</td>
<td>99.98</td>
<td>6,636 (0.6%)</td>
<td>31,55 (2.8%)</td>
<td>40,559 (3.6%)</td>
<td>51,707 (4.8%)</td>
<td>95.41%</td>
</tr>
<tr>
<td>82</td>
<td>2,563,583</td>
<td>99.51</td>
<td>8,884 (0.4%)</td>
<td>12,001 (0.5%)</td>
<td>40,637 (1.6%)</td>
<td>75,682 (3.0%)</td>
<td>98.56%</td>
</tr>
<tr>
<td>111**</td>
<td>550,287</td>
<td>99.99</td>
<td>535 (0.1%)</td>
<td>2,632 (0.5%)</td>
<td>3,924 (0.7%)</td>
<td>5,134 (0.9%)</td>
<td>99.06%</td>
</tr>
<tr>
<td>173</td>
<td>1,752,521</td>
<td>99.72</td>
<td>124 (0.01%)</td>
<td>138 (0.01%)</td>
<td>386 (0.02%)</td>
<td>386 (0.02%)</td>
<td>99.70%</td>
</tr>
<tr>
<td>175**</td>
<td>507,860</td>
<td>99.92</td>
<td>50 (0.01%)</td>
<td>0 (0.01%)</td>
<td>99 (0.02%)</td>
<td>157 (0.03%)</td>
<td>99.89%</td>
</tr>
<tr>
<td>216**</td>
<td>26,670</td>
<td>98.89</td>
<td>1,746 (6.6%)</td>
<td>0 (6.6%)</td>
<td>5,282 (18.8%)</td>
<td>6,381 (23.9%)</td>
<td>74.96%</td>
</tr>
<tr>
<td>562</td>
<td>103,607</td>
<td>100.00</td>
<td>1,933 (1.9%)</td>
<td>5,406 (5.2%)</td>
<td>7,368 (7.14%)</td>
<td>11,808 (11.4%)</td>
<td>88.60%</td>
</tr>
<tr>
<td>567</td>
<td>776,824</td>
<td>99.66</td>
<td>508 (0.1%)</td>
<td>1,832 (0.2%)</td>
<td>2,341 (0.3%)</td>
<td>2,373 (0.3%)</td>
<td>99.36%</td>
</tr>
<tr>
<td>676</td>
<td>92,364</td>
<td>99.93</td>
<td>18 (0.02%)</td>
<td>0 (0.02%)</td>
<td>35 (0.04%)</td>
<td>35 (0.04%)</td>
<td>99.90%</td>
</tr>
</tbody>
</table>

1. Data of pre-Europen extent and proportion (%) of association remaining from Government of Western Australia (2013).
2. Development Scenarios:
- Existing Development Scenario includes existing BHP Billiton Iron Ore and third party developments.
- Reasonably foreseeable third party includes future approved or proposed third party developments and does not include existing developments.
- 30% Conceptual Development Scenario includes existing development, reasonably foreseeable third party developments and BHP Billiton Iron Ore’s 30% Conceptual Development Scenario.
- Full Conceptual Development Scenario includes existing development, reasonably foreseeable third party developments and BHP Billiton Iron Ore’s Full Conceptual Development Scenario.

None of the 11 associations in Table 5 coincide with a TEC or PEC. The two associations predicted to be impacted the most are associations 216 (‘Low woodland; mulga (with spinifex on rises)’) and 562 (‘Mosaic – low woodland; mulga in valleys/snappy gum over Triodia wiseana’). The EPA notes that association 216 is found outside of the Pilbara bioregion and is common and widespread in the Pilbara region generally, while the majority of future impacts to association 562 is from third-party impacts and not the Strategic Proposal. BHP will need to demonstrate, at the derived proposal stage, that none of these vegetation associations will be impacted to an extent that ecological integrity is threatened.
The full development scenario is, however, predicted to directly impact (from clearing) on one of the two TECs (Ethel Gorge) and two of the eight PECs identified within the project boundary.

**Ethel Gorge (TEC)**

The ‘Ethel Gorge Aquifer Stygobiont Community’ comprises shallow alluvial and calcrete aquifers that support a unique and diverse stygofauna assemblage, as well as riparian woodland communities that are potentially groundwater dependent. The full development scenario (which represents likely maximum impact) is predicted to result in 10.31 per cent of the TEC being cleared, with the current allowed impact at 1.78 per cent of the TEC, which is an increase of 8.53 per cent associated with the Strategic Proposal.

As the conservation values for the TEC primarily lie in the stygofauna it supports, the management of the hydrological regimes and stygofauna habitat is more relevant in assessing the impacts of the Strategic Proposal on this TEC. These impacts are more appropriately assessed through the Subterranean Fauna and Hydrological Processes factors. However, measures taken to maintain the hydrological regimes in the aquifers, particularly groundwater levels, will help minimise any impacts on riparian woodlands. Therefore the Strategic Proposal is not likely to impact on the biological diversity and ecological integrity of this TEC for the flora and vegetation factor.

**Vegetation of sand dunes of Hamersley Range/Fortescue Valley (PEC)**

This PEC (previously known as ‘Fortescue Valley Sand Dunes’) is a Priority 3 PEC. The dunes are red linear iron-rich sand dunes that lie at the junction of the Hamersley Range and Fortescue Valley. These dunes are considered regionally rare, small and fragile and highly susceptible to threatening processes. A small number are vegetated with *Acacia dictyophleba* scattered tall shrubs over *Crotalaria cunninghamii, Trichodesma zeylanicum var. grandiflorum* open shrubland. Open shrubland vegetation communities are uncommon in the Pilbara.

A very small proportion of the ‘Vegetation of Sand Dunes of the Hamersley Range/Fortescue Valley’ PEC may be impacted by the Strategic Proposal. The predicted direct impact from the full development scenario is on 0.06 per cent of the PEC. Two occurrences of this ecological community are located within the Marillana mining hub. These two occurrences are isolated and distinct: 4.4 ha and 3.07 ha respectively, and are 25 km from the main area of the PEC and account for 0.06 per cent of the PEC. The proponent contends that the removal of these two isolated occurrences would not impact on the integrity or continued ecological functioning of the PEC as a whole. The EPA agrees with this contention given the very small scale of impacts (0.06 per cent) on the PEC.

This PEC is not considered surface water or groundwater dependent and, as such, indirect impacts are unlikely given the Strategic Proposal footprint is 1.9 km from the main body of the PEC at its closest point.

Given the small percentage of impact on this PEC, and that indirect impacts are able to be managed, the ecological integrity of this PEC is likely to be maintained during the Strategic Proposal's implementation.
Coolibah-lignum flats: Coolibah and mulga (Acacia aneura) woodland over lignum and tussock grasses on clay plains (Coondewanna Flats and Wanna Munna Flats) (PEC)

This PEC is divided into three sub-types. The Strategic Proposal is predicted to directly impact on sub-type 1. This community is only known at Coondewanna and Wanna Munna flats (the latter being 40 km south-east of the former).

Direct impacts are predicted on 2.24 per cent of sub-type 1 and 2.13 per cent of the total overall PEC (that is, 2.13 per cent of all three sub-types).

The larger potential impacts on flora and vegetation associated with this PEC arise from indirect impacts associated with altered hydrological regimes. Without management, Coondewanna Flats is expected to experience cumulative surface water reduction under the full development scenario. This surface water is an important source of recharge for the underlying groundwater. Cumulative drawdown of groundwater levels is therefore expected as a result of the Strategic Proposal.

However, vegetation in the PEC is considered to rely predominantly on soil water moisture rather than groundwater. Therefore groundwater drawdown is unlikely to significantly impact on flora and vegetation in the PEC.

Surface water and groundwater regimes in the Coondewanna Flats also require management through the recommended conditions for the water factors.

The EPA therefore considers that due to the limited scale of direct impacts and requirements to manage indirect impacts on this PEC, its ecological integrity can be maintained during the Strategic Proposal's implementation.

Indirect impacts on PECs

In addition to the direct impacts on the TECs and PECs, the full development scenario overlaps buffers for three PECs, being ‘Fortescue Marsh’, ‘Weeli Woli Spring’ and ‘Four Plant Assemblages of the Wona Land System’.

The buffers have been established to protect the ecological communities from deleterious impacts by maintaining ecological processes and functions within these habitats. The buffers help identify where indirect impacts may pose a risk to the TEC or PEC and management is required to ensure the ecological processes and functions of the individual TEC or PEC are maintained.

Indirect impacts that pose a threat to these TEC/PECs from the Strategic Proposal include groundwater drawdown, spread of weeds and dust. Management measures will need to be implemented for future proposals to minimise the impacts on the TEC/PECs so that the future proposals can be implemented in a manner that does not compromise the EPA’s objectives for Flora and Vegetation.

Conservation Reserve

Whilst the strategic proposal will not have direct impacts on conservation reserves in the Pilbara, some of the potential future proposals are in proximity
to areas of the conservation reserve and may have indirect impacts. The DBCA has raised this matter during consultation and the EPA notes and agrees with DBCA on this matter. In particular, DBCA have highlighted the need to protect the flora, fauna and social values of the conservation reserve. Consequently, the EPA recommends that a condition is applied that requires the development of a Conservation Reserve Impact Avoidance Plan (Condition 14). The EPA expects that this condition will not be applied to all future proposals identified in the strategic proposal, but to those that have a higher risk of indirect impacts on the conservation reserve, including Karijini National Park. The plan will need to address impacts on flora, fauna and the social values of the conservation reserve.

Vegetation condition

Historical activities, mostly associated with pastoral leases and mining, have modified the Pilbara’s landscape. Changes in fire regimes have also caused changes to the vegetation.

Approximately 89 per cent of the vegetation over BHP Iron Ore tenure is considered to be in ‘Good to Excellent’ condition. Areas yet to be mapped are considered likely to have vegetation in ‘Good to Excellent’ condition, given the majority of vegetation in mapped areas is considered to be in such condition.

Given the known scale of the ‘Good to Excellent’ vegetation, it is expected that the disturbance footprints of future proposals under the Strategic Proposal will mostly occur within vegetation in this condition.

Significance of impacts

While the Strategic Proposal involves clearing of a large area (98 500 ha) of native vegetation, most of the vegetation types to be cleared are considered widespread and not threatened. However, impacts on some conservation significant flora and vegetation are likely.

The impacts on conservation significant flora species are potentially significant, particularly to *Synostemon hamersleyensis*. However, actual impacts are likely to be lower than predicted in the PER document given surveys have found additional populations of this species.

Footprints are yet to be finalised, which provides an opportunity for targeted surveys in support of future proposals that allow final project design to avoid impacts, so that they may be lowered further than currently predicted.

If the further documentation provided with a 'request to declare a future proposal a derived proposal' cannot demonstrate that the proposal can be implemented without threatening the viability of a species, and hence not maintain biological diversity, then the future proposal will need to be assessed in its own right under the EP Act.

The direct impacts to conservation significant vegetation, particularly TECs and PECs, are likely to be small in scale. Management of future proposals is required to ensure indirect impacts do not threaten the ecological integrity of vegetation.
Biodiversity management – flora and vegetation

The proponent’s broad approach to management of the Strategic Proposal for preventing significant environmental impacts is discussed in Section 2.3. The PER document provides further information on targeted management measures that may be used for individual future proposals to manage impacts on Flora and Vegetation.

The EPA notes that this suite of management measures has been developed to demonstrate that future proposals will be implemented in accordance with the mitigation hierarchy. Undertaking site-specific surveys that feed into the mine planning process is the main method that BHP intends to use to avoid impacts on conservation significant flora and vegetation.

In the PER document, BHP presents the case study example of Orebody 31, whereby site-specific surveys identified locations of *Acacia* sp. East Fortescue, a Priority 1 species. The overburden storage areas (also known as waste rock stockpiles) were re-designed for the project so as to avoid the known locations of this species. The project footprint was also reduced by 25 per cent by utilising existing nearby facilities. A ‘hub’ approach, which the Strategic Proposal provides for, would allow sharing of infrastructure between mines to reduce the overall footprint.

The EPA notes that the proposed management measures have been successfully utilised for existing approved operations and contained within environmental management plans that are approved under different Ministerial statements. The EPA considers that the tailored implementation of these measures to proposals that are ‘declared derived proposals’ is important to ensure that proposals are implemented to meet the EPA’s objectives.

Rehabilitation and decommissioning

Whether the proposal area will be revegetated in a manner that promotes biological diversity and ecological integrity is a consideration for environmental impact assessment (EPA 2016a). As for other mining proposals in the Pilbara, the EPA expects that mine closure and rehabilitation will be undertaken for any derived proposals developed under the Strategic Proposal once operations have finished. This will require the preparation of a mine closure plan for each future proposal.

As noted in Section 2.3 of this report, given the limited historical evidence of successful rehabilitation in the Pilbara, the EPA considers that BHP should report on the success of ongoing rehabilitation when it submits a ‘request to declare a proposal a derived proposal’. The recommended Ministerial statement provides additional guidance on the requirements of such a report. Should this information not be provided with a ‘request to declare a proposal a derived proposal’, then the EPA anticipates it would formally request this information through section 38A of the EP Act.

Potential significant residual impacts

The Strategic Proposal has the potential for significant residual impacts that require offsets. Environmental offsets are actions that provide environmental
benefits which counterbalance the significant residual environmental impacts or risks of a project. Environmental offsets will only be considered after avoidance and mitigation options have been pursued.

Under the current *WA Environmental Offsets Guidelines*, impacts on listed TECs or Threatened flora are considered significant residual impacts that would require an offset, while impacts on PECs or Priority flora may require an offset, particularly if the impact would likely result in the ecological community or flora species being listed as Threatened.

The EPA also considers the clearing of ‘Good to Excellent’ vegetation in the Pilbara as a significant residual impact due to the cumulative impacts of clearing in the Pilbara. As noted above, 89 per cent of the vegetation in BHP’s tenure is considered to be in ‘Good to Excellent’ condition. Therefore, the vast majority of the clearing for the Strategic Proposal is considered likely to have a significant residual impact of this nature.

Potential residual impacts as a result of future derived proposals are therefore associated with the impacts to TECs and PECs discussed above, as well as the conservation significant flora species considered at risk from the proposal.

The actual significance of the residual impacts on flora and vegetation, and the requirements of offsets, will need to be determined in the future at the time of a derived proposal. The recommended conditions include a procedure for quantifying offsets for future proposals identified in the Strategic Proposal: these will be applied to derived proposals where a significant residual impact remains.

The application of offsets to the Strategic Proposal is discussed in more detail in Section 5 of this report.

**Overall significance of impacts once management is implemented**

While impacts are predicted on conservation significant flora and vegetation, these are not considered to threaten the overall biological diversity or ecological integrity within the project boundary. This is because the impacts are generally small-scale and effective management measures can be implemented to avoid and reduce the impacts. The EPA considers that the Strategic Proposal can be managed to prevent significant environmental impacts, provided conditions are imposed on future proposals.

**Recommended conditions**

The EPA considers that the recommended conditions should include a requirement for the proponent to prepare a management plan to minimise the impacts on Flora and Vegetation (Condition 7). The objectives of the condition are to ensure that the proposal is implemented in a manner that maintains local and regional populations of Threatened flora, and avoids and minimises impacts on flora listed as Priority flora, as well as TECs and PECs.

The EPA considers that if implementation of the future proposals that form part of the Strategic Proposal is in accordance with the objectives in Condition 7, then the future proposals can meet the EPA’s objectives for this factor.
The recommended Ministerial statement requires BHP to provide a draft management plan with referral of future proposals demonstrating that these objectives can be met. The EPA expects the draft plan would demonstrate how the suite of measures available under the regional management approach had been used to avoid and minimise impacts to an acceptable level. If the draft plan and other information included with the referral did not demonstrate that the proposal met the EPA’s objectives, then the proposal would be considered separately under s38 of the EP Act.

To ensure a mine closure plan is prepared, the EPA recommends that the standard mine closure condition that is applied to projects in the Pilbara is used for any ‘proposal declared a derived proposal’ (Condition 15).

**Summary and draft conditions**

The EPA has paid particular attention to the:

(a) EPA *Statement of environmental principles, factors and objectives*

(b) *Environmental factor guideline – Flora and Vegetation*

(c) Predicted impacts as a result of 98 500 ha of native vegetation being cleared

(d) Areas of biodiversity significance that are being avoided

(e) Limited impacts on Threatened flora

(f) Impacts on flora and vegetation in TEC and PECs being limited in nature

(g) Regional management approach, and the suite of management measures available

(h) Successful application of these management measures across the Pilbara

(i) Rehabilitation being required to reduce the significance of the impacts into the future

(j) Potential for significant residual impacts on conservation significant flora and vegetation

The EPA considers, having regard to the relevant EP Act principles and environmental objective for Flora and Vegetation, that the impacts on this factor are manageable and would no longer be significant, provided that for derived proposals there is:

- control through the authorised extent in schedule 1 of the recommended environmental conditions (Appendix 3)
- implementation of measures to avoid and minimise impacts on flora and vegetation through the preparation and implementation of an environmental management plan (Condition 7)
- implementation of measures to avoid indirect impacts from future proposals that are in proximity to conservation reserves (Condition 14)
• implementation of a mine closure plan so that future proposals are rehabiliated in an ecologically appropriate and sustainable manner (Condition 15)

• implementation of offsets for future proposals (see Section 5, Condition 16) to counterbalance significant residual impacts on conservation significant flora and vegetation, including the cumulative impacts on vegetation that is in ‘Good to Excellent’ condition.

4.2 Terrestrial Fauna

The EPA’s objective for the Terrestrial Fauna factor is ‘to protect terrestrial fauna so that biological diversity and ecological integrity are maintained’.

Ecological integrity is the composition, structure, function and processes of ecosystems, and the natural range of variation of these elements.

Relevant policy and guidance

The EPA considers that the following current environmental policy and guidance is relevant to its assessment of the proposal for this factor:

- Environmental factor guideline – Terrestrial Fauna (EPA 2016c)
- Technical guidance – sampling methods for terrestrial vertebrate fauna (EPA 2016d)
- Technical guidance – sampling of short range endemic invertebrate fauna (EPA 2016e)

The purpose of the above technical guidance documents is to ensure adequate data of an appropriate standard are obtained and used in environmental impact assessments.

The fauna surveys used in the assessment of the Strategic Proposal have been conducted over many years to support the assessment of BHP’s other proposals in the region. A review of each individual survey to determine its consistency with standards at the time of the survey has not been undertaken; however, these surveys are considered suitable for assessment of a strategic proposal. This is because more detailed survey information needs to be submitted as part of future proposals, to demonstrate that they meet EPA objectives before being declared as derived proposals.

The PER document states the following in regard to how terrestrial fauna surveys meet EPA guidance for terrestrial fauna:

1. That Guidance statement no. 20 – Sampling of short range endemic invertebrate fauna for environmental impact assessment in Western Australia (EPA 2009) ‘will be considered and applied as relevant in relation to validation of the modelled results at the derived proposal stage’.

2. That BHP’s Land and Biodiversity Management Toolkit is consistent with Guidance statement no. 6 – Rehabilitation of terrestrial
ecosystems (EPA 2006) and that the guidance ‘will also be considered and applied as relevant for derived proposals’.

3. That surveys undertaken for other proposals and used in this assessment align with Guidance statement no. 56 – Terrestrial fauna surveys for environmental impact assessment in Western Australia (EPA 2004) and that the guidance ‘will be considered and applied as relevant in relation to validation of modelled impacts at the derived proposal stage’.

4. That protocols detailed in Technical guide – terrestrial vertebrate fauna surveys for environmental impact assessment (EPA & DEC 2010) have been followed for all historical fauna survey work used in this assessment and that the guidance ‘will be considered and applied as relevant in relation to validation of modelled impacts at the derived proposal stage’.

The standards and information required for each survey have not changed over this time and therefore the EPA considers that the surveys are consistent with the standards in the technical guidance.

Under the EPA’s former guidance framework, the following documents are relevant to the assessment of this proposal:

- Cumulative environmental impacts of development in the Pilbara region – advice under Section 16e of the EP Act (EPA 2014)
- Mining and water assessments relating to mining and mining-related activities in the Fortescue Marsh management area – advice under Section 16e of the EP Act (EPA 2013).

The mining and water assessments s16e advice is most relevant to the Hydrological Processes and Inland Waters Environmental Quality factors. However, it is also relevant to Terrestrial Fauna to the extent that hydrological processes support ecosystems and habitat within the Fortescue Marsh.

**EPA assessment**

**Terrestrial vertebrate fauna within the project boundary**

The EPA has previously noted that the numerous fauna species found within the Pilbara contributes to the wealth of biodiversity and environmental values of the Pilbara biogeographic region (EPA 2014).

The region’s vertebrate fauna comprises avifauna, mammals and herpetofauna (frogs and reptiles). The avifauna (birds) are considered rich and ubiquitous, but with some seasonal variation. European colonisation has resulted in the decline of some mammal species, including 12 species now considered to be regionally extinct. Herpetofauna composition appears to be persistent despite the impacts of changed fire regimes, pastoralism, mining, and introduced feral fauna (BHP 2016a).
Identifying conservation significant fauna species and species of interest

To identify conservation significant vertebrate fauna species that may be impacted by the implementation of derived proposals, BHP collated data from four sources:

1. BHP’s internal database – most of the data in this database have been gathered from biological surveys undertaken in the Pilbara for environmental impact assessment of other proposals (BHP 2016a).
2. The DBCA Threatened and Priority fauna database.
3. The Western Australian Museum’s collection database for mammals, birds, reptiles and amphibians.

This collated dataset showed at least 50 conservation significant species had been observed within the proposed Strategic Proposal project boundary. These species are listed in Table 22 of the PER document.

It is noted that no specific fauna surveys have been completed for the Strategic Proposal. The approach outlined above was a primarily a desktop study that collated data from several sources (including BHP surveys related to other projects). The aim was to identify fauna species that might be significantly impacted and therefore require priority management.

It is also noted that the data collected likely show bias towards finding species within BHP tenements as it was these areas where significant effort has gone into surveying fauna, compared with areas where no development is proposed.

To identify the species potentially at risk of significant impacts from the Strategic Proposal, BHP categorised the species in Table 22 of the PER document into management tiers. Those species that BHP considers the highest priority in regard to managing impacts are generally also listed under the following:

- *Wildlife Conservation Act 1950* under schedules 1 to 4
- *Environmental Protection and Biodiversity Conservation Act 1999* as either critically endangered, endangered or vulnerable
- International Union for Conservation of Nature (IUCN) Red List.

The second tier lists species that BHP categorised as needing consideration on a case-by-case basis to determine management priority. These species are also generally listed under the following:

- *Wildlife Conservation Act 1950 (WA)* under schedules 5 to 7
- DBCA Priority species (Priority 1 to 4)
- *Environmental Protection and Biodiversity Conservation Act 1999 (Cth)* as marine or migratory
- otherwise listed under international agreements.
The Strategic Proposal is not being assessed through a bilateral assessment and the Commonwealth Department of Environment and Energy has conducted its own assessment of the impacts under the *Environmental Protection and Biodiversity Conservation Act 1999*. Therefore, the EPA assessment has focused on species that have being identified as having conservation significance through state mechanisms, principally the *Wildlife Conservation Act 1950* and DBCA’s Priority species list.

Table 6 breaks down the fauna species identified in the project boundary by their conservation status under the *Wildlife Conservation Act 1950 (WA)*. Priority species as identified by DBCA are also included in the table.

**Table 6: Species recorded in project boundary by Conservation Code**

<table>
<thead>
<tr>
<th>Conservation Code</th>
<th>Number of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critically Endangered (Schedule 1)</td>
<td>1</td>
</tr>
<tr>
<td>Endangered (Schedule 2)</td>
<td>3</td>
</tr>
<tr>
<td>Vulnerable (Schedule 3)</td>
<td>7^</td>
</tr>
<tr>
<td>Presumed Extinct (Schedule 4)</td>
<td>0</td>
</tr>
<tr>
<td>Migratory Birds (Schedule 5)</td>
<td>25^</td>
</tr>
<tr>
<td>Conservation Dependent (Schedule 6)</td>
<td>0</td>
</tr>
<tr>
<td>Other Specially Protected Fauna (Schedule 7)</td>
<td>1</td>
</tr>
<tr>
<td>Priority 1 Species</td>
<td>3</td>
</tr>
<tr>
<td>Priority 2 Species</td>
<td>2</td>
</tr>
<tr>
<td>Priority 3 Species</td>
<td>1</td>
</tr>
<tr>
<td>Priority 4 Species</td>
<td>8</td>
</tr>
</tbody>
</table>

^ The curlew sandpiper (*Calidris ferruginea*) is both a Vulnerable (Schedule 3) and Migratory (Schedule 5) species.

From the 50 conservation significant species listed, BHP identified 16 species considered to be of higher risk of significant impacts because five per cent or more of confirmed Australia wide-records occurred within the project boundary (BHP 2016a). These species are listed in Table 7 below.

