

**Appendix B1
Preliminary assessment
against EPA Strategy for
Identifying Regionally
Significant Natural
Areas**

APPENDIX B1 ASSESSMENT OF SIGNIFICANCE OF HAPPY VALLEY TENEMENTS, USING EPA GUIDANCE STATEMENT NO. 10

1. ABOUT THIS DOCUMENT

2. INFORMATION REQUIRED TO UNDERTAKE ASSESSMENT

A series of information sets are required to apply these six criteria and in turn, assess an area's 'natural significance' at the regional level. These information sets include both (1) National and Regional information sets for the SCP (Table 1); and (2) Specific area information for the locality of interest (Table 2). These information sets were derived for the Happy Valley Mining Tenement areas as summarised in Tables 3 and 4 and subsequently employed to assess whether the vegetation of the Happy Valley Proposal is considered 'regionally significant'.

Table 1 National and Regional Information Sets for the Swan Coastal Plain (from Table 1 of Appendix 3 of EPA 2003a)

Information required	Available National and Regional Information Sets
Landform and soil	Various sources
Vegetation and flora	Vegetation types (Beard 1979a, b&c, Beard 1981; Smith 1973 & 1974 and Hopkins et al. 1996)*
	Vegetation Complex (Heddle et al. 1980 and CALM)
	Floristic Community Types (Gibson et al. 1994; DEP 1996)
Wetlands	Wetland Types (Hill et al. 1996a&b and as updated periodically by WRC)
	Consanguineous suite (Hill et al. 1996a&b)
	Wetland Management Objective (after Hill et al. 1996a&b, Semeniuk 1998 and as updated periodically by WRC)
	EPP Lakes (Government of WA 1992)
Threatened Ecological Communities	After English and Blyth 1997 and as updated periodically by CALM
Threatened Species	DEC Declared Rare and Priority Flora (CALM current Declared Rare and Priority Flora and Fauna Lists, reports, specific area survey)
	DEC Threatened Fauna (CALM current Declared Rare and Priority Flora and Fauna Lists, reports, specific area survey)
International and National significance	Reference to international treaties, Commonwealth Environment Protection and Biodiversity Act 1999, listing on the register of the National Estate etc.

Table 2 Specific Area Information (from Table 2 of Appendix 3 of EPA 2003a).

Information type	Information requirements
Landscape features	Any existing information and specific survey area.
Vegetation and flora	Any existing information and specific survey area.
Structural units	Should be mapped and related to on the ground descriptions.
Vegetation condition	Should be mapped or recorded using standard terminology (Government of WA 2000b).

Total flora	Including total flora (level of survey should be indicated), significant flora (DRF, priority taxa, range extensions, species at geographic limits etc.)
Fauna	Including total fauna (level of survey should be indicated), significant fauna (DRF, priority taxa, range extensions, species at geographic limits etc.)
Linkage	Adjacent bushland areas.

Table 3 Extracts from National and Regional Information Sets (from Table 1 of Appendix 3 of EPA 2003a).

Information	Map Set	Date	Search Results
Landform and soil	Landform	05/08/08	Refer to section x DAFWA 2003
	Soil	05/08/08	Refer to section x
Vegetation and flora	Vegetation types		Not relevant, used ecosystem types of Havel 2000.
	Vegetation Complex	21/05/08	Refer to section x
	Floristic Community Types	NA	Refer to section x
Wetlands	Wetland Types (DEC)	21/05/08	NA
	EPP Lakes	21/05/08	NA
Threatened Ecological Communities	DEC/English & Blyth	TEC and PEC search	
Threatened Species	DEC Declared Rare and Priority Flora	To be done	
	DEC Threatened Fauna	To be done	
	<i>Other reports</i>	NA	Refer to section x
	<i>Area surveys</i>	NA	Refer to section x
International and National significance	Australian Heritage Database	07/08/07	No results
	EPBC Protected Matters Search Tool	To be done	

Table 4 Specific Area Information required for regional assessment (from Table 2 of GBRS Appendix 3 GBRS)

Information	Studies	Findings	Constraints
<p>Landscape features¹ Distribution patterns of landscape elements or ecosystems</p>	<p>ESM 1999 – landform subsystems Bemax/Strategen 2007/2008 – soil types and profiles</p>	<p>ESM (1999) identified 4 principle subsystems that typically form a continuum from the upper researches of the Whicher Scarp to the lower western foothills and mapped at scale of 1:25, 0000. These subsystems are as follow:</p> <p>Kingia subsystem: broad lateritic upland crests and divides with lateritic gravels and sands;</p> <p>Whicher subsystem: 2 phases – slopes and valleys; with mainly sandy gravels or some deep sands, and typically a shallow, seasonally active creek bed cuts the valley floor;</p> <p>Rosa subsystem: generally associated with moderately incised major valleys with gentle to moderate slopes; soils are variable, including sandy gravels, loamy gravels, deep sands and sandy earths.</p> <p>Cartis subsystem: represented on the lowest slopes and sandplain merging with the lower slopes of the Whicher subsystem.</p> <p>Strategen (2007) undertook soil sampling within and outside the proposed disturbance foot print, sampling at regular intervals (125m for areas of native vegetation within the proposed disturbance footprint and 250m for those outside).</p> <p>Identified 8 soil types and 4 of which dominate with 98% coverage:</p> <ul style="list-style-type: none"> ➤ grey sands ➤ lateritic soils – shallow grey or brown sands and gravels over laterite or outcrops ➤ orange to brown sands and gravels ➤ transition soils – typically brown sands over grey sands or grey sands over brown sands. 	<p>Both Bemax/Strategen (2007/08) and ESM (1999) undertook sufficient landform surveys for the locality but nether can be regionally placed. Therefore, the regional landform descriptions and map by DAFWA (2003) is useful as an EIA tool.</p>

