

## Appendix 1: LHSGIF Assessment

A quantitative assessment of the Spotted Gum-Ironbark vegetation community at the WEZ and WTC study sites has been undertaken to determine the presence/absence of the Lower Hunter Spotted Gum-Ironbark Forest (LHSGIF) Endangered Ecological Community (EEC). This assessment contains three separate elements:

1. An assessment against the Final Determination for LHSGIF (NSW Scientific Committee 2005)
2. An assessment against diagnostic species for Spotted Gum-Ironbark forests listed in NPWS (2000) and Bell and Driscoll (2007)
3. An assessment against OEH identification guidelines for LHSGIF

Conclusions in respect to the presence of LHSGIF in the WEZ and WTC study site, including consideration of relevant legal precedents in respect to the definition of EECs have been included.

### SECTION 1: LHSGIF FINAL DETERMINATION

The following table provides a quantitative assessment of the Spotted Gum-Ironbark vegetation community at the WEZ and WTC study sites against the Final Determination for Lower Hunter Spotted Gum-Ironbark Forest (NSW Scientific Committee 2005).

Final determination (NSW Scientific Committee 2005)	Comment
1. Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion is the name given to the ecological community that occurs principally on Permian geology in the central to lower Hunter Valley. The Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures, although smaller areas of the community may also occur on the Permian Singleton and Newcastle Coal Measures and the Triassic Narrabeen Group (NSW Department of Mines 1966, 1969). The community is strongly associated with, though not restricted to, the yellow podsolic and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath (Kovac and Lawrie 1991). These substrates are said to produce 'moderately fertile' soils (Kovac and Lawrie 1991).	<p>The WEZ and WTC study sites are not located in the central to lower Hunter Valley and are not located on Permian geology.</p> <p>It is noted that some small areas of the community may occur on Triassic Narrabeen Group geology. Sections of the WEZ and WTC study sites support Triassic Narrabeen Group geology.</p> <p>Soil landscapes at the WEZ site include: Gorokan (GK), Wyong (WY) and Tacoma Swamp (TS).</p> <p>Soil landscapes at the WTC site include: Gorokan (GK), and Woodburys Bridge (WO).</p> <p>Of these, only the Gorokan and Woodsbury Ridge soil landscapes occur on Triassic Narrabeen group geology (Murphy and Tille 1993).</p>

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Final determination (NSW Scientific Committee 2005)	Comment
<p>Lower Hunter Spotted Gum - Ironbark Forest is dominated by <i>Corymbia maculata</i>, (Spotted Gum) and <i>Eucalyptus fibrosa</i> (Broad-leaved Ironbark), while <i>E. punctata</i> (Grey Gum) and <i>E. crebra</i> (Grey Ironbark) occur occasionally. A number of other eucalypt species occur at low frequency, but may be locally common in the community. One of these species, <i>E. canaliculata</i>, intergrades extensively in the area with <i>E. punctata</i>.</p>	<p>Of the seven Biometric vegetation plots surveyed in Spotted Gum-Ironbark vegetation, only four plots (Plots 17, 39, 41 and IB1) had a canopy dominated by <i>Corymbia maculata</i> <b>and</b> <i>Eucalyptus fibrosa</i>.</p> <p>An additional three plots (Plots 20, 30 and 33) had both <i>C. maculata</i> and <i>E. fibrosa</i> present but not as dominant species. And a further three plots (Plots 3, 6 and 9) had a canopy dominated by <i>C. maculata</i> but not <i>E. fibrosa</i>.</p> <p>A range of other canopy species were recorded as dominants and co-dominants in the Spotted Gum-Ironbark vegetation including <i>Angophora costata</i>, <i>E. capitellata</i>, <i>E. globoidea</i> and <i>E. paniculata</i>.</p> <p>It is important to note that the vegetation at both the WEZ and WTC study areas has been variously disturbed from past agricultural and forestry activities which may have affected the canopy composition of the vegetation to some extent.</p> <p>In summary, while there are some minor areas of Spotted Gum-Ironbark vegetation in the WEZ and WTC study areas which have a canopy co-dominated by <i>C. maculata</i> <b>and</b> <i>E. fibrosa</i>, the vast majority of the Spotted Gum-Ironbark vegetation does not support both of these species.</p> <p>The remainder of this assessment will only consider those plots located within mapped Spotted Gum-Ironbark vegetation.</p>
<p>The understorey is marked by the tall shrub, <i>Acacia parvipinnula</i>, and by the prickly shrubs, <i>Daviesia ulicifolia</i>, <i>Bursaria spinosa</i>, <i>Melaleuca nodosa</i> and <i>Lissanthe strigosa</i>. Other shrubs include <i>Persoonia linearis</i>, <i>Maytenus silvestris</i> and <i>Breynia oblongifolia</i>.</p>	<p><i>Acacia parvipinnula</i> was not recorded in the WEZ or WTC study areas and <i>Lissanthe strigosa</i> was not recorded in any of the plots constituting Spotted Gum-Ironbark Forest.</p> <p><i>Daviesia ulicifolia</i> was recorded in Plot 17 and 30.</p> <p><i>Bursaria spinosa</i> was recorded in Plot 33.</p> <p><i>Melaleuca nodosa</i> was recorded in Plots 17, 30, 33, 39 and 41.</p> <p><i>Maytenus silvestris</i> was recorded in Plot 3.</p> <p><i>Breynia oblongifolia</i> was recorded in Plot 3.</p> <p>According NPWS (2000), <i>Daviesia ulicifolia</i> and <i>Melaleuca nodosa</i>, <i>Maytenus silvestris</i> and <i>Breynia oblongifolia</i> are also common components of Coastal Foothills Spotted Gum - Ironbark Forest (i.e. they are not unique to LHSGIF).</p>