**Table 7: Species considered at higher risk of significant impacts**

<table>
<thead>
<tr>
<th>BHP special interest fauna species</th>
<th>Conservation status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern quoll <em>(Dasyurus hallucatus)</em></td>
<td>Schedule 2 – Endangered</td>
</tr>
<tr>
<td>Pilbara olive python <em>(Liasis olivaceus barroni)</em></td>
<td>Schedule 3 – Vulnerable</td>
</tr>
</tbody>
</table>
From this list of 16, BHP identified those species which had 10 per cent or more of known recordings within the full development scenario footprint. By this process BHP identified five species at particularly high risk of impacts from the Strategic Proposal. These species, and other species that EPA considers require further assessment based on potential impact, are listed below and are considered in further detail in the assessment:

- ghost bat
- night parrot
- northern quoll
- Pilbara leaf-nosed bat
- Pilbara olive python
- western pebble-mound mouse
- Pilbara barking gecko
- Pilbara flat-headed blindsnake.

Potential impacts of the Strategic Proposal

BHP has identified the typical activities associated with iron ore mines that have the potential to impact terrestrial fauna. The implementation of derived proposals, in particular, may cause the following direct and indirect impacts:

- loss of breeding and/or foraging habitat
- loss of isolated habitats that contain Threatened or Priority species (destruction of local populations)
- fragmentation of habitat
- loss of fauna habitat corridors (e.g. dispersal habitat, migration routes)
- creation of pit-lakes, in turn encouraging population booms of introduced species and entraining native fauna; conversely, these may also provide permanent water sources for some native species to use
- degradation of habitat, such as riparian vegetation
- disturbance of permanent and semi-permanent waterholes that fauna rely on
- alteration of fire regimes
- increased noise, light and vehicular movements, which may affect fauna species.

The EPA has assessed potential impacts on species identified as being most at risk from the Strategic Proposal, as well as on species usually known to be of interest in environmental impact assessment in the Pilbara. Based on this preliminary assessment, impacts on individual species considered to require further assessment are discussed in more detail.

Species requiring further assessment

Ghost bat

One hundred and seventy-nine records of this species could potentially be impacted by the full development scenario, with 173 of these on BHP tenure. Historical survey effort has focused on environmental impact assessment for mining projects so the records tend to coincide with mining tenements. In Western Australia, ghost bats are found across all four Pilbara subregions as well as in the Kimberley. Populations tend to be found in clusters within the subregions, including areas where they roost in abandoned mine shafts and adits.

As noted in the PER document, all populations of ghost bats are considered to be of conservation value. Within BHP’s tenements that lie east of Karijini National Park, a breeding population of ghost bats is known to occur. This population is considered to be locally and sub-regionally significant. However,
the largest and most significant regional populations are outside the project boundary at the abandoned mines as noted above.

BHP’s existing operations are near the locally significant population of ghost bats and, as a result, it has had to implement management measures to minimise impacts on the bats. This includes the development of artificial roosts.

**Night parrot**

Using the five per cent and 10 per cent fauna species ‘at risk’ criteria that BHP applied to the Strategic Proposal, the night parrot was not identified as a species at high risk – due to of lack of historical records of this species. However, given recent recordings of the night parrot in Western Australia and the species being sighted at Fortescue Marsh previously, there is an express need to consider this species in the assessment of the Strategic Proposal.

BHP provided information in the PER document showing that potential breeding and foraging habitat is present within the project boundary. Since the PER document was released for comment, DBCA has developed interim guidelines on requirements for night parrot surveys. These guidelines provide more details on the night parrot’s preferred habitat and identified priority areas for survey.

Much of the area considered a high priority for survey lies within the project boundary. As such, there is potential for future proposals identified in the Strategic Proposal to impact on the night parrot. Given the apparent rarity and specific habitat requirements of the species, it is possible that large portions of the Strategic Proposal will not impact on night parrot habitat or known locations of the species. However, BHP will need to conduct surveys (that meet the required standards) to help ensure that future proposals are not significantly impacting on this species.

If the surveys result in night parrots being recorded and future proposals will impact on the species, then the EPA considers that those projects may not meet the tests under s39B of the EP Act. Under this scenario, a derived proposal could not be declared, particularly if new or additional information justified the reassessment of the issues raised by the proposal.

**Northern quoll**

Northern quoll were previously found continuously across northern Australia, but the species is now fragmented into smaller populations. The Pilbara population is separated from other populations by the Great Sandy Desert. They have been recorded across all four subregions of the Pilbara. They are often recorded during surveys for environmental impact assessment of mining proposals. Recent reporting by DBCA shows that the likelihood of northern quoll populations being present is higher to the north and west of the Strategic Proposal project boundary (Dunlop 2017).

Dunlop (2017) also notes some evidence that northern quoll will recolonise disturbed areas or use artificial habitat. However, there is no evidence that they will recolonise highly disturbed areas. This is considered a priority area for research, particularly in regard to re-creation of habitat during mine closure.
BHP notes that in the future, the risk to the species from the Strategic Proposal could increase if other environmental factors cause population declines, such as the establishment of populations of cane toads in the Pilbara.

*Pilbara leaf-nosed bat*

The Pilbara leaf-nosed bat is a form of the orange leaf-nosed bat that has become isolated from northern populations of this species and is largely restricted to the Pilbara. Three sub-populations are considered to occur in the Pilbara: an Eastern Pilbara population, a population in the Hamersley Ranges, and a population in Upper Gascoyne. It is found in caves and horizontal mine shafts with stable, warm and humid microclimates.

BHP’s Strategic Proposal is predicted to impact on an additional nine records of this species, which represents 1.44 per cent of the known records. Although this impact is low and unlikely to be significant in its own right, other projects in the region are also likely to impact on this species. Therefore, individual derived proposals will need to be designed and operated in a manner that avoids and minimises the impacts to prevent the cumulative impacts becoming significant.

Like the ghost bat, the Pilbara leaf-nosed bat will occupy artificial habitat. Reconstruction of habitat either as a management tool or as an offset can help reduce the impact on this species from disturbing known habitat.
**Pilbara olive python**

The Pilbara olive python is restricted to the Pilbara region. It is considered a cryptic species that is difficult to locate during targeted surveys. Sizeable populations are believed to occur in some areas of the Pilbara, along with remote populations that have some level of protection from threatening processes.

Radio-telemetry has shown that individuals spend the cooler months hiding in caves and rock crevices away from water sources. In the summer months the pythons move around widely, usually near water and rocky outcrops. There are areas of its habitat conserved within Karijini National Park.

Habitat loss is considered to be one of the threatening processes for this species. The implementation of future proposals identified in the Strategic Proposal is predicted to impact on riparian vegetation and waterholes that form its habitat. BHP intends to carry out targeted surveys and implement specific management measures for individual derived proposals to reduce the impacts on this species.

**Western pebble-mound mouse**

This species is considered largely endemic to the Pilbara. It is commonly found in areas where there is suitable habitat. Such habitat is considered widespread and known to occur within four conservation reserves in the Pilbara. Records of the species are lower in conservation reserves compared with mining tenure, but it is argued that this is an artefact of survey effort that has generally focused on mining tenure.

**Pilbara barking gecko**

This Priority 2 species is relatively recently described and thus relatively few recordings exist. It is believed to be rare and has a relatively small distribution covering an area of 240 km. Its habitat is considered unlikely to extend outside the Hamersley subregion. It has not been recorded in Karijini National Park, but a large portion of its inferred range is within the national park.

BHP acknowledges that further research into the ecology of this species is needed to accurately determine the impacts of future proposals.

**Pilbara flat-headed blindsnake**

This species is endemic to the Pilbara. Information on its distribution and ecology is considered sparse. The current distribution (excluding a potentially incorrect recording near Pannawonica) covers about 10 000 km², with its habitat occurring widely across the Hamersley Ranges. This includes within Karijini National Park. BHP considers that low survey effort outside of mining tenure has prevented the species being recorded more widely across the Pilbara and that additional survey effort would increase the distribution.
Other terrestrial fauna species of interest

Migratory bird species

In the s16e advice on Fortescue Marsh, the EPA noted the marsh is an important wetland for migratory waterbird species protected under various international agreements. The s16e advice considers the marsh itself (Zone 1b in the advice) as a high-priority area for management. As discussed under Hydrological Processes, the Strategic Proposal’s impacts on groundwater are not predicted to significantly impact on the marsh. Therefore, the Strategic Proposal is unlikely to impact on the marsh’s use by migratory waterbirds.

Other Priority species

Other Priority species will also be affected by the Strategic Proposal. Priority species are considered conservation significant because they do not meet the criteria to be considered Threatened, or are otherwise data deficient (Priority 1, 2 or 3); or they are species that are adequately known, are rare but not Threatened, or meet criteria for near Threatened; or that have been recently removed from the Threatened species or other specially protected fauna lists for other than taxonomic reasons (Priority 4).

Priority species generally require further surveys to determine their conservation status or require regular monitoring to ensure they don’t become Threatened. Surveys and monitoring will help determine whether a species’ conservation category is correct or needs amendment. Any change in categories may dictate what management is required for species at the time of application to ‘declare a proposal a derived proposal’. If a Priority species changes conservation category to such an extent that impacts of a future proposal on that species do not meet the test of s39B of the EP Act – in particular whether new information justifies reassessment – then separate formal assessment may be required for that particular future proposal.

Aside from the specific Priority species discussed above, the impacts on the known records of other Priority species recorded within the Strategic Proposal project boundary would be on a small number of the known records.

Overall impacts to conservation significant species

While impacts on individual conservation significant species are expected, once targeted surveys have been undertaken and tailored avoidance and mitigation measures are introduced, impacts on species can be reasonably expected to be reduced and biological diversity within the project boundary maintained.

In concluding this, the EPA has taken into account that habitat for a number of these species is found within Karijini National Park and more broadly in the Pilbara, and that under the assessment of Hydrological Processes, the proposal was considered not to significantly impact on the hydrological regime of Fortescue Marsh. The EPA also notes the potential bias in survey data towards recording species within mining tenure due to survey effort.

The EPA considers that the indirect impacts on conservation significant fauna habitat within conservation reserves can also be minimised through the implementation of a Conservation Reserve Impact Avoidance Plan.
Identifying habitat types and conservation significant species likely or possibly present in that habitat

In addition to identifying conservation significant fauna species of interest, BHP also mapped fauna habitat within its tenements. A single dataset was created by taking results from fauna habitat mapping for other BHP environmental impact assessments in the region. The vegetation mapping undertaken in 2014 (Onshore 2014) was the primary input to the dataset, along with aerial imagery to identify non-vegetation based habitats (e.g. gorges/gullies) and some supplementary field assessments. The supplementary field assessments were undertaken to address any gaps in baseline data or to verify the results from earlier surveys.

Based on the data, 17 fauna habitats were identified within BHP tenure (BHP 2016a). Fauna records (as outlined above) were overlain on the habitat maps to identify those habitat types with high species richness or which housed conservation significant species.

BHP has not provided conceptual mine layouts as part of the Strategic Proposal because detailed project design has not been conducted as yet. It has, however, analysed the impacts of potential mine footprints within its current tenure on different habitat types. The results of this analysis are presented below in Table 8, which gives the percentage of each habitat type that the Strategic Proposal is predicted to impact on. It should be noted that this represents the percentage of each habitat within BHP’s current tenure and not within the project boundary. The project boundary is a much larger area (7 650 074 ha versus the 415 380 ha total fauna habitat mapped in tenements) and all habitat types will have a range that extends beyond the tenement.

Table 8: Mapped fauna habitat types within BHP iron ore tenure in the Pilbara

<table>
<thead>
<tr>
<th>Habitat type</th>
<th>Total area mapped (ha)</th>
<th>Existing dev. scenario</th>
<th>Full conceptual dev. scenario</th>
<th>Total disturbance (current + proposed) (%)</th>
<th>Proposed disturbance (excluding existing dev. scenario) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcrete areas</td>
<td>8881</td>
<td>1</td>
<td>1247</td>
<td>14.0%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Gilgai (cracking clay)</td>
<td>2681</td>
<td>30</td>
<td>257</td>
<td>9.6%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Granite domes and boulders</td>
<td>564</td>
<td>10</td>
<td>10</td>
<td>1.8%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Hardpan plain</td>
<td>6112</td>
<td>0</td>
<td>1613</td>
<td>26.4%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Mulga</td>
<td>33 191</td>
<td>146</td>
<td>8230</td>
<td>3,674.1%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Sand dune</td>
<td>69</td>
<td>0</td>
<td>0</td>
<td>0.0%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Habitat type</td>
<td>Total area mapped (ha)</td>
<td>Existing dev. scenario</td>
<td>Full conceptual dev. scenario</td>
<td>Total disturbance (current + proposed) (%)</td>
<td>Proposed disturbance (excluding existing dev. scenario) (%)</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------------------</td>
<td>-------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Sand plain</td>
<td>55 572</td>
<td>600</td>
<td>6230</td>
<td>993.6%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Sandy/stony plain</td>
<td>3866</td>
<td>46</td>
<td>46</td>
<td>1.2%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Stony plain</td>
<td>44 623</td>
<td>527</td>
<td>8675</td>
<td>1,300.6%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Crest/slope</td>
<td>192 784</td>
<td>3710</td>
<td>53 483</td>
<td>54.9%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Gorge/gully</td>
<td>4553</td>
<td>26</td>
<td>1373</td>
<td>30.2%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Minor drainage line</td>
<td>10 969</td>
<td>136</td>
<td>3126</td>
<td>319.3%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Drainage area</td>
<td>37 243</td>
<td>816</td>
<td>9137</td>
<td>3,263.2%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Drainage line</td>
<td>823</td>
<td>5</td>
<td>83</td>
<td>10.1%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Fortescue Marsh samphire</td>
<td>367</td>
<td>2</td>
<td>2</td>
<td>0.5%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Major drainage line</td>
<td>13 071</td>
<td>211</td>
<td>1570</td>
<td>1,869.0%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>Artificial habitats</td>
<td>11</td>
<td>0.1</td>
<td>0.1</td>
<td>0.9%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
<tr>
<td>TOTALS</td>
<td>31,764</td>
<td>6,266</td>
<td>42,135</td>
<td>132.7%</td>
<td>!Undefined Bookmark, NULL</td>
</tr>
</tbody>
</table>

**Assessment of impacts on habitat**

The EPA notes that the percentage impact relates to the amount of each habitat type within BHP tenure and not the Pilbara as a whole. Hence, the maximum impact on any particular habitat type remains below 30 per cent of the mapped habitat and therefore substantial areas of habitat available will remain within BHP tenements.

At a regional level, critical habitat and habitat corridors, and dispersal habitat for terrestrial fauna, can be maintained and managed even with such large-scale proposed mining developments. Success depends on effective conservation of critical habitats and their regional connectivity. This, in turn, depends on the final design of development envelopes and the disturbance footprints of the derived proposals.

Individual habitat types that have higher values tend to provide breeding habitat for a number of conservation significant species. Examples of these include gorges and gullies and major drainage lines. Future proposals will require targeted survey work to verify the extent of impacts on these higher-value habitats and to demonstrate that the impacts have been minimised.
Riparian vegetation associated with drainage areas and drainage lines often provides habitat for vertebrate fauna species. Measures required under the recommended conditions for the factors of Flora and Vegetation and Hydrological Processes will also minimise the impacts on riparian habitat around drainage areas and drainage lines.

Not all of the future proposal is likely to contain critical habitat. However, the final design and management of derived proposals – where mining tenements contain higher biodiversity areas (such as PECs and TECs) or isolated habitat with populations of conservation significant fauna – will be required to implement targeted management measures or avoid impacts altogether to prevent impacts that would threaten biological diversity or ecological integrity through habitat loss.

**Assessment of methodology for identifying significant species and habitat**

At a regional scale, BHP has taken an appropriate approach to identifying fauna species that may be present within the full conceptual development scenario. Collating and mapping several sets of data to identify species confirmed to be within the Strategic Project definition boundary is a simple methodology to determine if conservation significant species (i.e. those scheduled under the *Wildlife Conservation Act 1950*) are at risk of impacts from the implementation of derived proposals.

However, it is accepted that calculating the percentage of known records falling within the full conceptual development scenario does not necessarily equate to a percentage of the regional (or national) population of that species. It may cause significant bias towards finding records within the development footprint because this is where most survey effort (in a regional context) has occurred. Nevertheless, it provides useful information to attempt to quantify the possible scale of impacts that derived proposals may have on particular species.

Parallel to the above approach, habitat mapping has provided another avenue by which to identify species that may be present within the full conceptual development scenario, even if those species have not been directly identified by survey. It also provides information on the scale of potential habitat loss in a regional context – albeit the information is limited to BHP tenements.

Overall however, BHP has identified at a regional scale what species will require consideration when designing the derived proposals. It is possible that at a local scale additional species will require consideration even if not identified above.

**Short range endemic species**

To identify the risk of impacts from derived proposals on short range endemic (SRE) invertebrate fauna, BHP did not undertake any proposal-specific surveys. Rather, BHP created two levels of habitat mapping – Phase 1 and Phase 2.

Phase 1 involved using the Pilbara Land Systems classifications and mapping undertaken by van Vreeswyk (2004). Land systems were ranked for suitability
for SRE fauna as either being low (1), low/medium (2), medium (3), medium/high (4) or high (5). Phase 2 involved consolidating higher-resolution mapping over BHP tenements (where data was available) to provide a spatial map of the likelihood of SRE-suitable habitats and species being present within development envelopes for the listed derived proposals.

By this approach, BHP created 10 broad SRE habitat types and ranked their suitability as habitat for SRE species. See Table 9 below.

### Table 9: Suitability of habitats for SRE species

<table>
<thead>
<tr>
<th>SRE broad habitat</th>
<th>Suitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groves and drainage foci</td>
<td>3</td>
</tr>
<tr>
<td>Boulders, outcrops, ridges and breakaways</td>
<td>4</td>
</tr>
<tr>
<td>Drainage foci and swamp/depressions</td>
<td>4</td>
</tr>
<tr>
<td>Shallow gullies and drainage foci</td>
<td>3</td>
</tr>
<tr>
<td>Dispersal habitats</td>
<td>2</td>
</tr>
<tr>
<td>Deep gullies/gorges</td>
<td>5</td>
</tr>
<tr>
<td>Dispersal habitats and swamp/depressions</td>
<td>3</td>
</tr>
<tr>
<td>Groves and outcrops</td>
<td>4</td>
</tr>
<tr>
<td>Boulders and outcrops</td>
<td>5</td>
</tr>
<tr>
<td>Isolated sands</td>
<td>4</td>
</tr>
<tr>
<td>Non-SRE habitat</td>
<td>1</td>
</tr>
</tbody>
</table>

(1 = low suitability to 5 = high suitability)

BHP also described seven taxonomic groups for SRE fauna (Table 5) and collated data from the following sources to quantify how many individual species occur within the Pilbara bioregion per taxonomic group:

1. Western Australian Museum databases
2. BHP’s own corporate data, most of which has been gathered from surveys undertaken in the Pilbara bioregion for other BHP impact assessments (BHP 2016a)
3. DBCA NatureMap database
4. Department of Energy and Environment Protected Matters Search Tool

All data collated was reviewed: records that described or named species differently were rationalised and species that have since been found not to be SRE were removed. At a regional level the data showed that within a 16 200 000 ha study area (which largely corresponds to the Pilbara bioregion) there are 144 known or potential SRE invertebrate species. These are broken down by taxonomic group in the table below.

Table 10: Taxonomic groups of short range endemic invertebrate species found in the Pilbara

<table>
<thead>
<tr>
<th>SRE taxonomic groups</th>
<th>Pilbara regional results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mygalomorph spiders (trapdoor spiders)</td>
<td>59</td>
</tr>
<tr>
<td>Selenopid spiders</td>
<td>13</td>
</tr>
<tr>
<td>Pseudoscorpions</td>
<td>13</td>
</tr>
<tr>
<td>Scorpions</td>
<td>10</td>
</tr>
<tr>
<td>Millipedes</td>
<td>35</td>
</tr>
<tr>
<td>Terrestrial snails</td>
<td>4</td>
</tr>
<tr>
<td>Isopods</td>
<td>10</td>
</tr>
</tbody>
</table>

These taxonomic groups include species of SRE fauna identified as being conservation significant within the Pilbara generally and also within the project boundary.

*Identifying derived proposals that are highly likely to contain SRE habitat and species*

Data from terrestrial vertebrate fauna habitat mapping (Biologic 2014) and flora and vegetation mapping (Onshore 2014) undertaken across BHP Iron Ore tenements was consolidated and reclassified into SRE habitat types as created in Phase 1 (above).

There is substantial variation in the habitat requirements and ranges of SRE species. Many millipedes, pseudoscorpions and spiders are likely to have linear ranges of less than 50 km (Car & Harvey 2013; Harms & Framenau 2013). Some species, such as goblin spiders in the genus *Oropaea* and
keeled millipedes of the genus *Boreohesperus*, are known only from the type locality and are unlikely to be more widespread, thus occupying ranges of a few kilometres at most. Some other species, such as wall crab spiders of the family Selenopidae, may be more widely distributed but still have a total range below the current threshold of SRE status of 10,000 km² (Harvey 2002).

In contrast to other forms of terrestrial fauna, BHP analysed each derived proposal listed in relation to SRE fauna (see Section 8.1.4.4 of the PER document) and provided the following information:

1. Percentage of area mapped
2. Whether surveys undertaken had found SRE fauna records
3. Percentage of area surveyed
4. Habitat types within derived proposal areas and BHP’s opinion on suitability as SRE habitat (based on microhabitat occurrence and frequency with habitat types)
5. Potential impact as predicted by BHP
6. BHP’s priority for future management.

**Significance of impacts on SRE species**

Table 28 of Section 8.1.1.4 in the PER document summaries the potential level of impact on SRE habitat types for each of the BHP mining tenements within the project boundary. For SRE fauna, all but three derived proposals impact on some type of habitat that is highly likely to contain SRE fauna and requires a high management priority. The potential impacts described in Table 28 in the PER document are based on potential for suitable habitat and not actual recordings of SRE species. Potential SRE habitat often extends outside of the full development scenario footprint and is therefore not expected to be impacted.

In the PER document, BHP notes that the variability in ranges and preferred habitats of SRE invertebrate species is sufficiently large that caution must be applied to predictions about the degree of potential threat from the full development scenario. The proponent considers that mapped areas of ‘low’ and ‘low/medium’ suitability may require no consideration of SRE fauna; mapped areas of ‘medium’ suitability habitat may require desktop investigations; and mapped areas of ‘moderate/high’ or ‘high’ suitability habitat may require targeted site-specific investigations.

BHP recognises that validation of the potential impacts and appropriate mitigation at the derived proposal stage are required to demonstrate that impacts to SREs can be managed to an acceptable level. Habitat suitability assessments conducted to date will inform future SRE surveys, further informing BHP Iron Ore’s knowledge of species potentially impacted by each development.

For some of the future proposals identified in the Strategic Proposal, potential SRE habitat is restricted or may contain conservation significant SRE fauna species. When this is the case, targeted surveys will be required to confirm whether SRE species are actually present in the suitable habitat and whether
the habitat is continuous outside the footprint or regionally common. Detailed project design and management would then need to be undertaken to ensure SRE species were not impacted to a level that threatens biological diversity.

**Biodiversity management – terrestrial fauna**

The proponent’s broad approach managing the Strategic Proposal to prevent significant environmental impacts is discussed in Section 2.3. The PER document provides further information on targeted management measures that may be used for individual future proposals to manage impacts on Terrestrial Fauna.

The EPA notes that this suite of management measures has been developed to demonstrate that future proposals will be implemented in accordance with the mitigation hierarchy. Undertaking site-specific surveys that feed into the planning process is the main method that BHP intends to use for avoiding impacts on conservation significant fauna species.

BHP provides the example of the Eastern Ridge proposal in the PER document. During surveys to inform environmental impact assessment of this proposal, semi-permanent waterholes were identified that provided habitat for Pilbara olive pythons. Removal of these waterholes was considered to have an unacceptable impact on the population and so the development footprint was amended to avoid such an impact.

For some species, such as the ghost bat, re-creation of habitat is a possibility. At Mining Area C, an artificial roost has been constructed because the proposal will need to disturb a known roost. To date, ghost bats have not been recorded using the roost. Nevertheless ghost bat scats have been found in the roost and another species of bat has also been recorded. The conservation advice for ghost bats notes that many of the old mines that provide habitat for ghost bats are at risk of collapse. The construction of purpose-built artificial habitat may help to reduce the risk of collapse by providing alternative long-term habitat. BHP notes that use of roosts can vary between colonies and it is doing further research to understand these differences and inform future design of artificial habitats.

Matters such as controlling vehicular impacts, managing scavenging introduced species in road reserve areas, or minimising light emissions are general tools typical of iron ore operations. Control programs and quarantine protocols can be generally applied to control weeds (that may impact on fauna habitat or food sources) and feral animals (that may compete or prey on native animals).

**Rehabilitation and decommissioning**

As for other mining proposals in the Pilbara, the EPA expects that once operations have finished, mine closure and rehabilitation will be undertaken for any derived proposals developed under the Strategic Proposal. This will require the preparation of a mine closure plan for each future proposal.

In addition to addressing revegetation, mine closure plans will also be required to demonstrate how areas will be rehabilitated to provide terrestrial fauna habitat. This is in addition to the requirements to provide information on
the success of ongoing rehabilitation, as discussed in the Context and Flora and Vegetation sections of this report. The EPA expects the information provided in the report on rehabilitation success (required by the guidelines for submitting a derived proposal in the recommended ministerial statement) to be used to inform the development of mine closure plans.