Information	Studies	Findings	Constraints
<p>Soil vegetation associations (vegetation units) Mapped and related to ground descriptions</p>	<p>Bennet Environmental Consulting (BEC) 2003</p> <p>Bennet Environmental Consulting 2006</p> <p>Bemax 2008</p>	<p>Three different vegetation and flora assessments were undertaken between 2003 and 2008 in order to accurately define and map the vegetation units.</p> <p>BEC (2003): 30 units identified.</p> <p>BEC (2006): 6 units identified.</p> <p>Bemax (2008): 14 units identified.</p> <p>The final selection of the most appropriate vegetation unit assessment and map was based on the following criteria for what constitutes a "rigorous" assessment:</p> <ol style="list-style-type: none"> 1. the rationale used to define (differentiate) vegetation units is both statistically and ecologically sound; 2. the resources and methods used to delineate (map) vegetation units are appropriate; and 3. boundary delineation between units makes ecological sense with respect to site vegetation complexes, landform units and soil data. <p>Bemax (2008) satisfied 3 criteria, BEC (2006) 2 and BEC (2003) only 1. Therefore Bemax (2008) unit descriptions employed.</p>	<p>BEC (2003): No statistical analysis performed to determine vegetation units. Units were determined by 'expert' knowledge which is partially subjective. It is best to combine both expert knowledge and statistical analysis when defining units.</p> <p>BEC (2006): Vegetation units not verified in the field.</p> <p>Bemax (2008): The most appropriate vegetation unit assessment given that sound data collection methods were used and widely accepted statistical analyses were employed. Vegetation units were validated in the field.</p>

Information	Studies	Findings	Constraints
<p>Vegetation condition Should be mapped or recorded using standard terminology</p>	<p>ESM (1999) and BEC (2001, 2003 and 2006) – condition of vegetation complexes</p> <p>BEC (2001, 2004a and b, 2006 and 2007) – search for DRF and Priority flora</p> <p>Glevan (2008 in prep) - dieback</p>	<p>ESM (1999) rated the condition status of vegetation as generally high throughout given that the vegetation within the mining tenements has diversity of structure, high diversity of understorey and very low levels of exotic weed establishment. However, localised impacts of timber extraction, numerous small quarries, clearing for farming and forestry, intrusion into vegetation areas by livestock, exploration track clearing and scattered areas of dieback are evident throughout the area.</p> <p>BEC (2001) used the same condition scale as ESM (1999) and rated most of the Kingia and Which Scarp vegetation complexes as pristine; Whicher Scarp vegetation complex (valleys) as very good; part Kingia and Whicher Scarp Vegetation Complex as good; a section of Kingia was classed as degraded due to the understorey being completely removed whilst the upper storey was still intact.</p> <p>BEC (2003) identified that about 50% of the proposed mining area is cleared for grazing with only pockets of remnant bushland remaining. However the eastern of the mining area abuts a State Forest where the vegetation is in good or better condition.</p> <p>BEC (2006) rated vegetation condition between 'good' and 'excellent'.</p> <p>Glevan (2008) identified that over 50% of the remaining bushland within the lease has been subject to the effects of dieback (<i>Phytophthora cinnamomi</i>)</p>	<p>ESM (1999) undertook a 'drive through' examination of vegetation condition and thus no systematic sampling design was employed and vegetation condition either over- or under-estimated. BEC (2006) sampled for vegetation condition using quadrat randomly sampled within the mining tenements. BEC (2006) sampling design was an improvement upon ESM (1999) however, quadrats were purposely placed in areas of better condition to adequately determine vegetation at the unit level. Hence, vegetation condition was not a true reflection of the whole area. ESM (1999) used regional scale devised by Trudgen (1990) which was superseded by Keighery (1994) as used by BEC (2006). Hence, BEC provides the more up-to-date assessment of vegetation condition at the regional scale, although both scales are very similar.</p>