## Biocertification Assessment of Warnervale Town Centre

Final determination (NSW Scientific Committee 2005)	Comment
The ground layer is diverse; frequent species include <i>Cheilanthes sieberi</i> , <i>Cymbopogon refractus</i> , <i>Dianella revoluta</i> , <i>Entolasia stricta</i> , <i>Glycine clandestina</i> , <i>Lepidosperma laterale</i> , <i>Lomandra multiflora</i> , <i>Microlaena stipoides</i> , <i>Pomax umbellata</i> , <i>Pratia purpurascens</i> , <i>Themeda australis</i> and <i>Phyllanthus hirtellus</i> (NPWS 2000, Hill 2003, Bell 2004).	<p>All of these species were recorded within the WEZ and WTC study sites with a range of between 33% and 66% of these species being recorded in each plot.</p> <p>According to Bell and Driscoll (2007), <i>Cymbopogon refractus</i>, <i>Entolasia stricta</i>, <i>Glycine clandestina</i>, <i>Pratia purpurascens</i>, <i>Themeda australis</i> and <i>Phyllanthus hirtellus</i> are also diagnostic species for Coastal Foothills Spotted Gum - Ironbark Forest (i.e. they are not unique to LHSGIF).</p>
In an undisturbed condition the structure of the community is typically open forest. If thinning has occurred, it may take the form of woodland or a dense thicket of saplings, depending on post-disturbance regeneration.	The vegetation recorded in the Spotted Gum-Ironbark Forest ranged from woodland to open forest.
Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion is characterised by the following assemblage of species [list of 55 species]	<p>The percentage of characteristic LHSGIF species recorded in each plot ranged from 22% (Plot 3) to 36% (Plot 33).</p> <p>The list of characteristic species for LHSGIF contains 11 species (20%) which were not found to occur in the WEZ or WTC study areas.</p>
3. The total species list of the community is considerably larger than that given above, with many species present in only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought condition and by its disturbance (including fire and logging) history. The number of species, and the above ground relative abundance of species will change with time since disturbance, and may also change in response to changes in fire regime (including changes in fire frequency). At any one time, above ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species, the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. Some of these components of the community are poorly documented.	No additional comments.