**Potential significant residual impacts**

The Strategic Proposal has the potential for significant residual impacts that require offsets. Environmental offsets are actions that provide environmental benefits which counterbalance the significant residual environmental impacts or risks of a project. Environmental offsets will only be considered after avoidance and mitigation options have been pursued.

Under the current *WA Environmental Offsets Guidelines*, the following are considered significant residual impacts that would require an offset:

- impacts on fauna habitat necessary to maintain a species declared specially protected under the *Wildlife Conservation Act 1950* (or any future legislation that supersedes this Act)
- impacts on areas with high biological value (e.g. nationally or internationally recognised biodiversity hotspots)
- impacts on habitat supporting listed migratory species.

Under the guidelines, the following may also be considered significant residual impacts that requires an offset:

- impacts that are likely to result in a species being listed as specially protected under *Wildlife Conservation Act 1950* (or any future legislation that supersedes this Act)
- impacts that affect significant habitat for a species
- impacts on communities or species that are representative of high biodiversity.

Potential residual impacts as a result of future derived proposals are therefore associated with the impacts on habitat of conservation significant fauna. In addition, significant residual impacts may arise should any terrestrial fauna species that are listed as being conservation significant be found within the Strategic Proposal project boundary and be impacted upon by future derived proposals. Where the impact is on important habitat for a species (that which is necessary to maintain a species declared as specially protected), the EPA considers that this would be an impact to ‘other important or specialised environmental values’.

The actual significance of the residual impacts and the requirement for offsets will need to be determined at the time of a derived proposal. The recommended conditions include a procedure for quantifying offsets for future proposals identified in the Strategic Proposal and these will be applied to derived proposals where a significant residual impact remains.

The application of offsets to the Strategic Proposal is discussed in more detail in Section 5 of this report.
Overall significance of impacts once management is implemented

While impacts are predicted on conservation significant terrestrial fauna at a regional scale, no species are threatened to a level that would compromise biological diversity or disturb habitat types such that ecological integrity could not be maintained – particularly when effective management measures are implemented to avoid and reduce the impacts. The EPA considers that the Strategic Proposal can be managed to prevent significant environmental impacts provided conditions are imposed on future proposals.

Recommended conditions

The EPA’s recommended conditions include a requirement for the proponent to prepare a management plan to minimise the impacts on Terrestrial Fauna (Condition 8). The condition’s objective is to ensure the proposal is implemented in a manner that maintains local and regional populations of Threatened fauna species, and avoids and minimises impacts on habitat for Threatened and Priority fauna, as well as SRE fauna species.

The EPA considers that if the future proposals that form part of the Strategic Proposal are implemented in accordance with the objectives in Condition 8, then the EPA’s objectives for this factor can be met.

The recommended Ministerial statement requires BHP to provide a draft management plan, as part of the referral of each future proposal, which demonstrates that these objectives can be met. The EPA expects the draft plan to demonstrate how the suite of measures available under the regional management approach have been used to avoid and minimise impacts to an acceptable level. If the draft plan and other information included with the referral cannot demonstrate that the proposal meets the EPA’s objectives, then the proposal will be considered separately under s38 of the EP Act.

The EPA considers that the management measures contained with the Conservation Reserve Impact Avoidance Plan recommended under Flora and Vegetation (Condition 14) will also help minimise impacts on terrestrial fauna habitat within the project boundary by helping to protect areas of conservation significant fauna habitat within conservation reserves.

To ensure a mine closure plan is prepared, the EPA recommends that the standard mine closure condition applied to projects in the Pilbara is used for any ‘proposal declared a derived proposal’ (Condition 15).

Summary and draft conditions

The EPA has paid particular attention to the:

(a) EPA Statement of environmental principles, factors and objectives
(b) Environmental factor guideline – Terrestrial Fauna
(c) Predicted impacts as a result of 98 500 ha of native vegetation that provides habitat for fauna being cleared
(d) Known locations of conservation significant vertebrate fauna in the Pilbara and the predicted impacts on these locations being limited in nature
(e) Use of targeted surveys in final project design to avoid impacts on conservation significant vertebrate fauna species

(f) Mapping of potential SRE invertebrate habitat demonstrating that habitat extends outside the conceptual footprint

(g) Regional management approach, and the suite of management measures

(h) Successful application of these management measures across the Pilbara

(i) Rehabilitation being required to reduce the significance of the impacts into the future

(j) Potential for significant residual impacts on conservation significant vertebrate fauna species.

The EPA considers, having regard to the relevant EP Act principles and environmental objective for Terrestrial Fauna, that the impacts on this factor are manageable and would no longer be significant, provided that for derived proposals there is:

- control through authorised extent in schedule 1 of the Recommended Environmental Conditions (Appendix 3)
- implementation of measures to avoid and minimise impacts to Terrestrial Fauna through the preparation and implementation of an environmental management plan (Condition 8)
- implementation of measures to avoid indirect impacts from future proposals that are in proximity to conservation reserves (Condition 14)
- implementation of a mine closure plan so that future proposals are rehabilitated in an ecologically appropriate and sustainable manner (Condition 15)
- implementation of offsets for future proposals (see Section 5, Condition 16) to counterbalance significant residual impacts to conservation significant terrestrial fauna species.

4.3 Subterranean fauna

The EPA’s environmental objective for Subterranean Fauna is “to protect subterranean fauna so that biological diversity and ecological integrity are maintained”.

Relevant policy and guidance

The EPA considers that the following current environmental policy and guidance is relevant to its assessment of the proposal for this factor:

- Statement of environmental principles, factors and objectives
- Environmental factor guideline – Subterranean Fauna (EPA 2016g)
- Technical guidance – subterranean fauna survey (EPA 2016h)
• Technical guidance – sampling methods for subterranean fauna (EPA 2016i).

The purpose of the Technical guidance – subterranean fauna survey is to provide guidance on the relevant impact assessment methods where subterranean fauna is likely to be a factor, particularly the standards of survey and type of information required to understand impacts. The content is the same as the EPA’s previous guidance document, Environmental assessment guideline 12 – Consideration of subterranean fauna in environmental impact assessment in Western Australia.

The Technical guidance – sampling methods for subterranean fauna provides guidance on survey design and sampling methods for subterranean fauna required for environmental impact assessment. The content is the same as Draft guidance no. 54a – Sampling methods and survey considerations for subterranean fauna in Western Australia, August 2007.

Appendix 1 of the PER document states that the desktop surveys, as well as subterranean fauna sampling, has been conducted in line with Environmental assessment guideline 12 and Draft guidance no. 54a, which were the relevant standards at the time of the surveys.

BHP noted that the Technical guidance – subterranean fauna survey recommends the use of surrogates, where survey alone has not provided sufficient evidence to determine distribution (to help predict impacts). BHP considers that the revised changes to this guideline, in relation to surrogates, is not applicable at the regional scale of the Strategic Proposal but may be used to validate modelled impacts at the derived proposal stage.

The EPA generally agrees with this statement, however at the time of submitting an application to ‘declare a future proposal as a derived proposal’, subterranean fauna surveys provided in support of the application will need to be carried out in accordance with the relevant technical guidance at the time of the survey, including consideration of the acceptability of using surrogates.

Any future surveys associated with future proposals will need to be carried out in line with the relevant EPA guidance at the time of the surveys.

Under the EPA’s former guidance framework, the following documents are relevant to the assessment of this proposal:

• Cumulative environmental impacts of development in the Pilbara region – advice under Section 16e of the EP Act (EPA 2014)
• Mining and water assessments relating to mining and mining-related activities in the Fortescue Marsh management area – advice under Section 16e of the EP Act (EPA 2013).

The mining and water assessments s16e advice is most relevant to the Hydrological Processes and Inland Waters Environmental Quality factors. However, it is also relevant to Subterranean Fauna to the extent that water regimes around Fortescue Marsh may be impacted by a proposal.
EPA assessment

Subterranean fauna within the project boundary

The EPA has previously acknowledged that the Pilbara region has a high diversity of subterranean fauna species. While understanding of subterranean fauna habitats in Western Australia is patchy, it is accepted that suitable pores or voids are necessary to allow air or water to be present. For subterranean fauna, the Pilbara region is thought to be the best studied region in the state (EPA 2016h).

BHP has undertaken work to characterise the subterranean fauna within the project boundary. It commissioned a study to collate existing survey data on subterranean fauna in the Pilbara for determining known distribution and producing maps of potential habitat.

Stygofauna

In 2014 a Pilbara-wide survey of stygofauna was conducted to collect baseline data on species distribution across the Pilbara. The study provided a conservative estimate that the Pilbara supports 500 to 550 species of stygofauna (Halse et al. 2014).

Halse et al. (2014) identified nine areas considered to have high stygofauna richness. Of the nine, two are located within the Strategic Proposal project boundary. These are Ethel Gorge (which is listed as a TEC based on its stygofaunal values) and an area near Paraburdoo (Paraburdoo Wellfield), with only Ethel Gorge being close to or within existing BHP-held tenements. The remaining sites sit west or north of the project boundary.

Within the Strategic Proposal project boundary (and the remainder of the Pilbara as well), stygofauna richness is highest in aquifers within Quaternary and Tertiary valley-fill deposits in palaeovalleys and modern river channels, which cover a substantial part of the Pilbara. These aquifers have numerous voids and spaces that provide prospective stygofauna habitat, as well as mostly having shallow watertables.

BHP identified where rich communities may occur by mapping areas predicted to have a higher likelihood of rich stygofauna communities. Such predictions were based on the attribute considered most important to stygofauna occurrence: shallow depth of groundwater (<30 m). BHP developed maps of depth to groundwater across the broad area containing proposed operations under the Strategic Proposal. To provide a conservative assessment, and to allow for any small mapping errors, all areas where depth to groundwater is <40 m were considered to be prospective for stygofauna (BHP 2016a).

The BHP-commissioned study built on the work of Halse et al. (2014) and identified seven areas containing 12 focal sites considered to have a high richness of stygofauna species within the project boundary. These focal sites are near Paraburdoo, Tom Price, Ethel Gorge, Upper Weeli Wolli and Coondewanna creeks, Weelumurra Creek, parts of the Fortescue Marsh and Mulga Downs. Figure 11 shows the location of the 12 focal sites. As noted, Ethel Gorge supports a stygofaunal TEC, while Weeli Wolli Spring is listed as a PEC partly because of the stygofauna species found at the spring.
The resultant mapping of stygofauna prospectivity (Figure 12) shows large areas in which rich stygofauna communities may occur, as well as other areas that are unlikely to support as-rich stygofauna communities because the groundwater is considered too deep. The mapping was a first-pass method of identifying areas potentially rich in stygofauna and does not identify specific locations where high stygofauna richness will occur. Several factors in addition to depth determine the occurrence of specious communities, including lateral and vertical hydraulic connectivity.

In terms of individual stygofauna species that are listed as conservation significant in Western Australia, none have been recorded within the project boundary. Two of the listed Nedsia species (N. hurlberti and N. sculptilis) may be regarded as occurring in the Pilbara, although it was actually their Barrow Island occurrence that was listed.
Figure 11: Stygofauna focal sites within the project boundary
Figure 12: Prospectivity of areas as stygofauna habitat
Troglofauna

Unlike stygofauna, no Pilbara wide-surveys to identify troglofauna species have been conducted. Information on the species found in the Pilbara and their habitat preferences has tended to be associated with environmental impact assessments.

Existing data on the Strategic Proposal area and the Pilbara as a whole suggests that troglofauna richness is highest in weathered and mineralised geologies. While the importance of mineralisation may sometimes be over-emphasised by the intense sampling of mineralised areas, there is a consistent pattern of troglofauna being found near mineralisation (BHP 2016a). Because sampling is generally associated with impact assessment of mining projects, the data may have a bias towards identifying mineralised areas as the preferred habitat.

A BHP study carried out for the assessment of the Strategic Proposal identified 17 focal sites for troglofauna in the Pilbara, based on previous records of troglofauna in drill holes associated with iron ore projects. Eight of these 17 sites are considered to sit within the Strategic Proposal area. A BHP analysis of Western Australian Museum records and of available EPA assessment reports, identified a further four focal sites within the Strategic Proposal project boundary considered to contain troglofauna communities where multiple species have been recorded. Hence a total of 12 focal areas of higher troglofauna value were identified. The focal sites are shown in Figure 13.

Areas considered to have higher richness of troglofauna species include mineralised areas of Brockman Iron Formation, Marra Mamba Formation, or channel iron deposits. The nature of the mineralisation (in terms of its grade from a commercial perspective) does not appear to affect habitat prospectivity, provided that voids and cavities are present (BHP 2016a).

Hardcap areas – weathered areas of surface banded iron formation (BIF) – also appear to be an important troglofauna habitat. Non-mineralised BIF has not been sampled intensively but it is considered to be less prospective troglofauna habitat because these rocks contain fewer spaces than mineralised ore deposits (BHP 2016a). Figure 14 shows areas considered to have high prospectivity in relation to BHP’s currently held tenure.

The overall weight of current information is that richness is usually greatest in mineralised geologies lying in, or adjacent to, mesas or valley flanks. The mapping highlights the Hamersley Range as being likely to contain the richest troglofauna communities in the Pilbara, which existing information suggests is correct. Furthermore, all focal areas identified in the Pilbara from sampling results, other than Cloudbreak, would be inferred from the mapping to have rich troglofauna communities (BHP 2016a).

Troglofauna ranges tend to be smaller than those of stygofauna and, although ranges are highly variable, the most restricted species may occupy areas of <100 ha (BHP 2016a).
In terms of conservation significant fauna, two identified PECs related to troglofauna are found in the Pilbara; however, these both sit to the west of the Strategic Proposal’s project boundary and therefore will not be impacted. There are also five species of troglofauna listed as being conservation significant in the Pilbara, along with two Priority species – all of these are associated with the ‘Subterranean invertebrate communities of the Robe Valley region’ PEC, which is one of the two PECs to the west of the project boundary that won’t be impacted by the Strategic Proposal.
Figure 13: Troglofauna focal sites within the project boundary
Figure 14: Prospectivity of areas as troglofauna habitat
Potential impacts of the Strategic Proposal

The Strategic Proposal would involve direct impacts on subterranean fauna. Groundwater drawdown for mining or water supply would affect stygofauna and ground disturbance resulting in habitat removal would affect troglofauna. Indirect impacts may also occur as a result of altered surface water runoff patterns causing changes in groundwater levels and compaction of soils due to construction of infrastructure. Contaminant leaching associated with mine closure may also impact on subterranean fauna.

Stygofauna

BHP compared the areas of high prospectivity for stygofauna with areas predicted to have the highest potential for ecohydrological change. The Tandanya, Mudlark, Jinidi, Newman, Jimblebar, Carramulla, Coordiner, Mindy and Marillana projects are considered to have the potential for significant impacts on stygofauna.

Ethel Gorge (TEC)

The Ethel Gorge TEC sits near BHP’s existing Newman and Jimblebar mining hubs. The ‘Ethel Gorge Aquifer Stygobiont Community’ comprises shallow alluvial and calcrite aquifers that support a unique and diverse stygofauna assemblage, as well as riparian woodland communities that are potentially groundwater dependent. The full development scenario (which represents likely maximum impact) is predicted to result in clearing of 10.31 per cent of the TEC. The current allowed impact is 1.78 per cent of the TEC, which is an increase of 8.53 per cent associated with the Strategic Proposal.

There are Ministerial Statement conditions on the existing projects that require management for maintaining the habitat of the stygofauna community in the aquifer. Any future proposal that also impacts on the TEC would require management consistent with the following current practices to ensure the habitat is maintained.

- Environmental monitoring of groundwater levels and groundwater quality at Ethel Gorge; groundwater quality in Ophthalmia Dam; and the stygofauna assemblage at Ethel Gorge.
- Maintenance of natural surface water flow into Ethel Gorge and further downstream within the upper Fortescue River. Flows in Fortescue River are captured by Ophthalmia Dam during low-flow events and provide recharge into the Ethel Gorge groundwater system.
- Ophthalmia Dam and other existing managed aquifer recharge (MAR) facilities provide for bulk and targeted replenishment of groundwater to minimise impacts in and near Ethel Gorge.
- Surplus water may be returned to the groundwater system where practicable and appropriate. The most likely surplus water management approach will be MAR via discharge into Ophthalmia Dam. The use of MAR minimises the spatial extent of groundwater drawdown, thereby contributing to the preservation of stygofauna habitat.
• Validation and refinement of the current ecohydrological conceptualisation for Ethel Gorge, including the contribution of groundwater to vegetation water use and level of dependence of the vegetation of groundwater.

**Weeli Wolli Spring (PEC)**

The hydrological regimes in the spring are currently influenced by nearby mining operations, particularly Rio Tinto’s Hope Downs operations. Conditions are in place for the existing operations (via Ministerial statements) that require management of dewatering and discharge to protect the values of the creek.

- Environmental monitoring of recharge dynamics in the upper catchment, and throughflow effects relevant to Weeli Wolli Spring and its stygofauna assemblage.
- Appropriate interfacing with management programs being implemented by third-party operators, in consultation with Rio Tinto Iron Ore.
- Surplus water – this may be returned to the groundwater system where practicable and appropriate. The use of MAR may minimise the spatial extent of groundwater drawdown.
- Surface water diversion – augmentation of natural surface water flow into Weeli Wolli Spring via targeted drainages, if required.
- Validating, amending and improving the current ecohydrological conceptualisation of Weeli Wolli Spring.
- Quantitative analysis of surface water and groundwater interactions at Weeli Wolli Spring.

**Other areas of high stygofauna prospectivity**

Additional areas that are considered to have elevated environmental value for stygofauna should be sampled and their presence confirmed. At this point the specific impacts will also need to be confirmed, including that drawdown will not impact on these areas in a derived proposal. The different sequencing of mines that are close together and how their drawdown interacts will need to be investigated.

**Troglofauna**

Current troglofauna data from areas sampled suggest that rich troglofauna communities occur in mineralised geologies on the flanks of valleys, as well as in the adjacent footslopes (where mineralised geologies may be overlain by colluvium) and the surrounding ridges and plateaus where hardcap is often well developed.

Areas likely to be prospective for troglofauna within the Strategic Proposal area and wider Pilbara region were determined by using contour maps to identify valley flanks and mesas. All areas with a slope greater than approximately 12 degrees were considered to contain valley flanks, mesas, or other features likely to support troglofauna. It should be noted that this is an investigative method of identifying areas of likely troglofauna occurrence.
Figure 14 indicates where the full development scenario intersects with areas of high troglobenthic prospectivity. Almost all currently-held Strategic Proposal tenure overlaps with areas that are predicted to be of high prospectivity for troglobenthic fauna. The exceptions are Jimblebar, Carramulla, Ophthalmia/Prairie Downs and Roy Hill.

In many cases, parts of the mapped impacted area associated with a mining operation will have more likelihood of troglobenthic occurrence than suggested by prospectivity analysis. For example, a valley slope associated with an ore deposit may have a slope that identifies it as prospective habitat, but the adjacent plateau containing weathered ore and hardcap may not. It is also likely that some areas of channel iron deposit and detrital iron deposit that support troglobenthic fauna will not be identified as highly prospective, while some areas of small, low pisolitic hills that support troglobenthic fauna may not be identified as highly prospective unless mapping is undertaken at a very fine scale.

**Significance of impacts**

The impacts on the Ethel Gorge TEC and Weeli Wolli Springs PEC were considered in the assessment of Hydrological Processes. It was concluded that while significant unmitigated impacts on these environmental values are possible, effective mitigation measures are available to reduce impacts to a level that meets the EPA’s objectives.

BHP contends, based on known data on stygofauna, that about 30 per cent of stygofauna species have ranges that are small enough to be affected by impacts approaching 30 km in linear extent. Thus for range-restricted species there is the potential for significant impacts, as dewatering and habitat loss associated with an individual mine (or multiple interacting mines) could extend across much of this 30 km linear extent of stygofauna habitat.

The EPA’s experience with environmental impact assessment of iron ore projects in the Pilbara generally supports this contention. There are some examples of projects assessed by the EPA where the overlap is such that impacts would be considered significant (such as the Koodaideri Iron Ore Project). In these circumstances the EPA has required that exclusion zones and amendments be applied to project layouts to reduce the impact on the area of habitat to a level where it can meet the EPA’s objectives for subterranean fauna and maintain the biological diversity of subterranean fauna species.

The EPA expects a similar approach to be required for the Strategic Proposal, whereby detailed and targeted subterranean fauna surveys are undertaken for a potential derived proposal. If it is shown that the impacts on subterranean fauna are significant, then the project would need to be amended so that impacts were reduced to a level where the biological diversity of subterranean fauna species were maintained and the EPA’s objective met.

As the EPA noted in its assessment of Hydrological Processes, the impacts on hydrogeological regimes are generally restricted to particular areas within the regional water assets and are not widespread; effective management measures are available to mitigate the impacts. Hence at the regional level significant impacts to stygofauna habitat are not expected.
If the documentation provided with the request to ‘declare a proposal a derived proposal’ cannot demonstrate that sufficient habitat remains for the proposal to be implemented without threatening the viability of a species, then the future proposal will need to be assessed in its own right under the EP Act.

**Biodiversity management – subterranean fauna**

The proponent’s broad approach to managing the Strategic Proposal to prevent significant environmental impacts is discussed in Section 2.3. The PER document provides further information on targeted management measures that may be used for individual future proposals to manage impacts on Terrestrial Fauna.

The EPA notes that this suite of management measures has been developed to demonstrate that future proposals will be implemented in accordance with the mitigation hierarchy. Undertaking site-specific surveys that feed into the mine planning process is the main method that BHP intends to use to avoid impacts on subterranean fauna. BHP has indicated that a possible approach might be the modification of pit shells to avoid impacts on areas identified as having high subterranean fauna value, while further survey work is undertaken to identify species outside of impact areas.

BHP has also identified potential receptor-specific management measures in the PER document for Ethel Gorge and Weeli Wolli Spring (Section 8.2.2.4 of the PER document) as an example of what actions can be taken to ensure the environmental values are protected from significant impacts.

In the PER document, BHP presents the case study example of the ‘WAMinals’ online resource, which was a pilot project between BHP, the Western Australian Museum and environmental consultants. The project’s aim was to consistently identify troglofauna species across the Pilbara that had not occurred historically because of the difficulty in describing such species. This helped the management of subterranean fauna species by supporting identification of genuinely range-restricted species that required focused environmental impact assessment and management – as opposed to species that are just poorly described.

The measures within the suite of management measures are successfully utilised for existing approved operations and contained within environmental management plans that are approved under different Ministerial statements.

**Rehabilitation and decommissioning**

For subterranean fauna the closure of pit lakes to prevent ongoing significant impacts on hydrological regimes and groundwater quality is important. As stated in the Hydrological Processes and Inland Waters Environmental Quality factors, the EPA expects that on referral, a derived proposal would address how mine pit lakes would be rehabilitated to reduce impacts post-closure (particularly backfilling of mine pits). The management of pit lakes is a significant part of the EPA/DMP mine closure guidelines and a key area of regulatory focus.
The EPA will require BHP to demonstrate that closure and rehabilitation of individual future proposals can be carried out in an ecologically sustainable manner. Consequently, the EPA has recommended a condition that requires a mine closure plan for future proposals. A draft mine closure plan is expected to be submitted with the request to ‘declare a future proposal a derived proposal’.

**Potential significant residual impacts**

The Strategic Proposal has the potential for significant residual impacts that require offsets. Environmental offsets are actions that provide environmental benefits which counterbalance the significant residual environmental impacts or risks of a project. Environmental offsets will only be considered after avoidance and mitigation options have been pursued.

Under the current *WA Environmental Offsets Guidelines*, the following are considered significant residual impacts that would require an offset:

- impacts on listed TECs
- impacts on habitat necessary to maintain a species declared as specially protected under the *Wildlife Conservation Act 1950* (or any future legislation that supersedes this Act)
- impacts on areas with high biological value (e.g. nationally or internationally recognised biodiversity hotspots).

Under the guidelines, the following may also be considered significant residual impacts that requires an offset:

- impacts on PECs
- impacts that are likely to result in a species being listed as specially protected under the *Wildlife Conservation Act 1950* (or any future legislation that supersedes this Act)
- impacts that affect significant habitat for a species
- impacts on communities or species that are representative of high biodiversity.

Potential residual impacts as a result of future derived proposals are therefore associated with the impacts on TECs and PECs discussed above. In addition, significant residual impacts may arise should any subterranean fauna species that are listed as being conservation significant be found within the Strategic Proposal project boundary and be impacted upon by future derived proposals. These would be considered as impacts on an additional environmental value.

The actual significance of the residual impacts on subterranean fauna, and the need for offsets will need to be determined in the future at the time of a derived proposal.
**Overall significance of impacts once management is implemented**

Although impacts on subterranean fauna are predicted, a suite of management measures has been used successfully in the assessment and Ministerial conditions imposed on iron ore mine developments in the Pilbara to minimise those impacts. Conditions have been recommended to ensure that any proposal submitted with the intention of it being deemed a derived proposal, would need to demonstrate – as is currently required for s38 referrals – that appropriate management is feasible to meet the EPA’s requirements. As such, the impacts are not considered likely to threaten the overall biological diversity or ecological integrity within the project boundary. This is because, at a strategic scale, management measures (proving habitat connectivity to areas outside the impact area, avoidance, exclusion zones) are available to ensure the EPA’s objectives can be met.