Information	Studies	Findings	Constraints
<p>Total flora Including significant flora</p>	<p>Bennet Environmental Consulting (BEC) 2003 and 2006 and Bemax 2008</p> <p>BEC (2001, 2004, 2006 and 2007) – search for DRF and Priority flora</p>	<p>BEC (2003): 195 taxa; 101 genera; 35 vascular plant families.</p> <p>BEC (2006): 286 taxa; 149 genera; 48 vascular plant families.</p> <p>Bemax (2008): 381 taxa; 182 genera; 56 vascular plant families.</p> <p>DRF and Priority Flora:</p> <p><i>Acacia flagelliformis</i> P4 (BEC 2001)</p> <p><i>Adersonia ferricola</i> P1 (BEC 2006)</p> <p><i>Boronia humifusa</i> P1 (BEC 2001)</p> <p><i>Caustis</i> sp. Boyanup P1 (BEC 2004)</p> <p><i>Cyathochaeta teretifolia</i> P3 (BEC 2004)</p> <p><i>Daviesia elongata</i> subsp. <i>elongata</i> DRF (BEC 2004 and 2006)</p> <p><i>Franklandia triaristata</i> P4 (BEC 2006)</p> <p><i>Hemigenia rigida</i> P1 (BEC 2007)</p> <p><i>Jacksonia sparsa</i> P3 (BEC 2001)</p> <p><i>Logania wendyae</i> P1 (BEC 2007)</p> <p><i>Stenanthemum sublineare</i> P2 (BEC 2006)</p> <p>Flora of interest:</p> <p><i>Daviesia nudiflora</i> subsp. <i>nudiflora</i> conservation significant (BEC 2004)</p> <p><i>Logania connii</i> (BEC 2004)</p> <p><i>Ricinocarpos cyanescens</i> conservation significant (BEC 2004)</p>	<p>Bemax (2008) recorded the greatest number of taxa given that 60 quadrats were sampled in contrast to only 40 by BEC (2006) and 45 BEC (2003).</p>

Information	Studies	Findings	Constraints
<p>Fauna including significant fauna</p>	<p>Bamford (1999)</p> <p>Bamford and Wilcox (2004)</p> <p>Bancroft and Bamford (2008)</p>	<p>Bamford (1999) literature review predicted the following:</p> <ul style="list-style-type: none"> ➤ 12 species of frogs ➤ 36 species of reptiles ➤ 120 species of birds ➤ 29 species of mammals <p>Bamford (1999) field program resulted in recording 7 species of frogs, 17 species of reptiles, 17 species of mammals and 97 species of birds in the project area.</p> <p>Bamford and Wilcox (2004) search for conservation significant fauna revealed the following:</p> <ul style="list-style-type: none"> ➤ A possible decrease in the Chuditch (<i>Dasyurus geoffroyi</i>) population which is listed as vulnerable under <i>EPBC Act 1999</i> ➤ No ringtail possums (<i>Pseudocheirus occidentalis</i>) were captured or spotted indicating a potential population decline due to marginal quality of habitat suitability ➤ Carnaby's Black-Cockatoo (<i>Calyptorhynchus latirostris</i>) and Baudin's Black-Cockatoo (<i>Calyptorhynchus baudinii</i>) found foraging but not breeding – both species are endangered. <p>Bamford (2008) recorded a total of 104 species of vertebrate were recorded: 5 frogs, 22 reptiles, 65 birds and 12 mammals. Eight species of conservation significance were recorded in the area: Square-tailed Kite (CS3), Forest Red-tailed Black-Cockatoo (CS1), Carnaby's Cockatoo (CS1), Baudin's Cockatoo (CS1), Rainbow Bee-eater (CS1), Brush-tailed Phascogale (CS2), Quenda (CS2) and Brush Wallaby (CS2).</p>	
<p>Linkage adjacent bushland areas</p>	<p>DEC (2003)</p>	<p>DEC (2003) identified the linkage between Cartis and Kingia Vegetation Complexes to be an important value to be maintained within the locality. 11 linkages were identified within and adjacent to the mining tenements of which 4 linkages will be disturbed by mining. Although linkages are of local significance they are not of regional significance.</p>	

1. 'Landscape features' are broadly defined as 'components of the overall landscape used by wildlife, differentiated by vegetative, geologic, hydrologic, and structural elements, which may occur at various scales.'

3. PERFORMANCE AGAINST THE SELECTION CRITERIA

To determine if a particular natural area is 'regionally significant' the area's natural values (Tables 1 and 2) are measured against the six selection criteria. The Happy Valley Proposal area conforms to two of the six criteria and thus considered to be regionally significant (Table 5). The justification of the area's regional significance is discussed below under the relevant sub-headings.

Table 5 Performance against selection criteria for the identification of regionally significant natural areas (from Table 5 of Appendix 3 of EPA 2003a)

Selection criterion	Reservation objective	Assessment
1. Representation of ecological communities	A number of areas selected to represent the range of ecological communities and the places in which these communities merge.	NO – Section 3-1
2. Diversity	Areas with a high diversity of flora and/or fauna species or communities in close association	YES – Section 3-2
3. Rarity	Areas containing rare or threatened communities or species, or species of restricted distribution	YES – Section 3-3
4. Maintaining ecological processes or natural systems	Maintenance of ecological processes or natural systems at a regional or national scale	NO – Section 3-4
5. Scientific or evolutionary importance	Areas containing evidence of evolutionary processes either as fossilised material or as relict species and areas containing unusual or important geomorphological or geological sites; areas of recognised scientific and educational interest as reference sites or as examples of the important environmental processes at work	NO – Section 3-5
6. General criteria for protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation	Conservation category wetland areas including fringing vegetation and associated upland vegetation; Coastal vegetation within the accepted coastal management zone.	NO – Section 3-6

3.1 CRITERION 1 – REPRESENTATION OF ECOLOGICAL COMMUNITIES

This criterion is aimed at maximising the comprehensiveness and representativeness of the ecological communities. Comprehensive representation of ecological communities is achieved primarily by attempting to select replicate areas that represent each of the floristic communities, in each of the vegetation complexes across the geographic extent in which they occur (EPA 2003a). With respect to the Happy Valley proposal area, a vegetation complex is considered to be an ecological community and the geomorphic unit is the entire Whicher Scarp.