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<p>4. Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion is restricted to a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area in the Central and Lower Hunter Valley (NPWS 2000). Within this range, the community was once widespread. A fragmented core of the community still occurs between Cessnock and Beresfield. Remnants occur within the Local Government Areas of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle, Port Stephens and Dungog but may also occur elsewhere within the bioregion. Outliers are also present on the eastern escarpment of Pokolbin and Corrabare State Forests on Narrabeen Sandstone.</p>	<p>The WEZ and WTC study sites are located in the Wyong LGA and are approximately 30km south of the known distribution of LHSGIF, are geographically isolated from the known distribution of LHSGIF by the Watagan National Park and associated ranges do not occur on the primary geological formation of the community (refer Figure 11).</p> <p>The Final Determination for LHSGIF contains one of the most specific descriptions for the location of the EEC out of all the Final Determinations. It is clear from the determination that the intent of listing is to cover vegetation which occurs in the central and lower Hunter Valley. The fact that the determination states 'may occur elsewhere in the bioregion' is inconsequential to the intent of the listing and is a standard term added to the end of this paragraph. Refer to Section 4. Conclusions and Discussions in which a discussion of legal precedents which apply specifically to locational information in the Final Determination.</p>
<p>5. Threatened species recorded within this community include <i>Callistemon linearifolius</i>, <i>Grevillea parviflora</i> subsp. <i>parviflora</i>, <i>Persoonia pauciflora</i>, <i>Rutidosia heterogama</i>, Swift Parrot <i>Lathamus discolor</i> (Saunders 2002), Turquoise Parrot <i>Neophema pulchella</i>, Glossy Black Cockatoo <i>Calyptorhynchus lathamii</i>, Regent Honeyeater <i>Xanthomyza phygia</i>, Black-chinned Honeyeater <i>Melithreptus gularis gularis</i>, Brown Treecreeper <i>Climacteris picumnus victoriae</i>, Powerful Owl <i>Ninox strenua</i>, Koala <i>Phascolarctos cinereus</i>, Yellow-bellied Glider <i>Petaurus australis</i>, Squirrel Glider <i>Petaurus norfolcensis</i> (Smith and Murray 2003), Common Bentwing Bat <i>Miniopterus schreibersii</i> and Eastern Freetail Bat <i>Mormopterus norfolkensis</i>.</p>	<p>A number of these species have been recorded in the study areas including <i>Callistemon linearifolius</i>, <i>Grevillea parviflora</i> subsp. <i>parviflora</i>, <i>Rutidosia heterogama</i>, Glossy Black Cockatoo, Powerful Owl, Koala, Squirrel Glider and Eastern Freetail Bat, however these species are not restricted to LHSGIF and occur elsewhere in the region.</p>

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Final determination (NSW Scientific Committee 2005)	Comment
<p>6. Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion belongs to a complex of ecological communities that were identified in an analysis of floristic data gathered in a vegetation survey of the Lower Hunter - Central Coast region (NPWS 2000). The methods of survey and analysis employed by NPWS (2000) were found to produce a reliable regional-scale overview of native vegetation in the Lower Hunter - Central Coast area, although limitations apply to fine-scale uses of the map (Nicholls et al. 2003). This analysis, and subsequent analyses based on additional floristic data from the Hunter valley floor (e.g. Hill 2003, Bell 2004, Peake unpubl. data), identified Lower Hunter Spotted Gum - Ironbark Forest as a distinct assemblage of species. <u>Other assemblages that may include Spotted Gum as a dominant species, have geographically distinct distributions outside the core area where this community primarily occurs (Cessnock - Beresfield).</u> These other assemblages include: Coastal Foothills Spotted Gum - Ironbark Forest, Seaham Spotted Gum - Ironbark Forest and Central Hunter Spotted Gum - Ironbark - Grey Box Forest (NPWS 2000). Analysis of additional data from north of the Hunter River and other parts of the Hunter valley indicates the existence of another distinct assemblage dominated by spotted gums and ironbarks on Carboniferous sediments of the footslopes of the Barrington plateau. Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion belongs to the Hunter - Macleay Dry Sclerophyll Forests vegetation class of Keith (2004).</p>	<p>The Spotted Gum-Ironbark vegetation within the WEZ and WTC study sites has been mapped by NPWS (2000) as Wyong Paperbark Swamp Forest (map unit 43) and Coastal Foothills Spotted Gum – Ironbark Forest (map unit 15). The Wyong Paperbark Swamp Forest is floristically similar to and transitions into Coastal Foothills Spotted Gum – Ironbark Forest in areas of higher relief.</p> <p>Neither of these mapped communities is equivalent to LHSGIF.</p> <p>As these assemblages have <u>geographically distinct distributions outside the core area where this community primarily occurs (Cessnock - Beresfield)</u>, it is considered likely that they form part of the Coastal Foothills Spotted Gum - Ironbark Forest which is not an EEC.</p>
<p>7. <i>Eucalyptus fibrosa</i>, <i>Acacia parvipinnula</i> and prickly shrub species occur more frequently or in greater abundance in Lower Hunter Spotted Gum - Ironbark Forest than in any of the other communities mentioned above. Around the margins of its core distribution, Lower Hunter Spotted Gum - Ironbark Forest may intergrade with other communities (e.g Hill 2003). Toward the coast and south, Lower Hunter Spotted Gum - Ironbark Forest may be replaced by Coastal Foothills Spotted Gum - Ironbark Forest, in which <i>Eucalyptus umbra</i>, <i>E. siderophloia</i>, <i>Syncarpia glomulifera</i> and <i>Angophora costata</i> occur more frequently, as do <i>Polyscias sambucifolia</i>, <i>Imperata cylindrica</i> and <i>Pseuderanthemum variabile</i>. Toward the north-east, Lower Hunter Spotted Gum - Ironbark Forest may be replaced by Seaham Spotted Gum - Ironbark Forest, in which <i>Eucalyptus crebra</i>, <i>E. punctata</i>, <i>E. acmenoides</i>, <i>E. moluccana</i> and <i>E. siderophloia</i>, occur more frequently, along with <i>Acacia falcata</i>, <i>A. implexa</i>, <i>Leucopogon juniperinus</i>, <i>Aristida vagans</i> and <i>Pseuderanthemum variabile</i>. Seaham Spotted Gum - Ironbark Forest typically occurs on sediments of Carboniferous age, in contrast to the younger Permian sediments that support Lower Hunter Spotted Gum-Ironbark Forest, although the two communities intergrade where these substrates adjoin (NPWS 2000, Hill 2003). Toward the west and north-west, Lower Hunter Spotted Gum - Ironbark Forest may be replaced by Central Hunter Spotted Gum - Ironbark - Grey Box Forest, which has a higher frequency of <i>Eucalyptus crebra</i> and <i>E. moluccana</i> and a more open grassy understorey distinguished by herbs such as <i>Desmodium varians</i>, <i>Glycine tabacina</i>, <i>Dichondra repens</i>, <i>Brunoniella australis</i> and <i>Calotis lappulacea</i>. On open depressions and drainage flats within the Cessnock-Beresfield area, Lower Hunter Spotted Gum - Ironbark Forest may be replaced locally by Hunter Lowlands Redgum Forest, in which <i>Eucalyptus tereticornis</i>, <i>E. punctata</i>, <i>E. crebra</i> and <i>Angophora floribunda</i>, occur more frequently, as do <i>Breynia oblongifolia</i>, <i>Leucopogon juniperinus</i>, <i>Jacksonia scoparia</i> and <i>Brunoniella australis</i> (NPWS 2000).</p>	<p>While some areas of vegetation in the WEZ and WTC study sites are co-dominated by <i>E. fibrosa</i>, these areas are generally small and not representative of the vegetation community as a whole.</p> <p><i>Acacia parvipinnula</i>, the characteristic midstorey species of LHSGIF was not recorded in the study areas.</p> <p>Spotted-Gum Ironbark vegetation in the WEZ and WTC study sites contain a greater proportion of Coastal Foothills Spotted Gum - Ironbark Forest diagnostic species than for LHSGIF (refer Section 2). Many of the species indicated as more indicative of Coastal Foothills Spotted Gum - Ironbark Forest were frequently recorded in the WEZ and WTC study sites.</p> <p>The Spotted-Gum Ironbark vegetation in the study areas contains a complex mosaic of dominant canopy species which is likely to be attributable to Coastal Foothills Spotted Gum - Ironbark Forest rather than LHSGIF.</p>