Impacts on conservation significant stygofauna communities (Ethel Gorge and Weeli Wolli Spring) are limited in extent and effective management measures can be implemented to avoid and reduce the impacts. The EPA considers that the Strategic Proposal can be managed to prevent significant environmental impacts provided conditions are imposed on future proposals.

**Recommended conditions**

The EPA’s recommended conditions include a requirement for the proponent to prepare a management plan to minimise the impacts on Subterranean Fauna (Condition 9). The condition’s objective is to ensure the proposal is implemented in a manner that maintains populations of range-restricted subterranean fauna and threatened subterranean fauna species, and avoids and minimises impacts on the habitat of subterranean fauna, including TECs and PECs that have recognised subterranean fauna values.

The EPA considers that if the future proposals that form part of the Strategic Proposal are implemented in accordance with the objectives in Condition 9, then the EPA’s objectives for this factor can be met.

The recommended Ministerial statement requires BHP to provide a draft management plan, as part of the referral of a future proposal, which demonstrates that these objectives can be met. The EPA expects the draft plan to demonstrate how the suite of measures available under the regional management approach have been used to avoid and minimise impacts to an acceptable level. If the draft plan and other information included with the referral cannot demonstrate that the proposal meets the EPA’s objectives, then the proposal will be considered separately under s38 of the EP Act.

To ensure a mine closure plan is prepared, the EPA recommends that the standard mine closure condition applied to projects in the Pilbara is used for any ‘proposal declared a derived proposal’ (Condition 15).

**Summary and draft conditions**

The EPA has paid particular attention to the:

(a) **EPA Statement of environmental principles, factors and objectives**

(b) **Environmental factor guideline – Subterranean Fauna**
(c) Predicted impacts as a result of disturbing 98 500 ha of native vegetation

(d) Absence of known listed Threatened subterranean fauna species within the project boundary

(e) Impacts on TECs and PECs that support stygofauna being limited in nature

(f) Factors that control distribution of subterranean fauna species being different to those factors that dictate impact areas, which means potential for distribution and impact areas are likely to be different

(g) Regional management approach, and the suite of management measures relating to both biodiversity and hydrological processes

(h) Successful application of these management measures across the Pilbara

(i) Rehabilitation being required to reduce the significance of the impacts into the future

(j) Potential for significant residual impacts on conservation significant subterranean fauna communities.

The EPA considers, having regard to the relevant EP Act principles and environmental objective for Subterranean Fauna, that the impacts to this factor are manageable and would no longer be significant, provided that for derived proposals there is:

- control through authorised extent in schedule 1 of the Recommended Environmental Conditions (Appendix 3)
- implementation of measures to avoid and minimise impacts to Subterranean Fauna through the preparation and implementation of an environmental management plan (Condition 9)
- implementation of a mine closure plan so that future proposals are rehabilitated in an ecologically appropriate and sustainable manner (Condition 15)
- implementation of offsets for future proposals (see Section 5, Condition 16) to counterbalance significant residual impacts to conservation significant subterranean fauna species.

4.4 Hydrological Processes and Inland Waters Environmental Quality

EPA’s environmental objectives

The EPA’s environmental objective for Hydrological Processes is:

‘to maintain the hydrological regimes of groundwater and surface water so that environmental values are protected’.
The EPA’s environmental objective for Inland Waters Environmental Quality is:

‘to maintain the quality of groundwater and surface water so that environmental values are protected’.

**Relevant policy and guidance**

The EPA considers that the following current environmental policy and guidance is relevant to its assessment of the proposal for these factors:

- *Environmental factor guideline – Hydrological Processes* (EPA 2016j)
- *Environmental factor guideline – Inland Waters Environmental Quality* (EPA 2016k).

Under the EPA’s former guidance framework, the following documents are relevant to the assessment of this proposal:

- *Cumulative environmental impacts of development in the Pilbara region* – advice under Section 16e of the EP Act (EPA 2014)
- *Mining and water assessments relating to mining and mining-related activities in the Fortescue Marsh management area* – advice under Section 16e of the EP Act (EPA 2013).

**EPA assessment**

**Hydrology and hydrogeology within the project boundary**

The Strategic Proposal project boundary covers a large portion of the Pilbara (7 650 074 ha) (see Figure 1 in Section 2). As a result, the hydrology and hydrogeology within the boundary are generally typical of the Pilbara region, and include some of the key water-related environmental values of the region.

**Surface water**

Surface water in the Pilbara is generally associated with rivers and smaller drainage lines. The area within the project boundary has a number of ephemeral watercourses, fed by high-intensity rainfall associated with cyclones and monsoonal events. The Strategic Proposal is located almost entirely in the Upper Fortescue River Basin.

However, the nature of the rainfall patterns coupled with high evaporation means there are limited surface water resources to support the environmental values. Although rainfall in the Pilbara is sporadic and can occur at any time of the year, the greatest precipitation occurs during the summer months. As a result, for many months of the year surface water is restricted to localised reservoirs such as permanent rockpools and springs.

Permanent and ephemeral rockpools form an important part of the ecosystem and hold water following rainfall events or from spring contributions. Ephemeral rockpools often have local significance, while permanent rockpools have regional significance, as they represent hotspots for species diversity and abundance, and act as important refuges in an arid landscape for fauna species.
Groundwater
Groundwater resources are recharged through direct infiltration and runoff following high-intensity rainfall events. Aquifer types within the Project Boundary are mostly complex fractured rock aquifers with variable structure. Regionally, groundwater flows in a north-westerly direction towards the coast and reflects the topography of the area. Groundwater quality across the Pilbara is generally considered fresh to brackish, although the Fortescue Marsh supports a saline to hypersaline groundwater system.

Some of the key environmental assets that rely on water within the project boundary include:

- Fortescue Marsh
- Lake Robinson/Coondewanna Flats
- Weeli Wolli Creek and in particular the Weeli Wolli Springs PEC
- Ophthalmia Dam and the Ethel Gorge Aquifer Stygobiont Community.

The project boundary is located inland from the Pilbara coast; therefore some of the more westerly water-related environmental values in the Pilbara (e.g. the permanent pools at Millstream and Pilbara coastal rivers and associated aquifers that supply water to the towns) will not be impacted by the Strategic Proposal.

Potential impacts of the Strategic Proposal
Given the wide scope of activities in the Strategic Proposal, impacts on Hydrological Processes and Inland Waters Environmental Quality may arise in several ways. These can generally be grouped into the broad categories of groundwater drawdown (e.g. dewatering for mine pits), changes to groundwater quality (e.g. saline intrusion or acid mine drainage), reduced surface water availability (e.g. construction of infrastructure across flow lines), surplus water management (predominantly likely to be discharge of excess dewatering), changes to surface water quality (e.g. spills of stored chemicals), and pit lakes (e.g. leaching of contaminants from pit lakes). Other impacts may arise from activities associated with the management of water generally. For example, release of water from water storage, such as Ophthalmia Dam, to manage the water supply system.

Particular impacts during rehabilitation and mine closure may be from permanently altered surface water or groundwater availability, changes in surface water quality (including erosion-induced turbidity), changes in groundwater quality (such as salinity) and, as discussed above, impacts from pit lakes. The EPA has previously expressed concern that the increase in mining below the watertable in the Pilbara could leave a significant legacy of pit lakes (EPA 2014).

Ecohydrological change assessment
BHP undertook an ecohydrological change assessment to support the strategic proposal and to demonstrate that the proposal could be managed to meet the EPA’s objectives for the water factors. The focus of the change
assessment was on the interactions and relationships between hydrological processes and ecosystem patterns and dynamics.

The ecohydrological change assessment considers the cumulative impacts of the Strategic Proposal and reasonably foreseeable third-party projects. It is an assessment of the potential for material changes in ecosystem structure, function and/or biodiversity resulting from a hydrological change.

The ecohydrological change assessment predicted that the ecological values of key receptors would be affected by hydrological changes associated with the proposals identified in the Strategic Proposal.

The EPA considers that this approach aligns with the EPA’s objectives for Hydrological Processes and Inland Waters Environmental Quality, whereby the assessment and recommended conditions need to ensure environmental values are maintained during changes in water regimes or water quality.

The potential for change takes into account the connectivity of water movement pathways and ecosystem components; variability in water regimes; and ecosystem resilience and resistance to change. The potential for change also considers the scale of the impacts, as well as the sensitivity of the ecohydrological receptors to change. Water-related environmental values that are sensitive to impacts are graded as having a high potential for change.

Ecohydrological units (EHU) were defined as part of the assessment modelling. These units were defined at a landscape scale and based on distinctive ecohydrological attributes. Surface features, rather than the subsurface groundwater environment, were used to define the units. To help address this limitation, BHP used depth-to-groundwater information (including information from DWER’s numerous studies of the Pilbara) as an indicator of potential connectivity between groundwater resources and groundwater-dependent ecosystems. From this work, nine EHUs were defined and considered in the proponent’s assessment of the Strategic Proposal’s impacts. Figure 15 provides a pictorial representation of the nine units, which are described in more detail in Section 8.2.2.1 of the PER document.

The proponent considers that EHU 8 and 9 have the highest level of management required. EHU 8 is described as ‘Lowland major channel systems and associated floodplains’, examples of which are the Fortescue River around Ethel Gorge and Weeli Wolli Creek. EHU 9 is ‘Lowland receiving areas’ (which translates to drainage terminuses in the form of ephemeral lakes, claypans and flats) – an example of EHU 9 is Fortescue Marsh.

Previous EPA assessments reinforce that these two types of EHUs have high environmental value: they need active management to prevent significant impacts. For example, the assessment of the Eastern Ridge Iron Ore Revised Proposal (July 2016) included a condition requiring a management plan to prevent significant impacts on the Fortescue River at Ethel Gorge. In addition, the EPA’s assessments of the Cloudbreak and Christmas Creek projects recommended conditions for managing the hydrological processes of Fortescue Marsh.

Submissions on the PER document contended that while the EHU approach provided a framework for identifying surface water and groundwater-dependent environments and the ecosystems at risk of change from the
Strategic Proposal, the approach did not specifically address impacts to small-scale, high-value environments such as some transition areas between EHUs.

The EPA, in its *Environmental factor guideline – Hydrological Processes*, has identified that it will focus on impacts to environmentally significant water-dependent ecosystems. This includes, but is not limited to:

- wetlands which are Ramsar listed, Conservation Category, or listed in the *Directory of Important Wetlands in Australia*
- wild and scenic rivers
- wetland types which may be poorly represented
- natural springs and pools, particularly in arid areas
- ecosystems which support conservation significant flora/vegetation and fauna species or communities, including migratory waterbirds, bats, and subterranean fauna
- ecosystems that support significant amenity, recreation and cultural values.

The EPA notes that in the Pilbara, the transition areas not specifically addressed in the EHU approach include natural springs and pools that can support conservation significant fauna. The EPA addressed the potential impacts on these springs and pools in the assessment of the water factors.

Several assumptions underlie the ecological change assessment. Some of these assumptions (e.g. no consideration of groundwater recharge and post-dewatering recovery of groundwater levels) make the predictions conservative and likely to overstate the impacts of the Strategic Proposal. The then Department of Water (now DWER) also made this observation in its submission on the PER document.

The EPA notes that because it is a strategic proposal there is a lack of specificity in project design and associated impacts of each future proposal (e.g. exact depth of an ore body or sequencing of mining that can be used to determine expected total volume of dewatering). However, given the ecohydrological change assessment takes a conservative approach, the impacts are unlikely to exceed those predicted at the regional scale.

**Outcomes of ecohydrological change assessment – potential significant impacts**

The ecohydrological change assessment shows that the unmitigated impacts of the full development scenario could have significant impacts on surface water availability. Particular ecohydrological units that are at risk from the proposal are within the central Pilbara, Fortescue Marsh and Marillana Creek regions, and include Ethel Gorge, Marillana and Weeli Wolli creeks. A significant cumulative change is also predicted to occur in the lowland receiving area (i.e. terminus of upstream drainage) associated with the Fortescue Marsh – this is an example of EHU9.

Figure 16 shows the sensitivity to change in hydrological regimes of different ecohydrological receptors in the study area. Figure 17 shows the predicted potential for change in ecological condition as a result of the Strategic
Proposal. Areas. As noted, this potential for change takes into account both the potential impacts of the future proposals on surface water, as well as the sensitivity of the environment to that change.

Similarly, figures 18 and 19 show the sensitivity of ecohydrological receptors to change in groundwater regimes and the predicted potential for change as a result of the Strategic Proposal. The unmitigated impacts of groundwater drawdown for the Strategic Proposal are expected to be extensive and potentially significant. Modelling by BHP indicates the EHUs most susceptible to drawdown are in the central Pilbara, Fortescue Marsh and Marillana Creek regions, as well as Weeli Wolli Creek. The areas of dark blue in Figure 19 show the receptors modelled as being most at risk of significant groundwater impacts. This includes where Marillana Creek flows into Fortescue Marsh; Weeli Wolli Creek upstream of Weeli Wolli Springs (near Hope Downs) and Ethel Gorge just downstream of Ophthalmia Dam.
Figure 15: Ecohydrological change assessment – ecohydrological units
Figure 16: Surface water receptors – sensitivity to change
Figure 17: Surface water receptors – potential for change
Figure 18: Groundwater receptors – sensitivity to change
Figure 19: Groundwater receptors – potential for change
Key environmental values at risk of significant impacts

Regionally significant water values that are predicted to be at risk of significant impacts are:

- Coondewanna Flats
- Ethel Gorge
- Fortescue Marsh
- Weeli Wolli Spring
- Freshwater Claypans of the Fortescue Valley.

**Coondewanna Flats**

These flats are an internal drainage feature that receive runoff from the surrounding hills. Lake Robinson lies on the flats' northern fringe and is an ephemeral claypan. Larger rainfall events inundate the lake and the water then replenishes the moisture in the vadose zone and underlying aquifers. PECs are also found with the Coondewanna Flats that require surface water inflows to maintain vegetation health.

Moderate impacts on groundwater are predicted in the Coondewanna Flats. However, surface water impacts may be significant from the construction of the Mining Area C, Southern Flank, Mudlark and Tandanya mines.

**Ethel Gorge (and Ophthalmia Dam)**

The gorge is located where the Fortescue River cuts through the Ophthalmia Range. Several creeks exist upstream and feed into Ophthalmia Dam before draining through the gorge. As a result, Ethel Gorge is subject to periodic flows when the Ophthalmia Dam fills with water and overflows.

The aquifers around Ethel Gorge provide habitat for the ‘Ethel Gorge Aquifer Stygobiont Community’ TEC. In this area, the hydrological regime is important for the TEC as it maintains groundwater levels and provides nutrients through the infiltration of surface water.

Ophthalmia Dam also forms part of the water supply scheme that provides Newman with its drinking water, particularly by recharging the aquifers from which the town water supply is drawn. This recharge was the principle reason for the dam’s construction.

**Fortescue Marsh**

Fortescue Marsh is the largest ephemeral wetland in the Pilbara region and is recognised as being nationally important (listed in the *Directory of Important Wetlands in Australia*). The marsh is also listed by the DBCA as a PEC (Priority 1).

The water regime in the marsh is dominated by surface water runoff and evaporative loss. It is also forms an ancient and complex array of alluvial aquifers and groundwater systems.
The ecohydrological change assessment indicates that an area on the southern side of the marsh (near where BHP’s Marillana mine would be developed) has the potential for significant unmitigated ecological impacts.

In 2013, the EPA released advice under s16(e) of the EP Act in relation to the Fortescue Marsh. The advice aims to provide clarity and consistency in relation to the environmental assessment and approvals process by identifying the water and environmental values in different zones of the Marsh and their relative priority.

The area of predicted unmitigated ecological impacts sits within the 1B Marsh, 2B Poonda Plain and 3B Marillana Plain management zones in the EPA’s 2013 s16e advice. In the s16e advice, 1B is recognised as having high conservation significance and 3B has low conservation significance.

The s16e advice lists a number of management strategies related to Fortescue Marsh to protect its conservation values, including maintaining the natural flow regime at the marsh boundary. Any future proposal identified in the Strategic Proposal that contributes to the potential for an unmitigated significant change to the Marsh would need to be managed in accordance with the s16e advice: this is to ensure the mitigated impacts are not significant. BHP’s suite of water management measures (discussed further below) include some of the recommended measures contained in the management strategies listed in the s16e advice.

**Weeli Wolli Spring**

The spring is 60 km upstream of Fortescue Marsh and is a natural expression of groundwater in Weeli Wolli Creek. Several permanent pools up-gradient from the spring are sustained by the shallow groundwater regime. The hydrological regime supports a PEC (Priority 1) comprising groundwater-dependent vegetation, permanent pools supporting fauna and a diverse stygofauna community.

The hydrological regimes in the spring are currently influenced by nearby mining operations, particularly Rio Tinto’s Hope Downs operations. Conditions are in place for the existing operations (via Ministerial statements) that require management of dewatering and discharge to protect the values of the creek.

A number of mines identified in the Strategic Proposal, as well as existing BHP operations, could impact on the hydrological regime of Weeli Wolli Spring. In addition, existing operations by other proponents will continue to influence the spring’s hydrological regime (including the impacts of mine closure for some of the existing operations, given the time scale of the Strategic Proposal). The groundwater impacts of BHP’s future operations on Weeli Wolli Spring are predicted to be low to moderate in the PER, but the cumulative unmitigated impacts are potentially high. Surface water impacts for BHP’s operations (Mining Area C and Jinidi) and other proponents are predicted to be high, due to mining operations reducing the spring’s catchment area.

**Freshwater Claypans of the Fortescue Valley**

This PEC (Priority 1) comprises five freshwater claypans downstream of the Fortescue Marsh – Goodiadarrie Hills on Mulga Downs Station. The claypans
are considered important for waterbirds, invertebrates and some poorly collected plants.

The claypan is close to BHP’s Roy Hill mining area, which is part of the Strategic Proposal. The claypan’s hydrological regime is dominated by surface water inflows. The Strategic Proposal is predicted to have low to moderate impacts on the localised drainage that feeds into the claypans.

**Impacts at smaller scales**

The environmental change assessment has focused on regional water-related environmental values. However, impacts can be expected on locally significant environments from individual future proposals that form part of the Strategic Proposal. As noted previously, rockpools in the Pilbara can have high environmental value. Consultation with Traditional Owners during the public review period identified that gorges in upland areas often support rockpools that have high local conservation significance (particularly for fauna species). Dewatering and interruptions to surface water flows can significantly affect the hydrology of these rockpools.

To support the Response to Submissions and following on from the Traditional Owner consultation, BHP conducted an additional study to identify the environmental values of rockpool habitats, particularly those found in EHU 3 (upland transitional areas) and EHU 4 (upland channel zones). BHP indicated it would manage rockpools at the same level as TECs for permanent rockpools and the same level as PECs for ephemeral rockpools.

BHP has stated that where practicable it will avoid impacts to rockpools. As an example of this, in the PER document it cites a case study from the Eastern Ridge Proposal whereby the disturbance footprint was amended to avoid semi-permanent waterbodies.

Given the importance of rockpools, particularly permanent rockpools, BHP will be required to demonstrate – in the referral of future proposals – how those proposals would be managed to avoid and minimise impacts on rockpools, so that their hydrological regimes are maintained and environmental values protected.

Further to this, during consultation on the PER, native title groups sought reassurance that impacts on local waterholes would be investigated and that subsequent details for management measures would be communicated to the groups before approval was sought for individual future proposals.

BHP stated in its response to submissions that it recognised the importance of water to the native title groups and was committed to undertaking scheduled, as well as targeted consultation with the groups to provide information about how it incorporated key Indigenous values, considerations and practices into water management for its current and proposed activities (BHP 2016b).

Calcrete and fractured rock aquifers also form another important water value at a local scale: individual aquifers can provide water supply for pastoralists as well as for important subterranean fauna. DWER recognises that setting allocation limits for these aquifers, particularly fractured rock aquifers, is not appropriate because of the complex and irregular structures and characteristics such as water availability, recharge and storage. Furthermore,
the sustainable amount of water that can be taken each year is very localised. (DoW 2013).

The significance of impacts on these aquifers needs to be considered on a case-by-case basis once detailed investigation work has been conducted to address the issues identified by DWER above. BHP would need to demonstrate that any future proposal that impacts on a locally significant aquifer is implemented in a sustainable manner. DWER would also need to consider this information before it issues a licence to take water under the Rights in Water and Irrigation Act 1914.

**Significance of impacts**

While the potential impacts on the five regionally important environmental values may be significant, the largest impacts are to sections of the environmental values and not the whole environmental value. In addition, the impacts are likely to be overstated due to the modelling method, which doesn’t take mitigation into account. The potential significance is determined by whether management can reduce the impacts to a level where hydrological regimes and water quality are maintained so as to support the water-related environmental values.

**Water management**

The proponent’s broad approach to managing the Strategic Proposal to prevent significant environmental impacts is discussed in Section 2.3. The PER document provides further information on targeted management measures that may be used for individual future proposals to manage impacts on Hydrological Process and Inland Waters Environmental Quality.

The EPA notes that this suite of management measures has been developed to demonstrate that future proposals will be implemented in accordance with the mitigation hierarchy.

The PER document details several management options from BHP’s suite of management measures for water. These are based on BHP’s experience operating across the Pilbara. Examples of management measures are MAR, controlled surface water discharge and water sharing between sites. BHP intends to use a suite of water management measures as part of the subregional management plans.

Across the Pilbara the management measures included in this suite have proven to be effective in mitigating the impacts of iron ore mines, not just for BHP’s operations but for other proponents as well. For example, large-scale aquifer re-injection has proven feasible at Fortescue Marsh to manage the impacts from Christmas Creek and Cloudbreak mines. Controlled surface water discharge is used at many minesites (noting that discharge is not the preferred management method) to ensure the environmental values of waterways are not significantly impacted upon.

The EPA has stated in the *Environmental factor guideline – Hydrological Processes* that disposal of excess water to waterways should only be done after other potential uses have been maximised, including mitigating environmental impacts, fit-for-purpose onsite activities, meeting the demands
of other water users, and aquifer reinjection (EPA 2016). BHP’s proposed water management measures include all of these management approaches.

The use of water sharing between sites and MAR are management measures supported by DWER in its Strategic policy 2.09: Use of mine dewatering surplus. As is noted in the policy, the appropriate use of mine dewatering surplus for purposes beyond the individual mining operation is supported in Western Australia, given it presents significant opportunities for local communities and the state.

As the EPA indicated in its s16e advice (Cumulative environmental impacts of development in the Pilbara region), the environmental acceptability of disposal to surface water systems depends on the ecology, hydrology and hydrogeology of the proposed disposal area. When requesting ‘a future proposal be declared a derived proposal’, and disposal to waterways is proposed, BHP will have to demonstrate in its documentation that it has considered other management options before resorting to discharge.

BHP has identified potential receptor-specific management measures in the PER document for Coondewanna Flats, Ethel Gorge, Fortescue Marsh and Weeli Wolli Spring (Section 8.2.2.4 of the PER document) as examples of what can be done to ensure the environmental values are protected from significant impacts. These measures are being used across the Pilbara to manage impacts on these receptors, particularly aquifer re-injection. Therefore, the EPA is of the view that it would be feasible to manage individual future proposals to prevent significant impacts.

The EHUs also identify whether each unit depends on groundwater or surface water. This helps to identify the management measures that are most likely to be effective in reducing impacts.

The EPA requires that characterisation of the surface water and/or groundwater systems include climatic influences on water availability. The ecohydrological change assessment notes that the Pilbara has been going through a 20-year wet phase and current baseline conditions will be based on this wet phase. Should the dry phase return (the wet phase does not represent a more permanent step change in the Pilbara’s climate), then groundwater levels may decline and surface water flows reduce. BHP acknowledges that the overall management approach would need to adapt to a dry phase, should the Pilbara return to this climate pattern.

**Rehabilitation and decommissioning**

The rehabilitation and decommissioning of future proposals may have several impacts on Hydrological Processes and Inland Waters Environmental Quality, including:

- increased turbidity in surface water due to surface erosion of final landforms
- acidification of surface waterbodies (natural or artificial) due to exposure and subsequent leaching of sulfide-bearing minerals (acid mine drainage)
- altered surface water availability
- establishment of pit lakes with degraded pit lake water quality
- reduction in groundwater availability
- change in groundwater quality (e.g. salinity).

The EPA has previously expressed the view that there is a significant risk from mine pit lakes when there is hydrogeological connection between the mine void and important wetlands, waterways or groundwater resources. However, as few mines have actually closed in the Pilbara, there is limited information on actual impacts.

Predictions about the volume of backfill material available and how many mine voids will remain open (i.e. not backfilled) have not been provided in the PER. This is due to the nature of the Strategic Proposal, whereby specific project design and mine scheduling information is not available to make such predictions. However, given the scale of the proposal it is expected that some mine voids would be left open, resulting in pit lakes.

The EPA expects that on referral, a derived proposal would address how mine pit lakes would be rehabilitated to reduce impacts post-closure (particularly backfilling of mine pits). How pit lakes will be managed at closure forms a significant part of the EPA/DMP mine closure guidelines and a key area of regulatory focus.

BHP has included a number of case studies in the PER document: these describe the research it is conducting to help predict the impacts and outcomes of mine closure and rehabilitation. The projects related to water include waste rock covers to prevent acid mine drainage and monitoring of pit lakes to better understand the water balance.