The ecological communities (vegetation complexes) within the Happy Valley proposal area are not considered of regional significance within the GBRs and do not meet this criterion for the following reasons (Tables 6 and 7). First, the area contains 4 vegetation complexes that contribute to the percentage retention of these complexes on the Whicher Scarp where each vegetation complex has >30% of its pre-European extent. For ecological communities where less than 30% pre-European extent remains, the EPA (2003) considers all areas to be regionally significant. Within the proposal area, all ecological communities have >30% retention within the region and thus are not considered regionally significant in this context.

Second, the EPA (2003) gives preference to largely undisturbed remnants of bushland that represent good examples of ecological communities within the region. Within the proposal area there are only isolated pockets of remnant bushland present, half of which has been largely disturbed. About 50% of the vegetation has been cleared for grazing with only pockets of remnant bushland where about 50% of this has been subject to the effects of dieback (Glevan 2008 in prep). Anthropogenic impacts associated with timber extraction, gravel pit quarries, exploration track clearing and intrusion into vegetation areas by livestock are clearly evident within the remaining areas of remnant vegetation. Hence, although the majority of the vegetation has been rated between very good and good (ESM 1999; BEC 2003), it has been largely disturbed and thus not considered to be as preferable for habitat conservation as the surrounding areas outside the lease that are of higher quality e.g. Dardanup and Treeton blocks highlighted in the Floristic study of the Whicher Scarp undertaken by DEC (Keighery *et al.* 2008).

NOTE: Conservation recommendations of Keighery *et al.* 2008 which are not currently endorsed by DEC are for the conservation of the entire Argyle forest block. The mining of 63 ha of State Forest and subsequent rehabilitation to a high standard should not significantly effect the conservation values of the block as a whole.

Table 6 Information derived for the Happy Valley proposal area required to assess the performance of the area against the 'representation of ecological communities' criterion.

Information type	Information derived for Happy Valley proposal area
Regional vegetation representation:	
Vegetation complexes	For the subsystems identified within the area which lie within the Donnybrook Sunkland Zone, there is a total of 17,174 ha of the Rosa complex, 4438 ha of the Whicher and 40,538ha of the Kingia vegetation complex. All vegetation complexes within the area have greater than 30% retention of pre-European extent and following disturbance will not be reduced below the EPA 30% retention of pre-European extent threshold. Therefore at the vegetation complex level, the area is not considered regionally significant.
Vegetation units	
Floristic community types	
Habitats	
	14 vegetation units were identified within the area, 10 of which will be disturbed. However, all disturbed units will have >50% retention and thus will be well represented at the unit level. Hence, not considered regionally significant at the unit level.
	9 floristic community types of the Whicher Scarp are in part comparable to 1a, 1b and 21b regional floristic types are classified by Gibson <i>et al.</i> (1994).
Vegetation condition	Glevan (2008) identified that more than 50% of the remaining bushland within the lease has been subject to the effects of dieback.
	BEC (2003) identified that about 50% of the proposed mining area is cleared for grazing with only pockets of remnant bushland remaining. However the eastern of the mining area abuts a State Forest where the vegetation is in good or better condition. BEC (2006) rated general vegetation condition between 'good' and 'excellent'.
	However, localised impacts of timber extraction, numerous small quarries, clearing for farming and forestry, intrusion into vegetation areas by livestock, exploration track clearing and scattered areas of dieback are evident throughout the area (ESM 1999).
Relationship/proximity to:	
Naturally vegetation areas	Abuts the National State Forest to the east of the lease.
Protected areas	
Other regionally significant naturally vegetation areas	

Table 7 Performance of Happy Valley proposal area against inclusion and exclusion guidelines for the selection criterion for representation of ecological communities.