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Final determination (NSW Scientific Committee 2005)	Comment
<p>8. Clearing and other disturbances have resulted in a high degree of fragmentation of the community. Four large patches of Lower Hunter Spotted-Gum - Ironbark Forest are estimated to have covered nearly 50 000 ha prior to European settlement, representing 75% of the total distribution. The community is currently mapped as occurring in more than 4 800 fragments, of which more than 4 500 are less than 10 ha in area (House 2003). The four largest patches now cover about 7 000 ha, representing less than one-quarter of the current distribution, or about 10% of the estimated pre-European distribution (House 2003). Clearing of native vegetation is listed as a Key Threatening Process under the Threatened Species Conservation Act (1995).</p>	<p>The Spotted Gum-Ironbark forests remaining in the WEZ and WTC study sites are located in large contiguous patches and have not undergone the scale of clearing and fragmentation as LHSGIF in the Lower Hunter.</p>
<p>9. Using recently updated mapping of extant Lower Hunter Spotted Gum - Ironbark Forest based on fine-scale aerial photograph interpretation of extant woody native vegetation, House (2003) estimated that approximately 26 500 ha of the community remains with its tree canopy cover in a 'substantially unmodified' condition, representing approximately 40% of its pre-European distribution. However, this estimate is based on the collective canopy cover of trees (i.e. where tree canopy cover was estimated to be greater than 20%, the canopy was assumed to be 'unmodified' and not substantially thinned), and does not consider the growth stages of trees that contribute to the cover. Growth stage mapping is available for approximately 6 000 ha of Lower Hunter Spotted Gum Ironbark Forest on public land (RACAC 1995), of which only 3% was assessed as containing a sub-dominance of 'overmature' and 'senescent' tree crowns indicative of old growth forest. Seventy-five per cent of this area was assessed as 'young forest', indicating regeneration from past logging and wildfire. Some areas of Lower Hunter Spotted Gum - Ironbark Forest on private land also reflect a continuing history of degradation. In the Blackhill district, for example, much of the existing vegetation was cleared, and is now largely composed of dense stands of juvenile saplings. This regrowth has since been further affected by clearing and thinning, creation of electricity transmission easements, and ongoing grazing by goats and cattle. In addition, House (2003) estimated that there are a further 4 650 ha of Lower Hunter Spotted Gum - Ironbark Forest with a modified or substantially modified tree canopy cover.</p>	<p>With 40% of its pre-European distribution remaining in a 'substantially unmodified' condition, LHSGIF is one of the least cleared EECs in the Hunter/Central Rivers CMA region.</p> <p>The Spotted Gum-Ironbark forests remaining in the WEZ and WTC study sites mainly comprise regrowth with very few large hollow bearing, 'overmature' or senescent trees.</p>
<p>10. The condition of the understorey has not been mapped systematically. There are no quantitative estimates of the area of the community that retains a substantially unmodified understorey. However, qualitative information suggests that there has been extensive disturbance to the understorey associated with logging, expansion of unplanned tracks and trails, rubbish dumping, off-road vehicle use, arson and weed invasion, even in stands that are currently within a conservation reserve (Bell 2004). These pressures are likely to intensify with the projected increases in the density of the human population within the region (Progress Economics 2004).</p>	<p>The Spotted Gum-Ironbark forests remaining in the WEZ and WTC study sites are considered to be relatively diverse (average of 37 native species per plot) and had a high percent cover of native species (58% average) where weed abundance was relatively low.</p>