Demonstration that closure and rehabilitation of individual future proposals can be carried out in an ecologically sustainable manner will be required. The EPA has recommended a condition that requires a mine closure plan for future proposals. A draft mine closure plan is expected to be submitted along with the request to ‘declare a proposal a derived proposal’.

**Potential significant residual impacts**

Water supports the flora and fauna (terrestrial and subterranean) found in several key ecohydrological resources, such as the Ethel Gorge TEC and Fortescue Marsh and Weeli Wolli Springs PECs and the PECs found within the Coondewanna Flats.

The significant residual impacts to these TECs and PECs have been considered under the Flora and Vegetation, Terrestrial Fauna and Subterranean Fauna factors. Impacts on these key ecohydrological resources would be considered an impact to an ‘other important or specialised’ environmental values.

The application of offsets to the Strategic Proposal is discussed in more detail in Section 5.
Overall significance of impacts once management is implemented

While modelling has indicated that significant changes could occur as a result of implementing the Strategic Proposal, these are unmitigated impacts. Given these are generally restricted to particular areas and not widespread, and that effective management measures are available to mitigate the impacts, the EPA considers that hydrological regimes and water quality can be managed to prevent significant environmental impacts – provided conditions are imposed on future proposals.

Recommended conditions

The EPA’s recommended conditions include a requirement for the proponent to prepare a water management plan to minimise the impacts on Hydrological Processes and Inland Waters Environmental Quality (Condition 10). The condition’s objective is to ensure that the proposal is implemented in a manner that avoids and minimises impacts on the hydrological regimes and water quality of the key water-related environmental values within the proposal boundary, including Fortescue Marsh, TECs and PECs, and permanent and ephemeral rockpools.

The EPA considers that if the future proposals that form part of the Strategic Proposal are implemented in accordance with the objectives in Condition 10, then the EPA’s objectives for this factor can be met.

The recommended Ministerial statement requires BHP to provide a draft management plan, as part of the referral of each future proposal, which demonstrates that these objectives can be met. The EPA expects the draft plan to demonstrate how the suite of measures available under the regional management approach have been used to avoid and minimise impacts to an acceptable level. If the draft plan and other information included with the referral cannot demonstrate that the proposal meets the EPA’s objectives, then the proposal will be considered separately under s38 of the EP Act.

To ensure a mine closure plan is prepared, the EPA recommends that the standard mine closure condition that is applied to projects in the Pilbara is used for any ‘proposal declared a derived proposal’ (Condition 15).

Summary and draft conditions

The EPA has paid particular attention to the:

(a) EPA Statement of environmental principles, factors and objectives
(b) Environmental factor guidelines for Hydrological Processes and Inland Waters Environmental Quality
(c) Impacts predicted by the ecohydrological change assessment, particularly to the key regional water values
(d) Largest impacts being localised to particular parts of the regional water environmental values and not being widespread across all the water resources that support the environmental values
(e) Ecohydrological change assessment representing unmitigated impacts, as well as providing a conservative prediction of impacts
(f) Regional management approach, and the suite of management measures contained in the water management toolkit

(g) Successful application of these management measures across the Pilbara

(h) Rehabilitation being required to reduce the significance of the impacts into the future, particularly from mine pit lakes

(i) Potential for significant residual impacts being considered under the key environmental factor which the water regimes support (i.e. Flora and Vegetation, Terrestrial Fauna and Subterranean Fauna).

The EPA considers, having regard to the relevant EP Act principles and environmental objectives for Hydrological Processes and Inland Waters Environmental Quality, that the impacts to these factors are manageable and would no longer be significant, provided that for derived proposals there is:

- implementation of measures to avoid and minimise impacts to the hydrological regimes and water quality to protect water-related environmental values through the preparation and implementation of an environmental management plan (Condition 10).

- implementation of a mine closure plan so that future proposals are rehabilitated in an ecologically appropriate and sustainable manner (Condition 15).

4.5 Social Surroundings

The EPA’s environmental objective for Social Surroundings is ‘to protect social surroundings from significant harm’.

Relevant policy and guidance

The EPA considers that the following current environmental policy and guidance is relevant to its assessment of the proposal for this factor:

- Statement of environmental principles, factors and objectives
- Environmental factor guideline – Social Surroundings (EPA 2016).

As stated in the environmental factor guideline, for Social Surroundings to be considered in environmental impact assessment, there must be a clear link between a proposal’s impact on the physical or biological surroundings and the aesthetic, cultural, economic or social surroundings.

Further, the above must also be read in the context of ‘significance’ as defined in relation to significant proposals in subsection 37B(1) of the Environmental Protection Act 1986. For the EPA to consider Social Surroundings as a factor in environmental impact assessment, a proposal’s effect on social surroundings, through its effect on the physical or biological environment, must be significant.

Future proposals identified in the Strategic Proposal have the potential to directly disturb sites of Aboriginal heritage significance. Future proposals identified in the Strategic Proposal may also potentially have direct impacts on amenity through dust and noise emissions, and visual changes to the
landscape as result of land disturbance. Therefore, Social Surroundings is considered to be a key environmental factor, with Aboriginal heritage and amenity being the focus of the environmental impact assessment.

**EPA assessment**

**Heritage**

*Aboriginal heritage values*

The Pilbara region has a rich and living Aboriginal culture with Traditional Owners retaining strong links to Country and playing a key role in protecting cultural and natural heritage. Archaeological sites in the Pilbara have the largest concentration of rock art in the world, estimated at around one million engravings (Government of Western Australia 2017).

BHP acknowledge that the Pilbara hosts a prolific number of Aboriginal rock engravings, some of the best-known being on the Burrup Peninsula (which is outside the project boundary). Similar engravings also occur within the project boundary (BHP 2016a).

As stated in its *Environmental factor guideline – Social Surroundings*, the EPA expects proponents to undertake surveys and consultation with the Traditional Owners to identify the presence of sites that have important and significant Aboriginal heritage value.

BHP has undertaken archaeological and ethnographic surveys to identify places of cultural significance. These surveys have been undertaken with the participation of Traditional Owners and will be ongoing. This participation is guided by heritage protocols established between the different Traditional Owner groups and BHP. At the time the PER document was prepared, approximately 55 per cent of the full development scenario had been subject to heritage surveys (BHP 2016a). BHP records indicate it has done 906 heritage surveys within and near the project boundary since 1975, and that 472 of these involved Indigenous people (BHP, pers. comm. 2017).

BHP has consulted with the Traditional Owner groups whose land would be directly physically impacted by the future proposals identified in the Strategic Proposal. The groups consulted and the details are discussed in Section 8.3.2 of the PER document. BHP has also stated it will undertake further consultation with Aboriginal communities that are near the Strategic Proposal (BHP 2016a).

To support engagement with Traditional Owners and give independent advice in relation to the Strategic Proposal (including reviewing and responding to the PER document), an independent environmental consultant was engaged through Yamatji Marlpa Aboriginal Corporation. BHP responded to the issues raised during this consultation in its Response to Submissions document (BHP 2016b).

The environmental issues identified as important during this consultation included water, mine rehabilitation, impacts on bush tucker and bush medicine, impacts on flora and fauna, and the scale of disturbance/cumulative impacts.
In regard to water, permanent rockpools were identified as having high value, given they provide a refuge for native fauna during periods of drought. These impacts were assessed under the Hydrological Processes and Terrestrial Fauna factors.

A number of Aboriginal reserves are located within the project boundary, such as Ethel Creek and the Weeli Wolli area. These reserves are crown land set aside for a number of public purposes and the use of Aboriginal people (BHP 2016a).

**Potential impacts on Aboriginal heritage**

The future proposals identified in the Strategic Proposal have the potential to impact on heritage values either through direct disturbance of sites of significance or indirectly through changes to water regimes, changes in public access, and impacts on vegetation and fauna.

BHP has entered into land use agreements with the Nyiyaparli, Banjima and Yinhawangka native title groups. These agreements provide certainty about future tenure requirements beyond the existing lease and mining operations in the areas. These agreements cover 92 per cent of BHP’s existing mining tenements related to the Strategic Proposal.

As part of these agreements, BHP and the native title groups have agreed to specific cultural heritage commitments in relation to the management of heritage sites, including the recognition, mapping and capture of places of ethnographic importance (referred to as ‘confidential areas’). BHP will seek to avoid impacts on these confidential areas under future derived proposals in line with its obligations under the agreement (while the agreement is in force).

The Nyiyaparli people provided a submission indicating they did not object to the Strategic Proposal. They noted the consultation process undertaken to date by BHP and further noted that BHP had made several commitments to them in regard to consultation and preparation of derived proposals under the EP Act.

The Banjima people also indicated they did not object to the Strategic Proposal. They advised the EPA of the existence of several ‘exclusion zones’, which are places or sites of particular cultural and/or environmental significance to the Banjima people. The exclusion zones are treated differently under the 2015 Comprehensive Agreement (a land use agreement between BHP and the Banjima people) with varying degrees of protection.

Impacts on flora and fauna generally were addressed under the Flora and Vegetation and Terrestrial Fauna factors. The species considered conservation significant are not generally those that are considered important for bush tucker. However, the EPA notes in the *Environmental factor guideline – Social Surroundings* that traditional customs such as hunting and gathering for bush tucker may be considered significant.

The EPA notes that the flora and fauna species generally used as bush tucker are not considered under threat. For example, it was noted by several Traditional Owner groups during consultation that the impacts on bush tucker (e.g. kangaroos, emus) would affect them more than the impacts on some
protected species such as the northern quoll. The EPA also notes that the Strategic Proposal involves disturbance to 98 500 ha within a 7 650 074 ha project boundary. Traditional Owners will be able to maintain access to large areas for collecting bush tucker and bush medicine. Therefore, the EPA considers that impacts on Traditional Owners’ ability to access bush tucker within the Strategic Proposal project boundary are unlikely to be significant.

BHP has stated it will engage with Traditional Owners to further understand the significance of native plants and animals to Indigenous values. This additional information will be used when the mitigation hierarchy is applied to individual future proposals (BHP 2017).

The then Department of Aboriginal Affairs (DAA), in its submission on the PER document, stated that based on the available records of past Aboriginal heritage surveys, it was of the opinion that potential impacts to Aboriginal sites from the Strategic Proposal could be addressed by the provisions of the Aboriginal Heritage Act 1972.

Derived proposals will be required to comply with the Aboriginal Heritage Act where relevant. In particular, where any heritage sites are required to be disturbed, BHP must seek consent from the responsible Minister under section 18 of the Aboriginal Heritage Act 1972 before undertaking any activities that may disturb the site.

Aboriginal heritage management

The proponent’s broad approach to management of the Strategic Proposal to prevent significant environmental impacts is discussed in Section 2.3. The PER document provides further information on targeted management measures that may be used for individual future proposals to manage impacts on Social Surroundings, including Aboriginal heritage.

The land use agreements provide a mechanism through which BHP can identify and avoid sites of significance. The EPA notes that through these agreements, exclusion zones and ‘confidential areas’ have been identified. Impacts on these sites will be avoided when future proposals are being designed. BHP has internal procedures in place for existing operations to ensure that unauthorised clearing or access to identified sites does not occur.

Historically and generally speaking, the EPA has not recommended specific conditions related to Aboriginal heritage for iron ore mines in the Pilbara. However, given this is a Strategic Proposal, it has drafted a condition requiring the preparation of an Aboriginal heritage management plan that would form part of the conditions for a derived proposal. Hence the EPA can recommend this condition be applied to a derived proposal if the potential impacts on Aboriginal heritage are deemed so significant that a management plan is considered necessary. This may be due to the identification of significant heritage sites or for some other reason, such as future changes in the Aboriginal Heritage Act or the land use agreements between BHP and the Traditional Owners, or the EPA becomes concerned about potential impacts on Aboriginal heritage arising from a particular future proposal.

As detailed under the assessment of land and water factors, BHP will be required to implement a range of management measures to minimise impacts
on flora, fauna and water regimes to maintain biological diversity and ecological integrity.

Rehabilitation and decommissioning

During the consultation process, BHP presented to the Traditional Owner groups on future disturbance, mine rehabilitation and decommissioning. Mine rehabilitation emerged as a key issue for the Traditional Owners. Discussions confirmed that the groups wished to become more involved in rehabilitation planning and works.

The EPA noted the importance of consultation with Traditional Owners during mine closure planning in Section 2.3 (Context). The EPA/DMP Guidelines for preparing mine closure plans provides further detail on the consultation expected when preparing a mine closure plan, as well as on how that information should be presented in the plan. The EPA expects mine closure plans to be consistent with these guidelines, which is reflected in the condition that the EPA recommends for mine closure.

The EPA will require BHP to demonstrate that closure and rehabilitation of individual future proposals can be carried out in an ecologically sustainable manner. Consequently, EPA has recommended a condition that requires a mine closure plan for future proposals. A draft mine closure plan is expected to be submitted with the request to ‘declare a proposal a derived proposal’.

The EPA notes the processes in place to ensure consultation with Traditional Owners, identification of exclusion zones, and management of Aboriginal heritage values to ensure that impacts on Aboriginal heritage are not significant.

The EPA also considers that the requirements of the recommended conditions for Flora and Vegetation, Terrestrial Fauna, Hydrological Processes and Inland Waters Environmental Quality will help reduce the impacts on flora, fauna and water resources that have value to Traditional Owners.

It also notes that clearance under section 18 of the Aboriginal Heritage Act 1972 is required before a site of significance can be disturbed.

Amenity

Amenity values

In the Environmental factor guideline – Social Surroundings, the EPA notes that amenity values can be highly subjective and vary from person to person based on individual values, perceptions and tolerances (EPA 2016).

The Pilbara is relatively sparsely populated. Most towns have been established to support the resources sector. Newman is the main townsite that may be impacted by the full development scenario. Other amenity impacts may occur where projects are close to Karijini National Park, regional peaks, and regional roads including the Great Northern Highway (BHP 2016a).

Dust

The EPA notes that the Pilbara is naturally dusty environment. The impacts of particulates, including dust, were also assessed under the air quality factor.
EPA noted under Air Quality that the impacts from particulates are not considered to threaten the environmental values of the Pilbara region, as the environment is naturally subjected to high dust levels and effective management measures can be implemented to avoid and reduce impacts.

**Noise**

The Environmental Protection (Noise) Regulations 1997 prescribe the standards for noise emissions under the EP Act. BHP has developed a regional-scale noise model that includes its operations and third-party operations. This modelling considered 35 sensitive receptors, with the results indicating that at two of these receptors, assigned noise levels may be exceeded (Marillana Homestead and Newman town centre).

At Marillana Homestead the modelling indicates that most of the noise comes from third-party operations and that noise levels may be exceeded without any contribution from BHP. Therefore, the Strategic Proposal is not expected to adversely impact on this sensitive receptor.

Newman town centre is predicted to have noise-level exceedences of up to 3.3 decibels. The Eastern Ridge Proposal was identified as the biggest contributor to noise levels, with other existing operations also contributing. The Eastern Ridge Proposal is an existing approved proposal; however, the predicted exceedence would occur due to an expansion of this proposal.

The regional modelling was based on an assumption of standard noise control measures rather than implementation of measures tailored for specific minesites. In addition, the location of operations around Newman will be finalised as part of future mine planning.

The EPA considers that the implementation of project-specific measures at final project design will be required to ensure that all future proposals meet the Environmental Protection (Noise) Regulations 1997. In forming this view, the EPA also notes that Regulation 17 provides a process for approval where a proponent is seeking to exceed the noise standards under these regulations (in cases where it is not reasonable or practicable to comply with the standards).

Noise sensitive receptors were also assessed for transportation noise impacts from the BHP operated rail network. Model predictions indicate that rail noise will not result in high received noise levels, with all assessed locations being compliant with the rail noise criteria contained in State planning policy 5.4: Road and rail transport noise and freight considerations in land use planning (BHP 2016a).

Individual mines will be required to obtain works approvals and licences under Part V of the EP Act for emissions and discharges. This will include those for emissions of noise, dust or odours.

**Visual amenity**

BHP commissioned a landscape and visual risk assessment (Appendix 8 in the PER document). The assessment collected data from several sources (including tourist maps and the Newman Visitor Centre) to identify areas of potential amenity value that the Strategic Proposal could affect.
Landscapes dominated by hills, ridges, plateaus and elevated areas typically have locations with the highest visual amenity values (panoramic viewpoints, lookouts, gorges and rockpools).

The risk assessment identified Newman and its surrounds, the Weeli Wolli Creek system, Great Northern Highway and Mt Meharry (within Karijini National Park) as the areas with greatest potential for impacts on the viewshed.

There are existing impacts to viewsheds in the Pilbara given iron ore mining began in the region in the 1960s. Newman was established in 1968 to support nearby mining (Landcorp 2015) and was particularly affected. Mt Meharry is the highest peak in Western Australia, which increases the size of its viewshed and the potential for mining operations to be within the line of sight from this peak.

BHP would use measures such as screening structures and vegetation to minimise the impacts of the modification of landforms. BHP recognises that mine closure and rehabilitation will also need to address visual amenity when determining completion criteria for closure of individual mines. Contouring and other measures taken to revegetate waste rock landforms (to minimise impacts on flora and fauna) can also prevent permanent impacts on visual amenity.

The EPA considers that the impacts on amenity are unlikely to be significant given that feasible management measures are available to reduce the impacts on amenity and that future proposals are required to comply with Part V of the EP Act in regard to emissions and discharges.

Overall significance of impacts once management is implemented

As the impacts to heritage and amenity are not expected to be significant once management measures are in place. Thus the EPA considers that the Strategic Proposal can be managed to prevent significant environmental impacts on Social Surroundings and its objectives for this factor can be met.

Recommended conditions

The EPA has recommended a condition (Condition 13) that requires a heritage environmental management plan, should it be determined (at the time of declaration of a derived proposal) that the impacts of a future proposal require targeted management of Aboriginal heritage values through such a plan. The condition’s objective is to ensure the proposal is implemented in a manner that minimises the impacts on Aboriginal heritage and culture.

The EPA considers that if implementation of the future proposals that form part of the Strategic Proposal are accordance with the objectives in Condition 13, then the future proposals can meet the EPA’s objectives for this factor.

The recommended Ministerial statement requires BHP to provide a draft management plan with referral of future proposals demonstrating that these objectives can be met. The EPA expects the draft plan would demonstrate how the suite of measures available under the regional management approach had been used to avoid and minimise impacts to an acceptable
level. If the draft plan and other information included with the referral did not demonstrate that the proposal met the EPA’s objectives, then the proposal would be considered separately under s38 of the EP Act.

To ensure a mine closure plan is prepared, the EPA recommends that the standard mine closure condition that is applied to projects in the Pilbara is used for any ‘proposal declared a derived proposal’ (Condition 15).

The EPA has noted that the impacts from emissions and discharges can be managed under Part V of the EP Act. Therefore, it considers that a condition that specifically requires an environmental management plan for emissions and discharges of odours and noise is not required. With the discharges of dust addressed under Air Quality.

The impacts on visual amenity are not considered significant and therefore no related condition has been recommended.

Summary and draft conditions
The EPA has paid particular attention to the:

(a) EPA Statement of environmental principles, factors and objectives;
(b) Environmental factor guideline – Social Surroundings
(c) Process for identifying areas of Aboriginal heritage values and exclusion zones
(d) Traditional Owner access to most of the area within the project boundary would not be restricted due to the Strategic Proposal
(e) Results of air quality and noise modelling
(f) Need to tailor management measures to individual mines to meet regulatory guidelines for emissions and discharges
(g) Suite of management measures available to manage impacts on amenity
(h) Existing and predicted impacts on the visual landscape in the Pilbara
(i) Rehabilitation being required to reduce the significance of the impacts into the future.

The EPA considers, having regard to the relevant EP Act principles and environmental objective for Social Surroundings, that the impacts on this factor are manageable and would no longer be significant, provided that for derived proposals there is:

- control of the total disturbance through the authorised extent in schedule 1 of the recommended environmental conditions (Appendix 3)
- implementation of measures to minimise impacts on Aboriginal heritage and culture through the preparation and implementation of an environmental management plan (Condition 13)
- implementation of a mine closure plan so that future proposals are rehabilitated in an ecologically appropriate and sustainable manner (Condition 15).
4.6 Air Quality

The EPA’s environmental objective for Air Quality is ‘to maintain air quality and minimise emissions so that environmental values are protected’.

The EPA defines air quality as the chemical, physical, biological and aesthetic characteristics of air.

Relevant policy and guidance

The EPA considers that the following current environmental policy and guidance is relevant to its assessment of the proposal for this factor:

- *Statement of environmental principles, factors and objectives*
- *Environmental factor guideline – Air Quality (EPA 2016m)*.

The EPA notes that Air Quality was considered an ‘other environmental factor’ and not a key environmental factor at the time the environmental scoping document was prepared for the Strategic Proposal. However, BHP commissioned an air quality model for the region and undertook a cumulative impact assessment for the Strategic Proposal.

EPA assessment

Pilbara ambient air quality and sensitive receptors

The Pilbara environment is considered naturally dusty due to its semi-arid nature. Windblown dust is considered to be a significant contributor to ambient particulate levels. Bushfires also influence the Pilbara’s ambient air quality.

The EPA has stated that when making judgments about the acceptability of potential impacts on ambient air quality, the EPA’s assessment will typically be informed by accepted air quality standards.

Given it has existing mining operations in the Pilbara, BHP has been collecting air quality data within the Newman townsite, along with background monitoring data from outside the townsite. Based on recordings from a monitoring station, in places most remote from mining operations the background PM$_{10}$ concentration is 18 µg/m$^3$ versus a National Environmental Protection (Ambient Air Quality) Measure (NEPM) standard of 50 µg/m$^3$. For total suspended particulates (TSP) the measured background level is 33 µg/m$^3$ versus a relevant standard of 90 µg/m$^3$ and a limit of 150 µg/m$^3$.

These are average levels, with individual exceedances of PM$_{10}$ and TSP levels naturally occurring at various times in the Pilbara based on the recordings from the monitoring station. The Southern Flank Iron Ore Project PER document states that PM$_{10}$ typically exceeds the 70 µg/m$^3$ level three to six times per year.

The following sensitive receptors were identified for the assessment of particulate impacts:

- Aboriginal community – Wirrilimarra community area
- Homestead – Juna Downs, Ethel Creek, Marillana, Mulga Downs, Prairie Downs, Sylvania
- Lookout – Munjina East Gorge, Fig Tree Crossing, Mount Meharry, Mount Newman, Tower Hill
- Recreation camp site – Karijini Eco Retreat
- Recreation site – Ophthalmia Dam, Round Hill, Hickman Crater, Weeli Wolli Spring and Outfall, Stuarts Pool, Kalgan Pool, Eagle Rock Hole
- Rest stop – Mount Robinson
- Roadhouse – Munjina Roadhouse, Auski Village, Capricorn Roadhouse
- Town centre – Newman
- Townsite – Rhodes Ridge.

The identified receptors are located in the eastern part of the project boundary close to BHP’s existing tenements (Figure 20). Receptors such as lookouts, recreation sites and rest stops represent areas where people’s exposure to any air quality impacts would be short-term.

**Greenhouse gas emissions in Western Australia**

In its environmental factor guideline, the EPA notes that emissions of greenhouse gases contribute to a changing climate, the effects of which are predicted to be more frequent and severe storms in the north-west of Western Australia (EPA 2016). The assessment of greenhouse gases needs to consider these emissions as representing an incremental contribution to a global issue.

The EPA has indicated it may decide to assess greenhouse gas emissions within the environmental impact assessment process if a proposal’s greenhouse gas emissions are deemed to be significant. The EPA defines this as proposal’s that have the potential to significantly increase the state’s greenhouse gas emissions, which totalled 83.4 Mt of CO₂ equivalent (CO₂-e) in 2013–14 (EPA 2016).
Figure 20: Sensitive receptors near current BHP tenure
Potential impacts of the Strategic Proposal

Impacts of the proposal

The Strategic Proposal would impact on air quality through particulate emissions from mobile equipment for blasting, loading and hauling ore, and from fixed plant such as that for crushing, screening and stockpiling ore.

The Strategic Proposal would also contribute to Western Australia's total emissions of greenhouse gases.

The assessment is focused on emissions of particulates (principally dust) and emissions of greenhouse gas, as these are the main emissions associated with iron ore mining.

Particulates

The impacts on the receptors were assessed against the NEPM standard. The NEPM standards set national standards for six air pollutants to which most Australians are exposed: carbon monoxide, ozone, sulphur dioxide, nitrogen dioxide, lead and particles (as PM\textsubscript{10}). The EPA recognises that NEPM provides a common national goal to best protect human health and wellbeing from the adverse impacts of air pollution. In addition, no regulations exist for total suspended particulates (TSP) in the Pilbara region, so the proponent used the standards and limit in the Kwinana Environmental Protection Policy (EPP).

The air quality model was used to predict impacts from the full development scenario. To predict likely emissions, site-specific data from existing operations and National Pollutant Inventory reporting was utilised. The method used under the full development scenario provides a conservative estimate of emissions as it assumes that all BHP operations under the Strategic Proposal and third-party projects are at maximum operational level at the same time. This scenario is unlikely as projects are typically developed at different rates. It does, however, provide a conservative worst-case scenario for air quality impacts.