Inclusion guidelines	Application of guidelines to the Happy Valley proposal area
<p>Areas which are good examples of each [ecological community], selected to be representative of the vegetation of a geomorphic unit.</p> <p>Geomorphic unit = Whicher Scarp Ecological community = Vegetation complex</p>	<p>Yes the area does provide a good example of 4 vegetation complexes of the Whicher Scarp specifically:</p> <ul style="list-style-type: none"> ➤ Kingia ➤ Rosa ➤ Whicher Scarp and Valley ➤ Cartis
<p>Areas contributing to at least 30% of each vegetation complex in at least ten separate areas. In the defined constrained areas, this may be modified to at least 10%.</p>	<p>The area contains 4 vegetation complexes that contribute to the percentage retention of these complexes on the Whicher Scarp. Each vegetation complex has >30% of its pre-European extent.</p>
<p>Best available examples of each natural wetland group and wetland types within each group.</p>	<p>This guideline is not applicable given that the absence of natural wetlands within the proposal area.</p>
<p>Best available examples of places where ecological communities merge</p>	<p>DEC (2003) identified the linkage between Cartis and Kingia Vegetation Complexes to be an important value to be maintained within the locality. 11 linkages were identified within and adjacent to the mining tenements of which 4 linkages will be disturbed by mining. Although linkages are of local significance they are not of regional significance.</p> <p>These linkages are probably not the best example of where ecological communities merge on the Whicher Scarp given that they occur on private land and therefore their integrity may be compromised.</p>
<p>Areas of native vegetation which are good examples of its type with particular reference to its fauna habitat</p>	<p>The area is an example of native vegetation that supports a diverse range of fauna where a total of 104 species of vertebrate were recorded: 5 frogs, 22 reptiles, 65 birds and 12 mammals within the area (Bancroft and Bamford 2008). In addition the area supports eight fauna species of conservation significance.</p>
<p>Areas identified as being of national or international significance through treaty/ convention/ policy</p>	<p>No given that it is not critical habitat for listed migratory species.</p>
Exclusion guidelines	
<p>Vegetation that does not satisfy the definition of bushland (unless it is the best example of its type with particular reference to fauna habitat or it constitutes one of the few examples of a particular ecological community)</p>	<p>Yes the area does satisfy the definition of a 'bushland' i.e. the area represents land on which there is vegetation which is a remainder of natural vegetation of the land, although slightly altered due to anthropogenic impacts it is still representative of the structure and floristics of the natural vegetation and provides the necessary habitat for native fauna.</p>
<p>Areas that are not the best available examples of particular ecological communities (FCT/vegetation complexes) because there are more appropriate (bigger, better condition, richer/ more diverse) areas elsewhere.</p>	<p>The Happy Valley proposal areas is probably not the best available example of the ecological communities that occur along the Whicher Scarp given that 50% of the native bushland has been cleared and the remaining half has been subject to the effects of dieback and anthropogenic impacts. Hence, there are likely to be larger blocks of vegetation complexes in better condition outside the proposal area. Some of these 'better' areas have been identified by Keighery <i>et al.</i> 2008 who recently undertook a floristic study of the Whicher Scarp.</p>

3.2 CRITERION 2 – DIVERSITY

The EPA (2003) considers areas with a high diversity of landforms, flora and/or fauna species to be ‘regionally significant’ given that one of its primary objectives is to maximise the representation of diverse natural areas. The area within the Happy Valley mining lease meets the diversity criterion and thus considered regionally significant in this context given that (Tables 8 and 9):

- a relatively diverse range of landform units (4), vegetation complexes (4) and vegetation units (14) occurs within a relatively small area;
- it is floristically rich with the occurrence of 381 taxa that belong to 182 genera of 56 vascular families (Bemax 2008); and
- a high diversity of fauna inhabit the area as identified by Bamford (2008) who recorded a total of 104 species of vertebrate were recorded (5 frogs, 22 reptiles, 65 birds and 12 mammals).

However, the proposal area does comply with several exclusion guidelines associated with the selection criterion as detailed in Table 9. The bushland has been subject to some alteration given that 50% of the bushland has been cleared; half of the remaining bushland has been subject to the effects of dieback (Glevan 2008 in prep) and human impacts within the bushland are clearly evident such as timber extraction, intrusion of livestock, gravel pit quarries and exploration tracks (ESM 1999). In addition the FCTs within the proposal area are only in part comparable to 3 regional FCTs (1a, 1b and 21b) which are better represented outside the proposal area as indicated by Keighery *et al.* (2008).

Table 8 Information derived for the Happy Valley proposal area required to assess the performance of the area against the ‘diversity’ criterion.

Information type	Information derived for Happy Valley proposal area
Landforms	4 (ESM 1999)
Vegetation complexes	4 (ESM 1999)
Vegetation units	14 (Bemax 2008)
Floristic community types	9 floristic community types of the Whicher Scarp are in part comparable to 1a, 1ba and 21b regional floristic types are classified by Gibson et al. (1994).
Flora	381 taxa; 182 genera; 56 vascular plant families (Bemax 2008)
Fauna	Bamford (2008) recorded a total of 104 species of vertebrate were recorded: 5 frogs, 22 reptiles, 65 birds and 12 mammals. Eight species of conservation significance were recorded in the area: Square-tailed Kite (CS3), Forest Red-tailed Black-Cockatoo (CS1), Carnaby’s Cockatoo (CS1), Baudin’s Cockatoo (CS1), Rainbow Bee-eater (CS1), Brush-tailed Phascogale (CS2), Quenda (CS2) and Brush Wallaby (CS2).

Table 9 Performance of Happy Valley proposal area against inclusion and exclusion guidelines for the selection criterion for diversity.

Inclusion guidelines	Application of guidelines to the Happy Valley proposal area
Areas with high flora diversity at the community, species or genetic level.	Yes the proposal area has a high floristic diversity with 381 taxa belonging to 182 genera and 56 vascular plant families being recorded within the area (Bemax 2008).
Areas with a high diversity of plant associations, assemblages or communities relative to the area.	14 vegetation units have been identified to occur within the proposal area (Bemax 2008).
Areas with a high diversity of faunal assemblages.	Yes the proposal area has a high diversity of fauna species where Bamford (2008) recorded a total of 104 species of vertebrate: 5 frogs, 22 reptiles, 65 birds and 12 mammals.