The modelling found that under the full development scenario and with standard dust controls, the full development scenario would see NEPM standards for PM\textsubscript{10} exceeded at 18 of the 26 sensitive receptors, five of which are continuously occupied. With leading controls this number is reduced to eight, of which two are continuously occupied. These two are Marillana Homestead and Wirrilimarra community area. Leading controls are those that utilise flexible and innovative management measures to match site-specific requirements as opposed to standard control measures.

However, what is predicted by the modelling is that the impacts on these two receptors are primarily from third-party operations and not from the Strategic Proposal itself. Similarly, for TSP, levels are modelled to exceed the Kwinana EPP limits at Marillana Homestead with third-party operators contributing the largest portion of the impacts.

These exceedences are also single events and occur under particular climatic conditions. The controls contemplated in the modelling are also general controls and not tailored to individual mine site characteristics.
Greenhouse gases

The National Greenhouse and Energy Reporting Act 2007 requires reporting from facilities in Australia with direct greenhouse gas emissions greater than 25 000 tonnes of CO$_2$-e per year. It is expected that facilities associated with the Strategic Proposal will be required to report greenhouse gas emissions under this Act to the Australian Government’s Clean Energy Regulator.

As stated in the environmental factor guideline, the information that the EPA requires for environmental impact assessment is the characterisation of Scope 1 (direct) and Scope 2 (energy indirect) greenhouse gas emission sources. This is in accordance with the National Greenhouse and Energy Reporting Act 2007 and the analysis of greenhouse gas intensity and comparison with published benchmarked practice for equivalent plant, equipment and operations.

In terms of total emissions from the Strategic Proposal, it is predicted that the full development scenario will emit 4.4 mtpa of CO$_2$-e, compared with 0.9 mtpa from existing BHP operations. This 3.5 mtpa increase represents 4.2 per cent of Western Australia’s 2013–14 emissions.

The intensity is the quantity of CO$_2$-e generated per tonne of product produced. For the future proposals identified in the Strategic Proposal, intensity is not expected to increase as mining methods are consistent with those currently used for operations. The predictions of emissions from the Strategic Proposal were based on greenhouse gas emissions from existing operations. BHP’s 2016 intensity was 8.17 CO$_2$-e per kiloton (CO$_2$-e/kt).

The EPA also expects decreased emissions per tonne of ore as BHP undertakes measures to improve greenhouse gas efficiency. In addition, as for particulates, not all operations will be in operation at the same time and therefore the intensity of greenhouse gas emissions is expected to be less than the conservative prediction required. The EPA considers that periodic review and adoption of advances in technology and process management can also reduce emission intensity over the life of the project (EPA 2016).

Significance of impacts

Particulates

It is noted in the PER document that the modelling results for the Strategic Proposal indicate the potential impacts from the proposed development in a regional context. The conceptual model includes both BHP operations and those of third-parties across the development timeframe. Individual projects within the assessed area are defined on a ‘typical’ or indicative basis to accommodate the absence of certainty around specific project definition. Therefore, the results from this study are not considered to be an accurate prediction of air quality impacts but more an indicator for prioritising dust mitigation strategies in the Pilbara.

It is noted that BHP has a long history of implementing dust mitigation measures to minimise impacts at sensitive receptors. Modelling of the strategic development indicates that:

- Without any dust control, the dust levels (PM$_{10}$ and TSP) may exceed relevant guidelines at sensitive receptors.
• To reduce the impacts on air quality and to meet the assessment criteria selected for this study, it is essential for BHP Iron Ore to implement dust controls at all mines in the Pilbara region.

• This study indicates some higher-risk locations that may require an increased focus on dust controls in the future.

The use of leading controls substantially reduced the predicted impacts compared with the standard controls and a ‘no control’ scenario (BHP 2016a).

**Greenhouse gases**

While the intensity of greenhouse gas emissions from BHP’s operations are not expected to increase as a result of the Strategic Proposal, the total emissions of greenhouse gases across the life of the proposal are potentially significant given they represent 4.2 per cent of the state’s total emissions in 2013–14.

This figure is also considered a conservative prediction because under the full development scenario, all future proposals identified in the Strategic Proposal would be active at the same time – which is an unlikely situation given some mines will close before others are brought into production over a 50-year timeframe. Therefore, yearly emissions are likely to be less than 4.2 per cent of total emissions.

The EPA encourages proposal design, technology and operations that ensure greenhouse gas emissions are minimised.

**Air quality management**

Consistent with the principle of waste minimisation as set out in section 4A of the *Environmental Protection Act 1986*, the EPA encourages the application of all reasonable and practicable measures to minimise harmful emissions to air. This might include facility design, technology choice, operation and closure.

Reasonable and practicable measures include those measures which are reasonably practicable, having regard to, among other things, local conditions and circumstances (including costs) and the current state of technical knowledge.

The subregional management plan approach has been implemented for existing approved proposals in the Pilbara. BHP’s approach is to develop specific and measurable outcomes for key environmental assets, species and other biophysical elements that may be impacted by the Strategic Proposal.

As noted, the EPA encourages the application of all reasonable and practicable measures to minimise harmful emissions to air. Given that air quality in the Pilbara can naturally exceed air quality standards related to dust, it is not considered reasonable to expect that future proposals could be managed in a manner such that air quality standards were always met in the vicinity of future proposals. It is, however, reasonable to expect that tailored management measures are implemented for future proposals to minimise the emission of particulates.

BHP maintains an air monitoring network across its Pilbara operations. In Port Hedland and Newman, key initiatives carried out in recent years to improve the network have included the installation of four new additional monitoring stations in Newman, further expansion of BHP’s boundary monitoring network, and installation of a boundary monitoring network at port operations. BHP has established a real-time dust monitoring and modelling system at its Port Hedland operations to actively
monitor and manage the potential for dust production. BHP has the ability to alter operations continuously to adapt to changing environmental conditions. A predictive model provides a three-day forecast to manage operations further into the future. Measures such as these may be implemented for the Strategic Proposal to ensure dust is managed to prevent significant impacts on air quality.

In regard to greenhouse gas emissions, BHP has indicated that it routinely identifies, evaluates and implements emission reduction initiatives in order to make efficiency improvements in its operations and reduce greenhouse gas emissions per tonne of material moved. It has improved from 8.50 tonnes of CO$_2$-e/kt of ore in 2014 to 8.17 t CO$_2$-e/kt in 2016. This also compares favourably to an iron ore industry average of 11.9 t CO$_2$-e/kt.

BHP prepares an annual sustainability report that covers all of BHP’s assets (not just iron ore). It has set a performance target of maintaining its greenhouse gas emissions below the company’s 2006 emission levels. In 2016, greenhouse gas emissions were 13 per cent lower than the 2006 baseline levels. The company was also on track to meet its 2017 target, partly due to greenhouse gas reduction projects and improved productivity (BHP 2016a).

**Overall significance of impacts once management is implemented**

While impacts on air quality are predicted, principally from dust emissions, these impacts are not considered to threaten the environmental values of the Pilbara region as the environment is naturally subject to high dust levels. However, effective management measures can be implemented to avoid and reduce the impacts.

The EPA considers that the Strategic Proposal can be managed to prevent significant environmental impacts, provided conditions are imposed on future proposals. These conditions should require future proposals to demonstrate adoption of best-practice management of emissions to air to reduce the impacts from particulates.

Further to this, under Part V Environmental Regulation of the EP Act, premises that cause unreasonable emissions to air require licensing. Derived proposals need to obtain all further approvals required under legislation, including under Part V of the EP Act. It is during this process that additional analysis will be undertaken to ensure that any derived proposal uses best-practice and that the proposal minimises emissions as far as practicable.

The EPA notes that the Part V Environmental Regulation licensing process will include further assessment, regulation and mitigation of air emissions, as well as assessment of the proposed technology to ensure best-practice will be implemented.

The greenhouse gas emissions do not exceed the industry benchmark per tonne of output. However, the whole Strategic Proposal does emit a large quantity of greenhouse gases. Therefore, greenhouse gas emissions should be minimised using best-practice measures.

Under the *National Greenhouse and Energy Reporting Act 2007*, reporting of emissions is at a corporate level. To allow continued benchmarking and for public accountability, the EPA considers that reporting at the individual proposal level is appropriate where emissions of greenhouse gases are considered significant.
Recommended conditions

The EPA considers that the recommended conditions should include a requirement for the proponent to prepare a management plan to minimise the impacts on Air Quality (Condition 11). The objectives of the condition are to ensure that the proposal is implemented in a manner that minimises emissions and meets recognised air quality criteria.

The EPA considers that if implementation of the future proposals that form part of the Strategic Proposal is accordance with the objectives in Condition 11, then the future proposals can meet the EPA’s objectives for this factor.

The EPA considers it is important that the proposal design, technology and operations ensure greenhouse gas emissions are avoided and minimised. To achieve this, the EPA recommends a condition (Condition 12) that requires proponents to implement a greenhouse gas management plan if the emissions of a future proposal are deemed significant (at the time of being declared a derived proposal). The EPA recommends the condition addresses the following matters:

- benchmarking and design of the proposal
- continuous improvement and minimising net emissions
- monitoring and public reporting
- offsets for greenhouse gas emissions.

The recommended Ministerial statement requires BHP to provide a draft management plan with referral of future proposals demonstrating that these objectives can be met. The EPA expects the draft plan would demonstrate how the suite of measures available under the regional management approach had been used to avoid and minimise impacts to an acceptable level. If the draft plan and other information included with the referral did not demonstrate that the proposal met the EPA’s objectives, then the proposal would be considered separately under s38 of the EP Act.

Summary and draft conditions

The EPA has paid particular attention to the:

(a) EPA Statement of environmental principles, factors and objectives
(b) Environmental factor guideline – Air Quality
(c) Ambient air quality in the Pilbara region, including the naturally high dust levels
(d) Predicted impacts to sensitive receptors
(e) Suite of management measures available to manage dust emissions
(f) Intensity of greenhouse gas emissions
(g) Potential for introducing new greenhouse gas efficiency measures.

The EPA considers, having regard to the relevant EP Act principles and environmental objective for Air Quality, that the impacts on this factor are manageable and would no longer be significant, provided that for derived proposals there is:
• implementation of measures to reduce air emissions through the preparation and implementation of an environmental management plan (Condition 11)
• implementation of a greenhouse gas management plan to avoid, minimise, and, if necessary, offset greenhouse gas emissions (Condition 12).

4.7 Landforms
The EPA’s environmental objective for Landforms is ‘to maintain the variety and integrity of distinctive physical landforms so that environmental values are protected’.

Relevant policy and guidance
The EPA considers that the following current environmental policy and guidance is relevant to its assessment of the proposal for this factor:

• Environmental factor guideline – Landforms (EPA 2016n).

The EPA notes that Landforms was considered an ‘other environmental factor’ and not a key environmental factor at the time the environmental scoping document for the Strategic Proposal was prepared. However, BHP commissioned a consultant to assess the impacts of the Strategic Proposal on landforms in the region, which included the cumulative impacts on landforms.

EPA assessment

Landforms within the project boundary
The project boundary sits within the Hamersley Plateau Zone of the Fortescue Province under the soil and landscape zones of Western Australia (Department of Agriculture and Food 2006). The dominant landform features within this province are rocky hills and stony plains. Rugged hills, ridges, dissected plateau and mountains are found on the basalt, banded iron formation and sandstone of the Hamersley Basin. The most notable of these are the Chichester and Hamersley ranges (Tille 2006). Ophthalmia Range also lies within the project boundary. Sections within the project boundary comprise deeply dissected high ridges and hills. The ridges tend to be dissected by numerous large gorges and gullies. Appendix 8 of the PER document describes the landforms within the project boundary in more detail.

The highest areas of relief occur along the western side of the project boundary. Notable peaks within the project boundary near BHP tenements are Mt Robinson (1158 m), the Governor (1051 m) and Mt Meharry (1250 m) which is the highest point in Western Australia.

Potential impacts of the Strategic Proposal
Potential impacts on landforms arising from the Strategic Proposal include permanent modification of landforms from the construction and operation of mines and associated infrastructure; erosion of landforms as a result of altered surface water regimes; and poor mine closure affecting the stability of surrounding landforms.

BHP has assessed the direct impacts on landscape types and their associated landforms. This assessment focused on the areas that would be directly impacted by third-party operations, as well as by BHP operations. The total extent of impacts on
landform types was quantified. The cumulative impacts on the dominant landform types are shown in Table 11.

**Table 11: Cumulative impacts to landforms within the Project Boundary**

<table>
<thead>
<tr>
<th>Dominant Landform1</th>
<th>Current Extent (% Pre-European) Undisturbed, Including Existing Impacts from BHP Billiton Iron Ore and Third Parties</th>
<th>% Pre-European Extent Impacted (Additional to Existing Impacts)</th>
<th>Combined Additional Impact (%)</th>
<th>Predicted Combined % Pre-European Extent Undisturbed Post-Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hills and Ranges</td>
<td>99.71</td>
<td>0.519</td>
<td>0.112</td>
<td>0.631</td>
</tr>
<tr>
<td>Plateau, Mesas and Breakaways</td>
<td>99.63</td>
<td>0.147</td>
<td>0.039</td>
<td>0.186</td>
</tr>
<tr>
<td>Dissected Plains</td>
<td>99.74</td>
<td>0.626</td>
<td>0.084</td>
<td>0.710</td>
</tr>
<tr>
<td>Stony Plains</td>
<td>99.84</td>
<td>0.625</td>
<td>0.146</td>
<td>0.771</td>
</tr>
<tr>
<td>Sandplains</td>
<td>99.69</td>
<td>0.025</td>
<td>0.055</td>
<td>0.080</td>
</tr>
<tr>
<td>Washplains</td>
<td>99.39</td>
<td>0.593</td>
<td>0.682</td>
<td>1.275</td>
</tr>
<tr>
<td>Alluvial Plains</td>
<td>99.33</td>
<td>0.106</td>
<td>0.550</td>
<td>0.656</td>
</tr>
<tr>
<td>River Plains</td>
<td>99.87</td>
<td>0.174</td>
<td>0.142</td>
<td>0.316</td>
</tr>
<tr>
<td>Calcreted Drainage Plains</td>
<td>99.93</td>
<td>0.307</td>
<td>0.026</td>
<td>0.333</td>
</tr>
</tbody>
</table>

1. Landscape units do not include Stony Gilgai Plains and Salt Lakes as these are not within the Strategic Proposal footprint.

**Significance of impacts**

Percentage impacts on dominant landform types (as shown in Table 11) are small compared with the current extent of these types remaining. More than 98 per cent of the landform types identified in the table would remain under the full development scenario.

In addition, regionally significant areas of high relief (Mt Robinson, The Governor and Mt Meharry) are not within existing BHP tenements or – in the case of Mt Meharry – in Karijini National Park. Mining of these peaks is not expected and the EPA considers that impacts to these peaks are not likely to be considered acceptable in a derived proposal, given they are regionally significant and have social and cultural values as well.

The Mining Area C – Southern Flank PER document (Assessment no. 2085) also notes that impacts to Mt Robinson have been avoided as BHP and the Traditional Owners have agreed that this feature will be an exclusion zone.
Management of impacts to landforms

The EPA’s Environmental factor guideline – Landforms requires the proponent to demonstrate application of the mitigation hierarchy, where possible. For a strategic proposal of this nature, where specific design of future proposals is not yet known, the EPA notes that it is difficult for the proponent to demonstrate that all practicable avoidance and minimisation measures have been taken.

Management of the direct impacts on landforms is principally through avoidance. However, in some locations this is not practical – given that location of the ore bodies is fixed. Management of indirect impacts, particularly during the mine closure planning process, will be required to ensure ongoing impacts on landforms are minimised. It is generally expected that mine closure would result in constructed landforms (principally overburden storage areas) that are safe, stable and non-polluting. BHP recognises this as an objective of its approach to mine closure.

Demonstration that closure and rehabilitation of individual future proposals can be carried out in an ecologically sustainable manner will be required. The EPA has recommended a condition that requires a mine closure plan for future proposals. A draft mine closure plan is expected to be submitted along with the request to ‘declare a proposal a derived proposal’.

Overall significance of impacts once management is implemented

While impacts on landforms would occur as part the Strategic Proposal, these impacts are not considered to threaten the variety and integrity of the landforms in the Pilbara region. The vast majority of landform types within the project boundary are expected to remain intact and regionally significant peaks are also being avoided.

The EPA considers that the Strategic Proposal can be managed to prevent significant environmental impacts, provided conditions are imposed on future proposals to prevent ongoing impacts on landforms from mine closure.

Recommended conditions

To ensure a mine closure plan is prepared, the EPA recommends that the standard mine closure condition that is applied to projects in the Pilbara is used for any ‘proposal declared a derived proposal’ (Condition 15).

Summary and draft conditions

The EPA has paid particular attention to the:

(a) EPA Statement of environmental principles, factors and objectives
(b) Environmental factor guideline – Landforms
(c) Predicted impacts on landforms
(d) Avoidance of impacts on regionally significant peaks
(e) Rehabilitation being required to reduce the significance of the impacts into the future.
The EPA considers, having regard to the relevant EP Act principles and environmental objective for Landforms, that the impacts on this factor are manageable and would no longer be significant, provided that for derived proposals there is implementation of a mine closure plan so that future proposals are rehabilitated in an ecologically appropriate and sustainable manner (Condition 15).

4.8 Terrestrial Environmental Quality

EPA’s environmental objectives

The EPA’s environmental objective for Terrestrial Environmental Quality is: ‘to maintain the quality of land and soils so that environmental values are protected’.

Relevant policy and guidance

The EPA considers that the following current environmental policy and guidance is relevant to its assessment of the proposal for this factor:

- Statement of environmental principles, factors and objectives
- Environmental factor guideline – Terrestrial Environmental Quality (EPA 2016).

The EPA notes that Terrestrial Environmental Quality was not considered a key environmental factor at the time the environmental scoping document was prepared. Therefore, the proponent was not required to carry out detailed modelling or other studies on the potential impacts related to this factor.

Under the EPA’s former guidance framework, the following document is relevant to the assessment of this proposal:

- Cumulative environmental impacts of development in the Pilbara region – advice under Section 16e of the EP Act (EPA 2014).

EPA assessment

The Strategic Proposal project boundary encompasses 7 650 074 ha within the Pilbara. Across the region 102 land systems were identified in 2004, defined by their unique combination of landforms, soils, vegetation and drainage patterns.

This survey categorised these land systems into 20 broad land types. Further to this, 21 soil types were identified in the area surveyed. Most of these soil types present low risks of erosion in their natural state, disregarding land use or management.

The project boundary spans several hundred square kilometres and there are at least 77 of the above land systems therein, comprising 11 land types. These systems are considered to be predominantly intact, with land systems having more than 95 per cent of their pre-European extents remaining in the state (BHP 2016a).

Several iron ore mining and processing activities proposed under the Strategic Proposal have the potential to impact on Terrestrial Environmental Quality of the land systems and soil types identified. The EPA considers that erosion of waste rock landforms and the contamination of lands have the potential for significant impacts.

Issues raised in the environmental factor guideline, particularly salinity and impacts to soil structures from agricultural land use practices, as well as the formation of acid sulfate soils, are not relevant issues to mining projects or occur in different
geographical areas outside of the Strategic Proposal project boundary (e.g. disturbance of coastal mangrove areas causing soil acidification). Therefore, these issues are not considered further in the assessment of the Strategic Proposal.

The EPA’s assessment of the Strategic Proposal will focus on erosion and the contamination of lands for this factor.

Potential impacts

Erosion

The following activities are relevant to erosion:

1. Design and management of overburden storage areas and other landforms, including waste storage areas.
2. Clearing of native vegetation and leaving areas exposed (e.g. gravel roads and laydown areas).

Wind- and water-driven erosion of disturbed land (excluding waste landforms) is not considered a significant issue. Under the suite of water management measures (which is discussed in more detail under the Hydrological Processes and Inland Waters Environmental Quality factors), water erosion and deposition of sediments in disturbed areas is considered a localised issue unique to each mine site. Similarly, wind erosion is a matter dealt with under the suite of air emissions management measures, with specific dust control methodologies proposed for certain activities and disturbed areas.

The only potentially significant erosion issue is that of overburden storage areas and other waste landforms eroding, which if not managed may cause significant environmental impacts on terrestrial land systems and surface and groundwater hydrology (as well as other environmental values support by land systems).

The proponent advises that three common geographical formations have been identified within BHP mine areas, two of which may produce waste susceptible to erosion: that is, waste associated with Marra Mamba geological formations (highly erodible) and waste associated with Brockman formations (significantly less susceptible to erosion than Marra Mamba).

Contamination of land

The following activities may contribute to land contamination:

- active mining and closure of pits where there is a potential for acid metalliferous drainage (AMD)
- design and management of overburden storage areas and other landforms, including waste storage areas, where potential acid forming materials are present
- design and management of tailings storage facilities
- storage and use of hydrocarbons and chemicals.

Storage and use of hydrocarbons and chemicals is itself unlikely to cause significant impacts; nevertheless, such operations are effectively managed by proper storage facilities constructed and operated in accordance with Australian Standards, which
the proponent has committed to in line with practices at its existing operations. In addition, the proponent is required to comply with the provisions of Western Australia’s dangerous goods legislation, which further reduces the potential for significant impacts on the quality of land and soils from hydrocarbons and chemical spills.

As with erosion, risks to terrestrial land systems can mitigated and minimised by proper planning and closure; that is, the closure of mine pits and management of AMD, construction of overburden storage areas and management of potential acid forming materials, and the design, construction and closure of tailings storage facilities (TSFs).

TSFs constructed and managed in accordance with appropriate guidelines and standards are unlikely to significantly impact on the quality of the land and soils within the project boundary. The proponent notes that waste from any beneficication processes will be stored in TSFs but does not refer to particular design standards. The detailed design of TSFs will be need to be developed when the proponent is conducting final project design and mine closure planning for future proposals.

The geological formation with the highest risk of acid generation leading to AMD is the Brockman Formation, with a medium likelihood associated with the Marra Mamba Formation. Management measures will be required to prevent significant impacts from AMD.

Management of impacts

To mitigate and manage the risks of erosion and land contamination, the proponent proposes to implement regional management approach. This approach provides a suite of management measures to ensure erosion and AMD is considered in the design, scheduling and construction of overburden storage areas and other waste landforms.

These are based on BHP’s experience operating across the Pilbara and have proven to be effective in mitigating the impacts of iron ore mines, not just for BHP’s operations but for other proponents as well. For example, BHP operations at Mt Whaleback show how the measures in the suite can be implemented to successfully manage erosion and AMD.

Demonstration that closure and rehabilitation of individual future proposals can be carried out in an ecologically sustainable manner will be required. The EPA has recommended a condition that requires a mine closure plan for future proposals. Such a plan is expected to be submitted along with the request to ‘declare a proposal a derived proposal’.

Further to this, under Part V Environmental Regulation of the EP Act, premises that cause discharges and emissions require licensing. Derived proposals need to obtain all further approvals required under legislation, including under Part V of the EP Act. It is during this process that additional analysis will be undertaken to ensure that any derived proposal uses best-practice and that the proposal minimises emissions as far as practicable.

Overall significance of impacts once management is implemented

The management systems proposed have been successfully implemented across the Pilbara. The EPA considers the proper implementation of the regional
management approach – when implementing a derived proposal – will prevent significant environmental impacts. Matters of rehabilitation and closure are also addressed in the other environmental factors considered in this assessment. These other relevant factors recommend a standard condition for rehabilitation and closure that requires a mine closure plan. Given this, the EPA considers that the Strategic Proposal can be managed to prevent significant environmental impacts provided the mine closure plan condition is applied.

**Recommended conditions**

Activities such as mining, processing and TSF operations are prescribed premises and regulated under Part V of the Act. As such, there is no requirement to recommend a Ministerial condition because conditions can be applied in works approvals and licences that may be issued.

However, to ensure a mine closure plan is prepared and implemented, the EPA recommends that the standard mine closure condition applied to projects in the Pilbara is used for any ‘proposal declared a derived proposal’ (Condition 15).

**Summary and draft conditions**

The EPA has paid particular attention to the:

(a) EPA *Statement of environmental principles, factors and objectives*

(b) *Environmental factor guideline – Terrestrial Environmental Quality*

(c) Regional management approach, and the suite of management measures contained in the relevant management toolkits

(d) Successful application of these management measures across the Pilbara

(e) Rehabilitation being required to reduce the significance of the impacts into the future.

The EPA considers, having regard to the relevant EP Act principles and environmental objective for Terrestrial Environmental Quality, that the impacts to this factor are manageable and would no longer be significant, provided that for derived proposals there is implementation of a mine closure plan so that future proposals are rehabilitated in an ecologically appropriate and sustainable manner (Condition 15).
5. Offsets

5.1 Relevant policy and guidance

The EPA considers that the following policy and guidance is relevant to its assessment of offsets for the proposal:

- WA Environmental Offsets Policy (Government of Western Australia 2011)
- WA Environmental Offsets Guidelines (Government of Western Australia 2014)
- Environmental Impact Assessment (Part IV Divisions 1 and 2) procedures manual (EPA, 2016).

The EPA has also considered its strategic advice on Cumulative environmental impacts of development in the Pilbara region – Advice of the Environmental Protection Authority to the Minister for Environment under Section 16 (e) of the Environmental Protection Act 1986 (EPA 2014) for the assessment of offsets.

EPA assessment

Environmental offsets are actions that provide environmental benefits which counterbalance the significant residual impacts of a proposal. The EPA may apply environmental offsets where it determines that a proposal’s residual impacts are significant, after avoidance, minimisation and rehabilitation have been pursued.

The impacts that will require an offset are generally impacts to species, ecosystems or reserve areas protected by statute or where the cumulative impact is already determined to be at a critical level. These types of impacts identified at the Strategic Proposal stage include:

- Threatened Ecological Communities
- Threatened flora
- habitat for Specially Protected fauna
- areas recognised as having high biodiversity (including Fortescue Marsh).

In addition, there are impacts arising from the Strategic Proposal that may require an offset. These include impacts on PECs, Priority flora and fauna, and important habitat such as riparian vegetation.

In identifying these potential significant residual impacts from the Strategic Proposal, the EPA has considered the residual impact significance model from the WA Environmental Offsets Guidelines (Government of Western Australia 2014). This model identifies that an offset is required where significant impacts are predicted in areas recognised as having high biological value, where the cumulative impact may reach critical levels if not managed, and where impacts on habitat necessary to maintain Threatened species are likely.

Current approach to offsets in the Pilbara

The EPA has recognised that cumulative impacts in the Pilbara have reached significant levels since 2012. As a result, the EPA prepared strategic advice under s16(e) of the EP Act, Cumulative environmental impacts of development in the...
Pilbara region. In this report, the EPA acknowledged that the Pilbara region is a national biodiversity hotspot. It is characterised as an area of very high biodiversity, with high species richness and many endemic flora and fauna species. The EPA also recognised that the Pilbara is an important area for the mining industry. The region is likely to remain the principal area for iron ore mining for the next 50 years, given the size of the iron ore reserves.

The rate, scale and nature of current and future development, combined with the impacts of other threatening processes, is of concern to the EPA. The EPA considers that without intervention, the increasing cumulative impacts of development and land use in the Pilbara region will significantly impact on biodiversity and environmental values (EPA 2014).

The EPA also recognises that the scale and nature of the clearing within the Pilbara has additional consequences. These include loss and fragmentation of fauna habitat, interruption of and changes in overland surface water flows, and reduced vegetation condition and fauna population resilience through mechanisms such as changes in fire regimes and increased feral pests and weeds (Government of Western Australia 2015). There is also limited evidence of successful rehabilitation of mined areas (EPA 2014).

The approach to offsets that is usually implemented in other areas of the state is the acquisition of land with similar environmental values and/or undertaking on-ground management actions, usually within conservation areas. Conservation areas in the Pilbara total about eight per cent of the area, with the remainder mostly crown land overlain with mining tenements and pastoral leases. The opportunity for proponents to implement traditional approaches to offsets, namely land acquisition and management, is therefore limited.

In recognition of these challenges faced in the Pilbara, since 2012 the EPA has been recommending conditions that require significant residual impacts be offset through contributions to a strategic conservation initiative. The initiative is now known as the Pilbara Environmental Offsets Fund and is currently being established by the state government. The fund will address these significant residual impacts through a coordinated approach at the landscape scale.

The EPA recognises that the fund’s establishment is consistent with the principles in the WA Environmental Offsets Policy, which states that environmental offsets will be focused on longer-term strategic outcomes (Principle 6). Strategic approaches, such as use of the fund, will provide a coordinating mechanism to implement offsets across a range of land tenures (Government of Western Australia 2014).

The EPA notes that in establishing and implementing the fund, the state government has committed to ensuring that the offsets implemented through the fund will:

- be relevant and proportionate to the values being impacted (Principle 3)
- use sound knowledge and ensure the offset counterbalances the significant residual impact and delivers long-term environmental benefits (Principle 4)
- be adaptive and evaluated to ensure they achieve the outcomes required (Principle 5).

In its previous assessments, the EPA has considered that the clearing of native vegetation in ‘Good to Excellent’ condition within the Chichester, Hamersley and
Fortescue IBRA subregions constituted a significant residual impact that required an offset. In addition, for some proposals the EPA has also considered that the clearing of foraging habitat for Threatened species, and impacts on PECs and riparian vegetation, also required an offset. Considering the potentially significant residual impacts of the Strategic Proposal, the EPA considers it likely that offsets will be required.

The EPA is also confident that the proposed offset requiring a contribution to the fund will counterbalance the significant residual impacts resulting from the proposal.

The EPA has previously recommended that within the Hamersley, Chichester and Fortescue IBRA subregions, a dollar rate per hectare of clearing should be contributed to the fund. These rates reflect the significance of the environmental values of the vegetation to be cleared and level of cumulative impact within each subregion. The approach to date has been a:

- base rate per hectare for impacts on native vegetation in ‘Good to Excellent’ condition, which includes impacts on fauna habitat
- higher rate per hectare for impacts on other important or specialised environmental values including but not limited to impacts on riparian vegetation, PECs, important vegetation types, and specialised fauna habitat
- a negotiated rate, or alternative approach, determined on a case-by-case basis for impacts that relate to specific Threatened species, or particular land tenure, for instance A-Class Reserves.

At present the EPA considers that when a derived proposal is referred and an offset is required, the fund’s current rates and approach will be applied.

The EPA expects that should it be determined that a significant residual impact exists at the time a derived proposal is declared, the proponent will make a contribution to the fund. The metrics for determining the quantum of offsets should also be consistent with the offsets policy and the endorsed offset metric for the fund at the time the derived proposal is declared. Condition 16 contains a method for quantifying the offset to achieve this requirement.

The EPA is of the view that offsets delivered via the fund should address all significant residual impacts from proposals. Funds should be used for landscape-scale on-ground actions in the Pilbara IBRA region and indirect actions (such as research) that is designed to directly counterbalance significant residual impacts and contribute to long-term biodiversity conservation outcomes in the region.

The EPA’s view is that project funding for offsets should not be used to provide substitute funding for existing government programs or proponent obligations.

**Summary**

The EPA recommends that an offset condition (Condition 16) is imposed to counterbalance the significant residual impacts of future proposals.

The recommended condition requires the fund’s rates to be applied according to the current rates at the time of the impact occurring; that is, in the financial year that clearing was undertaken.
6. Conclusion and recommendations

That the Minister for Environment notes:

1. That the proposal assessed is a Strategic Proposal which identifies future iron ore mining and associated mining infrastructure developments in the Pilbara by BHP Billiton Iron Ore Pty Ltd.

2. The key environmental factors identified by the EPA in the course of its assessment are Flora and Vegetation; Terrestrial Fauna; Subterranean Fauna; Hydrological Processes and Inland Waters Environmental Quality; Social Surroundings; Air Quality; Landforms; and Terrestrial Environmental Quality—each of which is set out in Section 4.

3. The EPA recommends that:
   a) the future proposals identified in the strategic proposal, as detailed in section 2 of this Report, may be implemented; and
   b) the implementation of the future proposals should be subject to the applicable\(^3\) conditions and procedures set out in Appendix 3, so as to ensure the future proposals meet the environmental objectives discussed in this Report.

4. The EPA have concluded that the environmental objectives for the key environmental factors identified in this Report are likely to be achieved provided the recommended conditions and procedures set out in Appendix 3 are imposed and complied with in the implementation of the relevant future proposal.

5. That guidance is also provided by the EPA, in the draft Ministerial Statement, to ensure the proponent is aware of the EPA’s expectation that draft environmental management plans and a report on rehabilitation success in the Pilbara are included with any request to declare a derived proposal.

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\(^3\) Section 45A(3) of the Environmental Protection Act 1986 provides that if the implementation agreement or decision previously made in relation to future proposals, declared a derived proposal, includes implementation conditions relating generally to two or more future proposals, the Minister may, in a notice under subsection 45A(2), specify which of those implementation conditions apply to the derived proposal.
Appendix 1

List of submitters
Organisations:

Care for Hedland
Department of Aboriginal Affairs
Department of Mines and Petroleum
Department of Parks and Wildlife
Department of Water
Town of Port Hedland
Wildflower Society of Western Australia (Inc)

Individuals:

Firetail Consulting
Frank Batini
Colin Fairclough
Appendix 2

Consideration of principles
<table>
<thead>
<tr>
<th>EP Act Principle</th>
<th>Consideration</th>
</tr>
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<tbody>
<tr>
<td><strong>1. The precautionary principle</strong>&lt;br&gt;Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.&lt;br&gt;In application of this precautionary principle, decisions should be guided by –&lt;br&gt;a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and&lt;br&gt;b) an assessment of the risk-weighted consequences of various options.</td>
<td>In considering this principle, the EPA notes Flora and Vegetation, Terrestrial Fauna, Subterranean Fauna, Hydrological Processes and Inland Waters Environmental Quality, Social Surroundings, Air Quality, Landforms and Terrestrial Environmental Quality could be significantly impacted by the proposal. The assessment of these impacts is provided in this report.&lt;br&gt;Investigations into the biological and physical environmental that have been undertaken by the proponent have provided sufficient certainty to assess risks and identify measures to avoid or minimise impacts. The EPA has recommended conditions (including preparation and implementation of management plans) to ensure relevant measures are undertaken by the proponent for future proposals identified in the Strategic Proposal.</td>
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<tr>
<td><strong>2. The principle of intergenerational equity</strong>&lt;br&gt;The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</td>
<td>This principle is a relevant consideration for the EPA when assessing and considering the impacts of the proposal on the environmental factors of Flora and Vegetation, Terrestrial Fauna, Subterranean Fauna, Hydrological Processes and Inland Waters Environmental Quality, Social Surroundings, Air Quality, Landforms and Terrestrial Environmental Quality.&lt;br&gt;The EPA notes that the proponent has identified measures to avoid or minimise impacts. The EPA has considered these measures during its assessment.&lt;br&gt;In assessing this proposal the EPA has recommended adaptive management mechanisms (through conditions</td>
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<td><strong>3. The principle of the conservation of biological diversity and ecological integrity</strong></td>
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<tr>
<td>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</td>
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<tr>
<td>This principle is a relevant consideration for the EPA when assessing and considering the impacts of the proposal on the environmental factors of Flora and Vegetation, Terrestrial Fauna, Subterranean Fauna, Hydrological Processes and Inland Waters Environmental Quality, Landforms and Terrestrial Environmental Quality.</td>
<td></td>
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<tr>
<td>The EPA identified impacts that may affect biological diversity and ecological integrity, as future proposals may impact on conservation significant flora, ecological communities and fauna.</td>
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<tr>
<td>The EPA notes that the proponent has identified measures to avoid or minimise these impacts. The EPA has considered these measures during its assessment and where appropriate, recommended conditions to ensure compliance with these measures.</td>
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<tr>
<td>The EPA also notes that future proposals are required to meet the requirements of section 39B of the EP Act in order to be declared a derived proposal.</td>
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<tr>
<td>The EPA has also considered to what extent the potential impacts from the proposal can be ameliorated by recommended conditions, including offsets. The EPA has concluded that given the nature of the impacts that offsets are likely to be required to ameliorate the impacts of the loss of biological diversity and ecological integrity.</td>
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### 4. Principles relating to improved valuation, pricing and incentive mechanisms

1. *Environmental factors should be included in the valuation of assets and services.*

2. *The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.*

3. *The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.*

4. *Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimize costs to develop their own solution and responses to environmental problems.*

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In considering this principle, the EPA notes that the proponent would bear the cost relating to waste and pollution, including avoidance, containment and rehabilitation. The EPA has had regard to this principle during the assessment of the strategic proposal.

### 5. The principle of waste minimisation

All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.

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In considering this principle, the EPA notes that the proponent proposes to backfill mine voids; use managed aquifer recharge preferentially over surface water discharge of excess water; and apply the waste management hierarchy (i.e. avoid, reduce, reuse, recycle, recover, treat, contain and dispose) to future proposals identified in the Strategic Proposal.

The EPA has had regard to this principle during the assessment of the Strategic Proposal.
Appendix 3

Identified decision-making authorities and recommended environmental conditions
Identified decision-making authorities

Section 44(2) of EP Act specifies that the EPA’s report must set out (if it recommends that implementation be allowed) the conditions and procedures, if any, to which implementation should be subject. This Appendix contains the EPA’s recommended conditions and procedures.

Section 45(1) requires the Minister for Environment to consult with decision-making authorities (DMAs), and if possible, agree on whether or not the proposal may be implemented, and if so, to what conditions and procedures, if any, that implementation should be subject.

The following decision-making authorities have been identified:

<table>
<thead>
<tr>
<th>Decision-making authority</th>
<th>Legislation (and Approval)</th>
</tr>
</thead>
</table>
| 1. Minister for Environment | *Wildlife Conservation Act 1950*  
(Taking of flora and fauna) |
| 2. Minister for Water      | *Rights in Water and Irrigation Act 1914*  
(Water abstraction licence) |
| 3. Minister for Aboriginal Affairs | *Aboriginal Heritage Act 1972*  
(Section 18 clearances) |
| 5. Minister for State Development | *Iron Ore (Goldsworthy-Nimingarra) Agreement Act 1972*  
*Iron Ore (Marillana Creek) Agreement Act 1991*  
*Iron Ore (McCamey's Monster) Agreement Authorisation Act 1972*  
*Iron Ore (Mount Goldsworthy) Agreement Act 1964*  
*Iron Ore (Mount Newman) Agreement Act 1964* |
| 6. Department of Water and Environmental Regulation | *Environmental Protection Act 1986*  
(Clearing of Native Vegetation Regulations)  
(Part V Works Approval and Licence) |
| 7. Department of Health    | *Health Act 1911* |
| 8. Department of Mines, Industry Regulation and Safety | *Mining Act 1978*  
(Mining proposal) |
|                             | Mining Act 1978  
|                             | (Miscellaneous licences) |
|                             | Mines Safety and Inspection Act 1995  
|                             | (Mine safety) |
|                             | Dangerous Goods Safety Act 2004  
|                             | (Dangerous goods) |
|                             | Health Act 1911 |
| 10. Shire of Ashburton      | Building Act 2011 |
|                             | Health Act 1911 |

Note: In this instance, agreement is only required with DMAs 1, 2, 3, 4 and 5 since these DMAs are Ministers.
STATEMENT THAT A FUTURE PROPOSAL(S) IDENTIFIED IN A STRATEGIC PROPOSAL MAY BE IMPLEMENTED

(Sections 40B and 45 of the Environmental Protection Act 1986)

PILBARA EXPANSION STRATEGIC PROPOSAL

Strategic Proposal: To construct and operate the iron ore mine developments, listed and described in Table 2 of Schedule 1 and represented in Figures 1 and 2 of Schedule 1.

Proponent: BHP Billiton Iron Ore Pty. Ltd.

Proponent Address: 125 St Georges Terrace
Perth Western Australia 6000

Australian Company Number 008 700 981

Assessment Number: 1934

Report of the Environmental Protection Authority: 1619

Pursuant to sections 40B and 45 of the Environmental Protection Act 1986 (the Act), it has been agreed that in the event of a declaration by the Environmental Protection Authority pursuant to section 39B of the Act that it is a derived proposal, a proposal to do one or more of the Developments (including the Associated Activities and Operations) listed in Column 1 within the location described in Column 2 and subject to the limitations and extent detailed in Column 3 of Table 2 in Schedule 1 of this Statement, and which was identified in the Strategic Proposal to which Report 1619 relates, may be implemented.

Upon declaration that the proposal is a derived proposal, subject to the Minister for Environment's identification of relevant conditions under section 45A(3) of the Act, the implementation of the proposal shall be subject to the following implementation conditions and procedures.

The Strategic Proposal or any future proposal does not include and this Statement does not authorise any developments, activities or operations within any existing national park, including the Karijini National Park.
1 Derived Proposals

1-1 Proposals referred to the EPA and declared to be derived proposals containing one or more of the Developments (including the Associated Activities and Operations) listed in Column 1 of Table 2, within the location described in Column 2 shall not exceed the Description of Limits or Extent, relevant to the Developments provided for in Column 3 of Table 2.

2 Contact Details

2-1 The proponent shall notify the CEO of any change of its name, physical address or postal address for the serving of notices or other correspondence within twenty eight (28) days of such change. Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.

3 Time Limit for Substantial Commencement

3-1 If the proposal is not substantially commenced within 5 years from the date of issue of the Section 45A Notice, the proposal may not be implemented.

3-2 If the proposal is substantially commenced in accordance with condition 3-1, the proponent must provide to the CEO documentary evidence demonstrating that they have complied with condition 3-1 no later than thirty (30) days after the expiration of five (5) years from the date of issue of the Section 45A Notice.

4 Compliance Reporting

4-1 The proponent shall prepare, and maintain a Compliance Assessment Plan which is submitted to the CEO at least six (6) months prior to the first Compliance Assessment Report required by condition 4-6, or prior to implementation of the proposal, whichever is sooner.

4-2 The Compliance Assessment Plan shall indicate:

(1) the frequency of compliance reporting;
(2) the approach and timing of compliance assessments;
(3) the retention of records concerning compliance assessments;
(4) the method of reporting of potential non-compliances and corrective actions taken;
(5) the table of contents of Compliance Assessment Reports; and
(6) public availability of Compliance Assessment Reports.

4-3 After receiving notice in writing from the CEO that the Compliance Assessment Plan satisfies the requirements of condition 4-2 the proponent shall assess
compliance with conditions in accordance with the Compliance Assessment Plan required by condition 4-1.

4-4 The proponent shall retain reports of all compliance assessments described in the Compliance Assessment Plan required by condition 4-1 and shall make those reports available when requested by the CEO.

4-5 The proponent shall advise the CEO in writing of any potential non-compliance including exceedance of threshold criteria and/or failure to implement management actions in an Environmental Management Plan within seven (7) days of that potential non-compliance being known.

4-6 The proponent shall submit to the CEO a Compliance Assessment Report annually by 1 October each year addressing compliance in the previous financial year, or as otherwise agreed in writing by the CEO.

4-7 The Compliance Assessment Report shall:

(1) be endorsed by the proponent’s CEO or a person delegated to sign on the CEO’s behalf;

(2) include a statement as to whether the proponent has complied with the conditions;

(3) identify all potential non-compliances and describe corrective and preventative actions taken;

(4) be made publicly available in accordance with the approved Compliance Assessment Plan; and

(5) indicate any proposed changes to the Compliance Assessment Plan required by condition 4-1.

4-8 The proponent:

(1) may review and revise the Compliance Assessment Plan, or

(2) shall review and revise the Compliance Assessment Plan as and when directed by the CEO.

4-9 The proponent shall implement the latest revision of the Compliance Assessment Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 4-2.

5 Public Availability of Data

5-1 Subject to condition 5-2, within a reasonable time period approved by the CEO after the issue of the Section 45A Notice and for the remainder of the life of the proposal the proponent shall make publicly available, in a manner approved by
the CEO, all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products (e.g. maps)) relevant to the assessment of the strategic proposal and implementation of this proposal.

5-2 If any data referred to in condition 5-1 contains particulars of:

(1) a secret formula or process; or

(2) confidential commercially sensitive information;

the proponent may submit a request for approval from the CEO to not make these data publicly available. In making such a request the proponent shall provide the CEO with an explanation and reasons why the data should not be made publicly available.

6 Condition Environmental Management Plans

6-1 The proponent shall prepare and submit Condition Environmental Management Plans:

(1) prior to ground disturbing activities, and within six (6) months from the date of issue of the Section 45A Notice or as otherwise agreed in writing by the CEO, to demonstrate that the environmental objectives specified in the conditions referred to in the Section 45A Notice for the proposal will be met.

6-2 The Condition Environmental Management Plan(s) shall:

(1) specify environmental outcomes that achieve the environmental objectives, specified in the relevant conditions referred to in the Section 45A Notice for the proposal;

(2) specify trigger criteria that will provide early warning for the implementation of trigger level actions if exceeded;

(3) specify threshold criteria that provides a limit beyond which the environmental outcome is not achieved;

(4) specify monitoring to determine if trigger criteria and threshold criteria are exceeded;

(5) specify trigger level actions to be implemented in the event that trigger criteria have been exceeded;

(6) specify threshold contingency actions to be implemented in the event that threshold criteria are exceeded;

(7) provide the format and timing for the reporting of monitoring results against trigger criteria and threshold criteria to demonstrate that the
relevant conditions referred to in the Section 45A Notice for the proposal have been met over the reporting period in the Compliance Assessment Report required by condition 4-6; and

(8) provide for reporting of exceedances of the trigger and threshold criteria.

Or where it is not possible to specify environmental outcomes for the proposal:

(9) specify the environmental objectives to be achieved, as specified in the relevant conditions referred to in the Section 45A Notice for the proposal;

(10) specify risk-based management actions that will be implemented to demonstrate compliance with the environmental objectives specified in the relevant conditions referred to in the Section 45A Notice for the proposal;

(11) specify measurable management target(s) to determine the effectiveness of the risk-based management actions;

(12) specify monitoring to measure the effectiveness of management actions against management targets, including but not limited to, parameters to be measured, baseline data, monitoring locations, and frequency and timing of monitoring;

(13) specify a process for revision of management actions and changes to proposal activities, in the event that the management targets are not achieved. The process shall include an investigation to determine the cause of the management target(s) not being achieved;

(14) provide the format and timing to demonstrate that the relevant conditions referred to in the Section 45A Notice for the proposal have been met for the reporting period in the Compliance Assessment Report required by condition 4-6 including, but not limited to:

(a) verification of the implementation of management actions; and

(b) reporting on the effectiveness of management actions against management target(s).

6-3 The failure to implement one or more management actions, the exceedance of a threshold criteria (regardless of whether threshold contingency actions have been or are being implemented in accordance with 6-7(2)), and/or comply with the requirements of a Condition Environmental Management Plan(s) represents non-compliance with these conditions.
6-4 After receiving notice in writing from the CEO that the Condition Environmental Management Plan(s) satisfies the requirements of relevant conditions referred to in the Section 45A Notice for the proposal, the proponent shall:

(1) implement the provisions of the Condition Environmental Management Plan(s); and

(2) continue to implement the Condition Environmental Management Plan(s) until the CEO has confirmed by notice in writing that the proponent has demonstrated the objectives specified in the relevant conditions referred to in the Section 45A Notice for the proposal have been met.

6-5 If monitoring, tests, surveys or investigations indicate non-achievement of management target(s) specified in a Condition Environmental Management Plan(s), the proponent shall:

(1) report the non-achievement in writing to the CEO within twenty one (21) days of the non-achievement being identified;

(2) investigate to determine the cause of the management target(s) not being achieved;

(3) provide a report to the CEO within ninety (90) days of the non-achievement being reported as required by condition 6-5(1). The report shall include:

(a) the cause(s) of the management targets not being achieved;

(b) the findings of the investigation required by condition 6-5(2);

(c) details of revised and/or additional management actions to be implemented to prevent non-achievement of the management target(s); and

(d) relevant changes to proposal activities.

6-6 If monitoring, tests, surveys or investigations indicate that one or more management actions specified in a Condition Environmental Management Plan(s) has not been implemented, the proponent shall:

(1) report the failure to implement the management action(s) in writing to the CEO within seven (7) days of identification;

(2) investigate to determine the cause of the management action(s) not being implemented;

(3) investigate to determine the potential environmental harm or alteration of the environment that occurred due to the failure to implement the management action(s);
(4) provide a report to the CEO within twenty one (21) days of the reporting required by condition 6-6(1). The report shall include:

(a) the cause of the failure to implement the management actions;

(b) the findings of the investigations required by conditions 6-6(2) and 6-6(3);

(c) relevant changes to proposal activities; and

(d) measures to prevent, control or abate the environmental harm which may have occurred.

6-7 In the event that monitoring, tests, surveys or investigations indicates exceedance of trigger criteria and/or threshold criteria specified in a Condition Environmental Management Plan(s), the proponent shall:

(1) report the exceedance in writing to the CEO within seven (7) days of the exceedance being identified;

(2) immediately implement the trigger level actions and/or threshold contingency actions specified in the Condition Environmental Management Plan(s) and continue implementation of those actions until the trigger criteria and/or threshold criteria are being met and implementation of the trigger level actions and/or threshold contingency actions are no longer required;

(3) investigate to determine the cause of the trigger criteria and/or threshold criteria being exceeded;

(4) identify additional measures required to prevent the trigger criteria and/or threshold criteria being exceeded in the future;

(5) investigate to determine potential environmental harm or alteration of the environment that occurred due to threshold criteria being exceeded; and

(6) provide a report to the CEO within ninety (90) days of the exceedance being reported. The report shall include:

(a) details of any trigger level actions or threshold contingency actions implemented;

(b) the effectiveness of the trigger level actions or threshold contingency actions implemented, monitored and measured against trigger criteria and threshold criteria;

(c) the findings of the investigations required by condition 6-7(3) and 6-7(5);
(d) additional measures to prevent the trigger or threshold criteria being exceeded in the future; and

(e) measures to prevent, control or abate the environmental harm or alteration of the environment which may have occurred.

6-8 The proponent:

(1) may review and revise the Condition Environmental Management Plan(s), or

(2) shall review and revise the Condition Environmental Management Plan(s) as and when directed by the CEO.

6-9 The proponent shall implement the latest revision of the Condition Environmental Management Plan(s), which the CEO has confirmed by notice in writing, satisfies the requirements of condition 6-3.

7 **Flora and Vegetation Environmental Management Plan**

7-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) protect flora and vegetation so that biological diversity and ecological integrity are maintained, and in particular:

  (a) maintain the local and regional populations of flora taxa declared as threatened flora under the relevant legislation.