Exclusion guidelines	
Significantly altered or man-made landform units.	The bushland within the proposal area has been substantially altered in the following ways: <ul style="list-style-type: none"> ➤ 50% of the bushland has been cleared; ➤ Half of the remaining bushland has been subject to the effects of dieback (Glevan 2008 in prep); ➤ Human impacts within the bushland are clearly evident such as timber extraction, intrusion of livestock, gravel pit quarries and exploration tracks (ESM 1999).
Floristic community types (ecological communities) which are replicated in many areas.	The FCTs within the proposal area are only in part comparable to 3 regional FCTs (1a, 1b and 21b) which are better represented outside the proposal area as indicated by Keighery <i>et al.</i> 2008.
Areas with low to moderate diversity at the community, species or generic level.	The area has a high diversity at the species level (see above).

3.3 CRITERION 3 – RARITY

The protection of rare or restricted taxa of flora and fauna (species, subspecies or varieties) is enabled through the preferential selection of representative examples of communities that are known to support populations of these species (EPA 2003). The rarity criterion applies to aspects of the environment that are rare or relatively rare and can encompass any environmental biological or ecological feature or phenomenon which can be regarded as outstanding because it is one of the few of its type (EPA 2003).

In this context, the Happy Valley proposal area can be considered a representative example of a rare area and thus of regional significance given the occurrence of:

- 1 Declared Rare flora species and 10 Priority flora species;
- 3 flora species at the end of their range; and
- 8 fauna species of conservation significance (Table 10).

However, no TEC or PEC communities occur within the proposal area nor any vegetation complexes with <10% retention of pre-European extent.

Although the proposal area meets all of the inclusion guidelines it also complies with one exclusion guideline: areas which, if supporting outlying species or communities, are replicated by better examples elsewhere (Table 11). The proposal area only contains 3 of the 90 species of the Whicher Scarp that are at the end of their range and 1 of the more than 60 rare flora (Table 11). Hence, it is most probable that there are better areas that support outlying species elsewhere along the Whicher Scarp.

Table 10 Information derived for the Happy Valley proposal area required to assess the performance of the area against the 'rarity' criterion.

Information type	Information derived for Happy Valley proposal area
Vegetation complexes <10% remaining	None
TEC and PEC occurrence	None

Information type	Information derived for Happy Valley proposal area
Flora	<p>DRF and Priority Flora:</p> <p><i>Acacia flagelliformis</i> P4 (BEC 2001) <i>Adersonia ferricola</i> P1 (BEC 2006) <i>Boronia humifusa</i> P1 (BEC 2001) <i>Caustis</i> sp. Boyanup P1 (BEC 2004) <i>Cyathochaeta teretifolia</i> P3 (BEC 2004) <i>Daviesia elongata</i> subsp. <i>elongata</i> DRF (BEC 2004 and 2006) <i>Franklandia triaristata</i> P4 (BEC 2006) <i>Hemigenia rigida</i> P1 (BEC 2007) <i>Jacksonia sparsa</i> P3 (BEC 2001) <i>Logania wendyae</i> P1 (BEC 2007) <i>Stenanthemum sublineare</i> P2 (BEC 2006)</p> <p>Flora of interest:</p> <p><i>Daviesia nudiflora</i> subsp. <i>nudiflora</i> conservation significant (BEC 2004) <i>Logania connii</i> (BEC 2004) <i>Ricinocarpos cyanescens</i> conservation significant (BEC 2004)</p>
Fauna	<p>Eight species of conservation significance were recorded in the area: Square-tailed Kite (CS3), Forest Red-tailed Black-Cockatoo (CS1), Carnaby's Cockatoo (CS1), Baudin's Cockatoo (CS1), Rainbow Bee-eater (CS1), Brush-tailed Phascogale (CS2), Quenda (CS2) and Brush Wallaby (CS2).</p>

Table 11 Performance of Happy Valley proposal area against inclusion and exclusion guidelines for the selection criterion for rarity.

Inclusion guidelines	Application of guidelines to the Happy Valley proposal area
Threatened Ecological Communities.	The area does not contain any TECs or PECs.
Habitats of rare, uncommon or restricted flora and/or fauna species outside of or at the limit of their range.	The area contains 1 DRF and 10 Priority flora, and 8 fauna species of conservation significance.
Areas supporting rare, uncommon or restricted communities and/or communities outside of or at the limit of their range.	The area is a component of the Whicher Scarp that collectively supports rare, uncommon and restricted vegetation communities with 90 species at the end of their range (Keighery <i>et al.</i> 2008) and more than 60 rare species. 3 of the species at the end of their range occur within the proposal area and 1 rare flora species.
Exclusion guidelines	
Habitats of species or communities whose significance (as described above) is not established.	The conservation significance of flora and fauna within the proposal area has been clearly established by ground surveys (Table 10).
Areas which, if supporting outlying species or communities, are replicated by better examples elsewhere.	The proposal area only contains 3 of the 90 species of the Whicher Scarp that are at the end of their range and 1 of the more than 60 rare flora. Hence, it is most probable that there are better areas that support outlying species elsewhere along the Whicher Scarp.

3.4 CRITERION 4 – MAINTAINING ECOLOGICAL PROCESSES OR NATURAL SYSTEMS

The selection of areas for their role in ‘maintaining ecological processes or natural systems’ relates to the ‘adequacy’ objective of the National Strategy (Commonwealth of Australia 1996) which is the most difficult of the national criteria to achieve fully on the Swan Coastal Plain given the degree of clearing and fragmentation (EPA 2003). The protection of remaining large areas of native vegetation, particularly those providing representation of 2 or more vegetation complexes, a range of floristic community types or contiguous upland and wetland areas, is an important component of this criterion.