  (b) avoid and minimise direct and indirect impacts on flora taxa that is specially protected under the relevant legislation.

  (c) avoid and minimise direct and indirect impacts on flora taxa listed as priority flora.

  (d) avoid and minimise direct and indirect impacts on the occurrences of threatened and priority ecological communities, and their habitat.

7-2 The proponent shall prepare a Flora and Vegetation Management Plan required by condition 6-1 that satisfies the requirements of condition 6-2, to meet the objectives specified in condition 7-1, in consultation with the agency responsible for administration of the *Wildlife Conservation Act 1950* and the *Biodiversity Conservation Act 2016*.

7-3 The Flora and Vegetation Management Plan required by condition 6-1 shall include provisions required by condition 6-2 to address impacts on conservation significant flora and vegetation, where relevant, including from, but not limited
to: changes to groundwater levels and groundwater quality; changes to surface water flows and quality; dust; fire regimes, and weeds.

7-4 The proponent shall continue to implement the version of the Flora and Vegetation Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition 6-1 satisfies the requirements of condition 6-2 to meet the objectives specified in condition 7-1.

8 Terrestrial Fauna Environmental Management Plan

8-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) protect terrestrial fauna so that biological diversity and ecological integrity are maintained, and in particular:

(a) maintain the local and regional populations of terrestrial fauna taxa that are listed as threatened or specially protected under the relevant legislation.

(b) avoid and minimise direct and indirect impacts on the habitat of terrestrial fauna that is specially protected under the relevant legislation.

(c) avoid and minimise direct and indirect impacts on terrestrial fauna listed as priority fauna, and its habitat.

(d) avoid and minimise direct and indirect impacts on conservation significant short-range endemic fauna.

8-2 The proponent shall prepare a Terrestrial Fauna Management Plan required by condition 6-1 that satisfies the requirements of condition 6-2, to meet the objectives specified in condition 8-1, in consultation with the agency responsible for administration of the *Wildlife Conservation Act 1950* and the *Biodiversity Conservation Act 2016*.

8-3 The Terrestrial Fauna Management Plan required by condition 6-1 shall include provisions required by condition 6-2 to address impacts on conservation significant fauna, where relevant, including from, but not limited to: loss of habitat, changes to surface water regimes; risk of vehicle strikes; changes to fire regimes; emissions of dust, light and noise; and impacts from feral animals.

8-4 The proponent shall continue to implement the version of the Terrestrial Fauna Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition 6-1 satisfies
the requirements of condition 6-2 to meet the objectives specified in condition 8-1.

9 Subterranean Fauna Environmental Management Plan

9-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) protect subterranean fauna so that biological diversity and ecological integrity are maintained, and in particular:

(a) maintain the local population of subterranean fauna taxa which are known to have a restricted distribution.

(b) maintain the local and regional populations of subterranean fauna that is specially protected under the relevant legislation.

(c) avoid and minimise direct and indirect impacts on the habitat of subterranean fauna that is specially protected under the relevant legislation.

(d) avoid and minimise direct and indirect impacts on the occurrences of threatened and priority ecological communities, and their habitat, which are recognised as having conservation significant subterranean fauna values, including, but not limited to:

(i) Ethel Gorge aquifer stygobiont community Threatened Ecological Community.

9-2 The proponent shall prepare a Subterranean Fauna Management Plan required by condition 6-1 that satisfies the requirements of condition 6-2, to meet the objectives specified in condition 9-1, in consultation with the agency responsible for administration of the *Wildlife Conservation Act 1950* and the *Biodiversity Conservation Act 2016*.

9-3 The Subterranean Fauna Management Plan required by condition 6-1 shall include provisions required by condition 6-2 to address impacts on conservation significant subterranean fauna, where relevant, including from, but not limited to: changes to groundwater levels and groundwater quality; ground disturbance.

9-4 The proponent shall continue to implement the version of the Subterranean Fauna Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition 6-1 satisfies the requirements of condition 6-2 to meet the objectives specified in condition 9-1.
10 Water Environmental Management Plan

10-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) Maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected, including where relevant avoiding and minimising direct and indirect impacts of the proposal, on:

(a) Fortescue Marsh;
(b) hydrological regimes that support threatened and priority ecological communities;
(c) Proclaimed Public Drinking Water Source Areas;
(d) permanent and ephemeral rock pools;
(e) wetlands which are Ramsar listed, or listed in the Directory of Important Wetlands in Australia;
(f) Wild Rivers;
(g) wetland types which may be poorly represented;
(h) natural springs and permanent and ephemeral rock pools;
(i) ecosystems which support conservation significant flora/vegetation and fauna species or communities, including migratory waterbirds, bats, groundwater dependent biota and subterranean fauna; and
(j) ecosystems which support significant amenity, recreation and cultural values.

10-2 The proponent shall prepare a Water Management Plan required by condition 6-1 that satisfies the requirements of condition 6-2, to meet the objectives specified in condition 10-1, in consultation with the agency responsible for administration of the Wildlife Conservation Act 1950 and the Biodiversity Conservation Act 2016.

10-3 The Water Management Plan required by condition 6-1 shall include provisions required by condition 6-2 to address impacts on hydrological regimes and water quality, where relevant, including from, but not limited to: water abstraction; managed aquifer recharge; disposal of mine dewater to surface water systems; diversion of surface water systems; discharge of wastes to storage or
evaporative basins and dewatering of aquifers and exposure of acid sulfate soils or the creation of acid rock drainage.

10-4 The proponent shall continue to implement the version of the Water Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition 6-1 satisfies the requirements of condition 6-2 to meet the objectives specified in condition 10-1.

11 Air Quality Environmental Management Plan

11-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) Maintain air quality and minimise emissions so that environmental values are protected, and in particular:

(a) meet recognised air quality standards and criteria, including:

(i) National Environment Protection (Ambient Air Quality) Measure for carbon monoxide, nitrogen dioxide, ozone, Sulphur dioxide, lead, particles as PM$_{10}$ and PM$_{2.5}$; or

(ii) Other guidelines on a proposal specific basis as determined by the CEO.

11-2 The proponent shall prepare an Air Quality Management Plan required by condition 6-1 that satisfies the requirements of condition 6-2, to meet the objectives specified in condition 11-1.

11-3 The Air Quality Management Plan required by condition 6-1 shall include provisions required by condition 6-2 to address impacts on air quality, where relevant, including from, but not limited to: dust emissions due to clearing of vegetation; emissions from power plants; mining (including blasting), handling, stockpiling and transport of iron ore; and crushing and screening of materials.

11-4 The proponent shall continue to implement the version of the Air Quality Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition 6-1 satisfies the requirements of condition 6-2 to meet the objectives specified in condition 11-1.

12 Greenhouse Gas Management Plan

12-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) avoid, where possible, and minimise greenhouse gas emissions as far as practicable.
12-2 The proponent shall prepare a Greenhouse Gas Management Plan required by condition 6-1 that satisfies the requirements of condition 6-2, to meet the objective required by condition 12-1.

12-3 The Greenhouse Gas Management Plan required by condition 6-1 shall include provisions required by condition 6-2 to address the following matters:

(1) benchmarking and design of the proposal;

(2) monitoring and public reporting;

(3) continuous improvement and minimising net emissions; and

(4) offsets for greenhouse gas emissions.

12-4 The proponent shall continue to implement the version of the Greenhouse Gas Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition 6-1 satisfies the requirements of condition 6-2 to meet the objectives specified in condition 12-1.

13 Cultural Heritage Management Plan

13-1 The proponent shall prepare and submit, within six (6) months from the date of issue of the Section 45A Notice or as otherwise agreed in writing by the CEO, a Cultural Heritage Management Plan to meet the following environmental objective:

(1) manage the proposal to minimise the impacts on Aboriginal heritage and culture.

13-2 The Heritage Management Plan required by condition 13-1 shall address impacts on Aboriginal heritage and culture, where relevant, including from, but not limited to: disturbance of the ground that may impact cultural associations and heritage; potential loss of access to areas to undertake traditional activities; and changes to water regimes of water resources known to have Aboriginal heritage value.

13-3 After receiving notice in writing from the CEO that the Cultural Heritage Management Plan satisfies the requirements of condition 13(2), the proponent shall:

(1) implement the provisions of the Cultural Heritage Management Plan; and

(2) continue to implement the Cultural Heritage Management Plan(s) until the CEO has confirmed by notice in writing that the proponent has demonstrated the objectives in condition 13-1 have been met.
13-4 The proponent:

(1) may review and revise the Cultural Heritage Management Plan, or

(2) shall review and revise the Cultural Heritage Management Plan as and when directed by the CEO.

13-5 The proponent shall implement the version of the Cultural Heritage Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition 13-1 satisfies the requirements of condition 13-2 to meet the objectives specified in condition 13-1.

14 Conservation Reserve Impact Avoidance Plan

14-1 The proponent shall prepare and submit, within six (6) months from the date of issue of the Section 45A Notice or as otherwise agreed in writing by the CEO, a Conservation Reserve Impact Avoidance Plan to meet the following environmental objectives:

(1) avoid direct impacts on public reserve lands to which the Conservation and Land Management Act 1984 (or any subsequent Act with similar objectives to that Act) applies and their associated public values and uses.

(2) avoid, where possible, and minimise indirect impacts as far as practicable on public reserve lands to which the Conservation and Land Management Act 1984 (or any subsequent Act with similar objectives to that Act) applies and their associated public values and uses.

14-2 The Conservation Reserve Impact Avoidance Plan required by condition 14-1 shall address impacts on flora, fauna, heritage and where applicable to the type of reserve, public use and amenity, including from, but not limited to: changes to groundwater levels and groundwater quality; surface water regimes and quality; dust emissions; altered fire regimes; and weed introduction and spread.

14-3 After receiving notice in writing from the CEO that the Conservation Reserve Impact Avoidance Plan satisfies the requirements of condition 14-2, the proponent shall:

(1) implement the provisions of the Conservation Reserve Impact Avoidance Plan; and

(2) continue to implement the Conservation Reserve Impact Avoidance Plan until the CEO has confirmed by notice in writing that the proponent has demonstrated the objectives in condition 14-1 have been met.

14-4 The proponent:
(1) may review and revise the Conservation Reserve Impact Avoidance Plan, or

(2) shall review and revise the Conservation Reserve Impact Avoidance Plan as and when directed by the CEO.

14-5 The proponent shall implement the version of the Conservation Reserve Impact Avoidance Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition 14-1 satisfies the requirements of condition 14-2 to meet the objectives specified in condition 14-1.

15 Rehabilitation and decommissioning

15-1 The proponent shall manage the implementation of the proposal to meet the following environmental objective:

(1) ensure that the proposal is decommissioned and the site of the proposal rehabilitated to be safe, stable and non-polluting and in an ecologically appropriate and sustainable manner.

15-2 Within six (6) months from the date of issue of the Section 45A Notice or as otherwise agreed in writing by the CEO, the proponent shall prepare and submit a Mine Closure Plan in accordance with the Guidelines for Preparing Mine Closure Plans, May 2015 (or any subsequent revisions of the guidelines), on advice of the Department of Mines, Industry Regulation and Safety and the Department of Biodiversity, Conservation and Attractions.

15-3 The plan required by condition 15-2 shall include provisions to address the following:

(1) specify the environmental objectives to be achieved, as specified in condition 15-1;

(2) specify the management actions that will be implemented to demonstrate compliance with the environmental objectives specified in condition 15-1. Failure to implement one or more of these management actions represents non-compliance with these conditions;

(3) the provisions required by conditions 6-2(11) to 6-2(13); and

(4) demonstrate the validity of assumptions used in the Mine Closure Plan and consideration of the effects of breakdown of those assumptions.

15-4 If monitoring, tests, surveys or investigations indicate non-achievement of management target(s) specified in the Mine Closure Plan, the proponent shall:
(1) report the non-achievement in writing to the CEO within twenty one (21) days of the non-achievement being identified;

(2) investigate to determine the cause of the management targets not being achieved;

(3) provide a report to the CEO within ninety (90) days of the non-achievement being reported as required by condition 15-4(1). The report shall include:

(a) cause of management targets not being achieved;

(b) the findings of the investigation required by condition 15-4(2);

(c) details of revised and/or additional management actions to be implemented to prevent non-achievement of the management target(s); and

(d) relevant changes to proposal activities.

15-5 In the event that monitoring, tests, surveys or investigations indicate that one or more management actions specified in the Mine Closure Plan have not been implemented, the proponent shall:

(1) report the failure to implement management action/s in writing to the CEO within seven (7) days of identification;

(2) investigate to determine the cause of the management action(s) not being implemented;

(3) investigate to provide information for the CEO to determine potential environmental harm or alteration of the environment that occurred due to the failure to implement management actions;

(4) provide a report to the CEO within twenty one (21) days of the reporting required by condition 15-5(1). The report shall include:

(a) cause for failure to implement management actions;

(b) the findings of the investigation required by conditions 15-5(2) and 15-5(3);

(c) relevant changes to proposal activities; and

(d) measures to prevent, control or abate the environmental harm which may have occurred.

15-6 The proponent shall review and revise the Mine Closure Plan required by condition 15 at intervals not exceeding three (3) years, or as otherwise specified by the CEO, and submit the plan to the CEO at the agreed interval.
15-7 The proponent shall continue to implement the version of the Mine Closure Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 15-2, to meet the objectives of condition 15-1.

16 Offsets

16-1 In view of the significant residual impacts as a result of the implementation of the proposal identified in condition 16-2, the proponent shall contribute funds to the Pilbara Environmental Offsets Fund.

16-2 The significant residual impacts are:

1. clearing of ‘Good’ to ‘Excellent’ condition native vegetation, including habitat for threatened fauna species, within the Hamersley and/or Chichester IBRA subregion.

2. clearing of native vegetation referred to in condition 16-2(1) which has other important or specialised environmental values within the Hamersley and/or Chichester IBRA subregion.

3. clearing of ‘Good’ to ‘Excellent’ condition native vegetation, including habitat for threatened fauna species, within the Fortescue IBRA subregion.

4. clearing of native vegetation referred to in condition 16-2(3) which has other important or specialised environmental values within the Fortescue IBRA subregion.

16-3 The proponent shall contribute funds to the Pilbara Environmental Offsets Fund calculated pursuant to conditions 16-4 and 16-5, subject to any reduction approved by the CEO under condition 16-11.

16-4 The proponent’s contribution to the Pilbara Environmental Offsets Fund shall be paid biennially, with the amount to be contributed calculated based on the clearing undertaken in each year of the biennial reporting period in accordance with the following calculation:

\[ C = R \times H \]

Where:

- \( C \) = the contribution to the fund for clearing done in the relevant year
- \( R \) = contribution rate for the year in which the clearing is undertaken as published for the Pilbara Environmental Offsets Fund by the CEO for each significant residual impact identified in condition 16-2.
- \( H \) = number of hectares of land cleared in the relevant year for each significant residual impact referred to in condition 16-2.
16-5 The first biennial reporting period shall commence at the beginning of the financial year that ground disturbing activities causing one or more of the significant residual impacts identified in condition 16-2 are undertaken.

16-6 Prior to ground disturbing activities, the proponent shall prepare and submit an Impact Reconciliation Procedure to the CEO.

16-7 The Impact Reconciliation Procedure required pursuant to condition 16-6 shall:

(1) state that clearing calculations for each biennial reporting period will commence on 1 July of the required reporting period, unless otherwise agreed by the CEO;

(2) include a methodology to calculate the amount of clearing undertaken during each year of the biennial reporting period for each of the significant residual impacts identified in condition 16-2; and

(3) indicate the timing and content of the Impact Reconciliation Reports.

16-8 The proponent shall not commence ground disturbing activities, unless otherwise agreed by the CEO, until the CEO has confirmed in writing that the Impact Reconciliation Procedure satisfies the requirements of condition 16-7.

16-9 The proponent shall submit Impact Reconciliation Reports in accordance with the Impact Reconciliation Procedure approved in condition 16-8.

16-10 The Impact Reconciliation Reports required pursuant to condition 16-9 shall provide the location and spatial extent of the clearing undertaken within each biennial reporting period.

16-11 The proponent may seek the written approval of the CEO to reduce all or part of the contribution payable under condition 16-4 where:

(1) a payment has been made to satisfy a condition of an approval under the *Environment Protection and Biodiversity Conservation Act 1999* in relation to the proposal;

(2) the payment counterbalances impacts of the proposal on matters of national environmental significance; and

(3) the payment counterbalances the significant residual impacts to the environmental values identified in condition 16-2.
Guidelines for submitting a derived proposal

When submitting a request to the EPA to declare a referred proposal to be a derived proposal the proponent must comply with the following:

1. a request to declare a referred proposal to be a derived proposal must include:
   
   (a) targeted surveys identifying conservation significant flora and vegetation, terrestrial fauna and subterranean fauna species;
   
   (b) a demonstration of how the results of the targeted survey have been used to apply the mitigation hierarchy to the proposal;
   
   (c) a report that details the following information:
      
      (i) the types of ecosystems and total area of rehabilitation that the proponent will be required to rehabilitate across their iron ore tenure including the derived proposal.
      
      (ii) an analysis of the history of rehabilitation that the proponent has undertaken in the Pilbara and the demonstrated success of this rehabilitation.
      
      (iii) the likely success of future rehabilitation activities in establishing self-sustaining areas of rehabilitation, taking into account:
         
         • relevant contemporary scientific evidence;
         
         • the types of area to be rehabilitated; and
         
         • the scale of rehabilitation activities.
   
   (d) draft management plans than specifically demonstrate how the objectives in the conditions of this ministerial statement will be met by the implementation of the management plans for the proposal; and
   
   (e) details of the consultation that has been undertaken with relevant stakeholders in regards to the proposal and the outcomes of this consultation.
Table 1: Summary of the Strategic Proposal

<table>
<thead>
<tr>
<th>Proposal title</th>
<th>Pilbara Expansion – Strategic Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short description</td>
<td>This Strategic Proposal identifies future iron ore mining and associated activities and operations within the project boundary delineated in Figure 1.</td>
</tr>
</tbody>
</table>

Table 2: Location and authorised extent of physical and operational elements

<table>
<thead>
<tr>
<th>Column 1 developments</th>
<th>Column 2 location</th>
<th>Column 3 Description of limits/extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron ore mines and associated activities and operations, being new mining operations at:</td>
<td>Within mining tenements and any other interest in land, including amendments to these tenements and interests, or the future acquisition of related tenements or interests, held by BHP or its Associates within the Project Boundary and as identified in Figures 1 and 2.</td>
<td>3. Clearing (as defined in s51A of the Environmental Protection Act 1986), caused by or likely to be caused by all future proposals identified in Column 1 of Table 2, shall not exceed 98 500 hectares</td>
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<tr>
<td>• Caramulla</td>
<td></td>
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<tr>
<td>• Coondiner</td>
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<td>• Gurinbiddy</td>
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<td>• Jinidi</td>
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<td>• Marillana</td>
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<td>• Mindy</td>
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<td>• Ministers North</td>
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<tr>
<td>• Mudlark</td>
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<tr>
<td>• Munjina/Upper Marillana</td>
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<tr>
<td>• Ophthalmia/Prairie Down</td>
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<td>• Rocklea</td>
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<td>• Roy Hill</td>
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<td>• Tandanya</td>
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<tr>
<td>and future expansions to new mining operations listed above and existing mining operations at:</td>
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<td></td>
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<tr>
<td>• Jimblebar</td>
<td></td>
<td></td>
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<td>• Mining Area C</td>
<td></td>
<td></td>
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<tr>
<td>• Newman</td>
<td></td>
<td></td>
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<tr>
<td>• Yandi.</td>
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<tr>
<td>Associated Activities and Operations may be located on tenements and any other interests in land currently held by BHP or its Associates or, which will be acquired in the future, and located within the Project Boundary</td>
<td></td>
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<tr>
<td>4. Planned, designed and managed (demonstrated in the referral of future proposal and draft management plans submitted at the time of referral of future proposals) to ensure:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Cumulative impacts to key environmental factors are minimised through use, where practicable, of existing mine infrastructure, rail, road and associated developments and do not exceed cumulative impact limit of 98 500 ha specified above</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. The environmental objectives specified in the relevant conditions will be met</td>
<td></td>
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</tbody>
</table>
as identified in Figures 1 and 2.

c. Scientifically verifiable estimates of the likely success of future rehabilitation have been made

Table 3: Abbreviations and definitions

<table>
<thead>
<tr>
<th>Acronym or Abbreviation</th>
<th>Definition or Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associates</td>
<td>Means joint venture partners, subsidiaries, related bodies corporate, contractors or agents.</td>
</tr>
</tbody>
</table>
| Associated activity and operations | Means: (a) any of the following activities associated with the Developments:  
(i) Geotechnical investigations and associated activities  
(ii) Mine pit excavation  
(iii) Dewatering  
(iv) Blasting, drilling, and extraction  
(v) Ore transportation infrastructure, including conveyors  
(vi) Ore processing infrastructure including crushers  
(vii) Beneficiation and associated activities  
(viii) Over burden storage areas, ore stockpiles and topsoil stockpiles and associated stacking, reclaiming and loading activities  
(ix) Laydown areas, vehicle maintenance areas, assembly areas, water bores, turkey nests and culverts  
(x) Tailings storage facilities, fuel and hydrocarbon storage, explosives storage and storage of environmentally hazardous goods and materials  
(xi) Accommodation camps  
(xii) Airstrips and airports  
(xiii) Administration and workshop buildings  
(xiv) Rehabilitation and decommissioning activities  
(xv) Ancillary infrastructure and associated activities, including concrete batching plants  
(xvi) Ground disturbance and earthworks (vegetation, habitat and landform removal)  
(xvii) Emissions to the environment  
(xviii) Abstractions from the environment |
| (xi) Water supply, water abstraction, water use, water storage, water treatment, drainage and stormwater management and water discharge and water reinjection |
| (xii) Power distribution infrastructure including substations, switchyards and above or below ground cables |
| (xiii) Diesel power generators |
| (xiv) Waste management |
| (b) any rail associated with the Development and including: |
| (i) Rail spurs |
| (ii) Rail loops |
| (iii) Expanded rail capacity of the Newman-Port Hedland rail line |
| (iv) Accommodation camps for rail development |
| (v) Borrow pits |
| (vi) Rail welding yards |
| (vii) Workshops and repair yards |
| (viii) Support infrastructure including pipelines, powerlines, fibre optic cables and other service infrastructure |
| (ix) Laydown areas |
| (x) Roads and access tracks |

| CEO | The Chief Executive Officer of the Department of the Public Service of the State responsible for the administration of section 48 of the *Environmental Protection Act 1986*, or his delegate. |
| EPA | Environmental Protection Authority |
| EP Act | *Environmental Protection Act 1986* |
| Ecological Integrity | The composition, structure, function and processes of ecosystems, and the natural range of variation of these elements. |
| ‘Good’ to ‘Excellent’ condition native vegetation | Means the condition of native vegetation rated in accordance with the EPA’s *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* (December, 2016), including any revision to this technical guidance |
| ha | Hectare |
| IBRA | Interim Biogeographic Regionalisation for Australia |
| Other important or specialised environmental values | Refers to areas identified as specialised fauna habitat, important vegetation types, and management and/or conservation areas, such as but not limited to, riparian vegetation, threatened or priority ecological communities, or Fortescue Marsh management zones |
| Pilbara Environmental Offsets Fund | A special purpose account created pursuant to section 16(1)(d) of the *Financial Management Act 2006* by the Department of Water and Environmental Regulation. |
| Relevant legislation | Means the *Wildlife Conservation Act 1950* and/or the *Biodiversity Conservation Act 2016* or any other Western Australian legislation that has similar objects to the above Acts. |
| Wild Rivers | Rivers listed in DWER’s Water Notes no. 37 *Wild rivers in Western Australia* (January 2009). |

**Management-based provisions**

| Management actions | Risk-based actions to be implemented to meet the environmental objective. |
| Management targets | Targets to determine the effectiveness of the management actions. |
| Monitoring | Monitoring to measure the effectiveness of management actions. |
| Reporting | Reporting of implementation of management actions and reporting on the effectiveness of management actions to demonstrate that the objective/s have been met. |

**Outcome-based provisions**

| Outcome | Proposal-specific, desired state for an environmental factor/s to be achieved from the implementation of outcome-based provisions. |
| Trigger criteria | Criteria that provide an early warning that the threshold criteria may not be met. |
| Threshold criteria | Limit of acceptable impact beyond which there is likely to be a significant effect on the environment, which indicates the environmental outcome is not being met. |
| Monitoring | Monitoring to determine if trigger criteria and threshold criteria are exceeded. |
| Trigger level actions | Actions to be implemented in the event that trigger criteria are exceeded. |
| Threshold contingency actions | Actions to be implemented in the event that threshold criteria are exceeded. |
| Reporting | Reporting of monitoring results against trigger criteria and threshold criteria to demonstrate that the outcome/s have been met. |
Figures (attached)

Figure 1  Strategic Proposal project boundary and BHP Billiton Iron Ore tenements
Figure 2  Future proposals Identified in the Strategic Proposal
Figure 1: Strategic Proposal project boundary and BHP Billiton Iron Ore tenements
Figure 2 Future Proposals identified in the Strategic Proposal
Schedule 2

Coordinates defining the Project Boundary and Future Proposals identified in the Strategic Proposal are held by the Department of Water and Environmental Regulation, 2018-1528354351392.
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