The Happy Valley mining lease does not meet this criterion given that (Tables 12 and 13):

- only a small amount of native vegetation remains within the lease, half of which has been subject to the effects of dieback and disturbed by anthropogenic impacts (timber extraction, numerous small quarries, clearing for farming and forestry, intrusion into vegetation areas by livestock, exploration track clearing);
- does not contain substantive corridors connecting bushland areas – the lease abuts State Forest to the east but only 50% of the lease area contains remnant vegetation that doesn’t connect to any regionally significant ecological corridor as identified by DEC (EPA 2003); and
- doesn’t contain any regionally significant floristic community types or contiguous upland and wetland areas.

The lease does contain more than 2 vegetation complexes but none of these are considered regionally significant (see Section 3.1). Also, 8 fauna species of conservation significance were recorded in the proposal area by Bancroft and Bamford (2008): Square-tailed Kite (CS3), Forest Red-tailed Black-Cockatoo (CS1), Carnaby’s Cockatoo (CS1), Baudin’s Cockatoo (CS1), Rainbow Bee-eater (CS1), Brush-tailed Phascogale (CS2), Quenda (CS2) and Brush Wallaby (CS2). However, giving consideration to the disturbance and condition of the bushland within the proposal area there are likely to be better areas for supporting these fauna populations. Keighery *et al.* 2008 identified several areas (Dardanup and Treeton blocks) along the Whicher Scarp that are in a better condition than that of Happy Valley which are considered valuable for maintaining ecological processes or natural systems.

Table 12 Information derived for the Happy Valley proposal area required to assess the performance of the area against the ‘maintaining ecological processes or natural systems’ criterion.

Information type	Information derived for Happy Valley proposal area
Natural condition with natural processes intact or largely so.	Gleavan (2008) identified that more than 50% of the remaining bushland within the lease has been subject to the effects of dieback. BEC (2003) identified that about 50% of the proposed mining area is cleared for grazing with only pockets of remnant bushland remaining. However the eastern of the mining area abuts a State Forest where the vegetation is in good or better condition. BEC (2006) rated general vegetation condition between ‘good’ and ‘excellent’. However, localised impacts of timber extraction, numerous small quarries, clearing for farming and forestry, intrusion into vegetation areas by livestock, exploration track clearing and scattered areas of dieback are evident throughout the area (ESM 1999).
Vegetation complexes	Contains 4 vegetation complexes
Range of floristic community types or upland and wetland areas	9 floristic community types of the Whicher Scarp are in part comparable to 1a, 1b and 21b regional floristic types are classified by Gibson <i>et al.</i> (1994).
Wildlife corridors connecting bushland areas.	Doesn’t contain substantive corridors connecting bushland areas. The lease abuts State Forest to the east but only 50% of the area contains remnant vegetation which doesn’t comprise in regionally significant ecological corridor as identified by DEC.

Table 13 Performance of Happy Valley proposal area against inclusion and exclusion guidelines for the selection criterion for the maintaining ecological processes or natural systems.

Inclusion guidelines	Application of guidelines to the Happy Valley proposal area
Large areas in natural condition with natural processes intact or largely so.	The proposal area only in part contains natural bushland in good condition where natural processes have been partially interrupted by: <ul style="list-style-type: none"> ➤ the effect of dieback (50% of remaining bushland); ➤ clearing for grazing (50% of the proposal area is cleared); ➤ other anthropogenic influences such as timber extraction, intrusion of cattle for grazing, gravel pit quarries and exploration tracks.
Fauna habitats providing specific requirements for feeding/breeding/nursery functions.	Eight species of conservation significance were recorded in the area: Square-tailed Kite (CS3), Forest Red-tailed Black-Cockatoo (CS1), Carnaby's Cockatoo (CS1), Baudin's Cockatoo (CS1), Rainbow Bee-eater (CS1), Brush-tailed Phascogale (CS2), Quenda (CS2) and Brush Wallaby (CS2).
Substantive wildlife corridors connecting bushland areas.	The proposal area does not contain substantive wildlife corridors connecting bushland areas – the lease abuts State Forest to the east but only 50% of the lease area contains remnant vegetation that doesn't connect to any regionally significant ecological corridor as identified by DEC (EPA 2003);
Habitats for significant populations of migratory birds	The area does not contain habitats for significant populations of migratory birds.
Exclusion guidelines	
Areas which are replicated by other areas supporting significant populations or in a better condition.	Giving consideration to the disturbance and condition of the bushland within the proposal area there are likely to be better areas for maintaining ecological processes or natural systems of which some bushland blocks have been identified by Keighery <i>et al.</i> (2008).
Areas not recognised as being of national or international significance for migratory birds.	The proposal area is not recognised as being of national or international significance for migratory bird species.

3.5 CRITERION 5 – SCIENTIFIC OR EVOLUTIONARY IMPORTANCE

This criterion applies generally to areas which contain evidence of past ecological or biological processes; unusual or important geomorphological or geological sites; and/or have recognised value as research sites, type localities or to sites having a reference or benchmark value. The Happy Valley proposal area lies within the Whicher Scarp which conforms to all of the above components and is considered regionally important in terms of its scientific value given that:

- it is a disjunct landform that is naturally restricted;
- contains six unique vegetation complexes of which 2 are highly restricted and 3 have in effect less than 30% of their area remaining;
- the Scarp is a centre for speciation;
- the Scarp shows high levels of highly endemic flora; and
- the Scarp is considered a biodiversity hotspot (Keighery *et al.* 2008).

However, there are likely to be larger areas outside the proposal area in better condition and thus better represent the scientific importance of the Whicher Scarp giving consideration to the size of the proposal area and its condition. Hence, the Happy Valley proposal area does not meet the criterion.

Table 14 Performance of Happy Valley proposal area against inclusion and exclusion guidelines for the selection criterion for scientific or evolutionary importance.

Inclusion guidelines	Application of guidelines to the Happy Valley proposal area
Areas with unusual or important geomorphological or geological sites.	The proposal area lies within the Whicher Scarp that is considered a distinct landform that is naturally restricted (Keighery <i>et al.</i> 2008).
Areas with remains of flora and fauna now extinct (fossil sites).	The proposal area does not contain remains of flora or fauna now extinct.
Areas with primitive or relic flora or fauna surviving from earlier times.	The areas does not have primitive or relic flor and fauna surviving from earlier times.
Areas with fossil or other records of identifiable past climates or environments.	Fossil records of identifiable past climates or environments have not been identified within the proposal area.
Long term scientific or educational monitoring sites or study areas.	The proposal areas lies within the Whicher Scarp that is considered a regionally significant area and thus suitable for scientific studies given that: <ul style="list-style-type: none"> ➤ the Whicher Scarp is a naturally restricted landform; ➤ contains six unique vegetation complexes of which 2 are highly restricted and 3 have in effect less than 30% of their area remaining; ➤ the Scarp is a centre for speciation; ➤ the Scarp shows high levels of highly endemic flora; and ➤ the Scarp is considered a biodiversity hotspot.
Exclusion guidelines	
Areas in which the evidence of past processes is not clearly established.	Evidence of past processes may not be as clearly established as alternative areas along the Whicher Scarp giving consideration to the level of human impacts that have occurred within the area.
Areas which are replicated by places with clearer evidence of the above or in better condition.	There are likely to be larger areas outside the proposal area in better condition and thus better represent the scientific importance of the Whicher Scarp.
Areas not identified as important geomorphological sites.	The proposal area lies within the Whicher Scarp that is considered a regionally significant geomorphological unit (Keighery <i>et al.</i> 2008).
Areas not identified as important geological sites.	The proposal area lies within the Whicher Scarp that is considered a regionally significant geological site (Keighery <i>et al.</i> 2008).

3.6 CRITERION 6 – GENERAL CRITERIA FOR PROTECTION OF WETLAND, STREAMLINE AND ESTUARINE FRINGING VEGETATION AND COASTAL VEGETATION

This criterion applies to Conservation Category wetlands, their vegetation (including fringing vegetation) and associated upland vegetation; streamline/ riverine/ estuarine fringing vegetation; and to coastal vegetation within the accepted coastal management zone. The Happy Valley mining proposal does not conform to this criterion given the absence wetland, streamline and estuarine fringing vegetation and coastal vegetation in the area.

4. CONCLUSIONS

The extent to which the Happy Valley proposal area can be considered a regionally significant natural area within the GBRS of the SCP was assessed by applying 6 selection criteria and associated inclusion and exclusion guidelines developed by the EPA (2003). The proposal area was found to meet in part, 2 of the 6 selection criteria, those pertaining to diversity and rarity and can be considered of regional significance in this context.

The proposal area in part meets the diversity criterion and thus considered regionally significant in this context given that:

- a relatively diverse range of landform units (4), vegetation complexes (4) and vegetation units (14) occurs within a relatively small area;
- it is floristically rich with the occurrence of 381 taxa that belong to 182 genera of 56 vascular families (Bemax 2008); and
- a high diversity of fauna inhabit the area as identified by Bamford (2008) who recorded a total of 104 species of vertebrate were recorded (5 frogs, 22 reptiles, 65 birds and 12 mammals).

However, the proposal area also agreed with 2 exclusion guidelines: the area had been subject to substantial alteration and FCT were likely to be better replicated in other areas along the Whicher Scarp of better condition.

The proposal area is considered a representative example of a rare area and thus of regional significance given the occurrence of:

- 1 Declared Rare flora species and 10 Priority flora species;
- 3 flora species at the end of their range; and
- 8 fauna species of conservation significance.

However, no TEC or PEC communities occur within the proposal area nor any vegetation complexes with <10% retention of pre-European extent. Further, the proposal area complies with one exclusion guideline: areas which, if supporting outlying species or communities, are replicated by better examples elsewhere. The proposal area only contains 3 of the 90 species of the Whicher Scarp that are at the end of their range and 1 of the more than 60 rare flora. Hence, it is most probable that there are better areas that support outlying species elsewhere along the Whicher Scarp.

Although the Happy Valley proposal area met 2 of the 6 selection criteria, these were not met in their entirety. This indicates that the proposal area is not unique or critical for regional conservation. Larger areas of better condition along the Whicher Scarp have been identified in a detailed study undertaken by Keighery *et al.* 2008. These larger and more intact bushland blocks (e/g/ Dardanup and Treeton) may be considered better representatives of the regional natural significance of the Whicher Scarp.

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