## Biocertification Assessment of Warnervale Town Centre

Final determination (NSW Scientific Committee 2005)	Comment
<p>11. Much of the remaining Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion shows evidence of disturbance. Past logging practices and fire regimes have heavily modified some parts of the community, resulting in a simplified structure and floristics. Production areas of State Forests are actively logged at intensities specified by regulations. Frequent fires (&lt;3 years) dramatically simplify understorey vegetation (Bell 2004). Grazing, uncontrolled human access and associated dumping of solid and garden waste, as well as weed invasion (notably by <i>Lantana camara</i> and <i>Solanum mauritianum</i>, wild tobacco) have degraded the more accessible remnants of the community, while transport corridors and power and communication easements have further fragmented them. As a likely consequence of continuing habitat loss and degradation, local bird observers have noted declines in species associated with spotted gum/ironbark forests, including the Swift Parrot, Regent Honeyeater, Brown Treecreeper, Black-chinned Honeyeater, Diamond Firetail, Turquoise Parrot, Fuscous Honeyeater, Eastern Shrike-tit and Spotted Quail-thrush.</p>	<p>No additional comments.</p>
<p>12. Clearing pressures from rural residential and residential subdivisions, industrial developments and new cropping enterprises (e.g. vineyards) continue to threaten the community particularly in Cessnock Local Government Area where the core of this community occurs. Over the past 10 years, demand for housing lots in the Lower Hunter area has nearly doubled from 1 726 in 1991-92 to 3 904 in 2003-04 (Progress Economics 2004). The 'medium' forecast for housing demand in Lower Hunter is 2 500 lots/yr; the current supply of land zoned for housing is 12 000 lots and is projected to meet demand only for the next 5 years. Hence there are substantial pressures for rezoning land for housing within the next 10 years (Progress Economics 2004). A study of the Thornton-Killingworth sub-region projected the population to expand by 169 000 people, requiring 2 600 new dwellings annually over the next 25 years (Parsons Brinckerhoff 2003). Existing proposals to rezone land from rural to rural /residential around the villages of Millfield and Paxton and applications for clearing associated with rural residential and residential developments around Paxton, Bellbird, Ellalong and Mulbring will affect the ecological community. Loss of remnants of Lower Hunter Spotted Gum - Ironbark Forest will be associated with the Cessnock LEP Amendment No 60 - Hunter Economic Zone, Donaldson and Bloomfield coalmine sites at Thornton/Killingworth and F3 to Branxton National Highway link (Ecotone Ecological Consultants 1999, 2000; Connell Wagner 1997). In the Maitland Local Government Area, Hill (2003) assessed Lower Hunter Spotted Gum - Ironbark Forest as exposed to high levels of threat from development, tree dieback and grazing, and under moderate levels of threat from fragmentation, weeds, and fire.</p>	<p>While industrial development is proposed and is likely to have some impact on the Spotted Gum-Ironbark Forests of the WEZ and WTC study sites, none of the comments listed in paragraph 12 of the Final Determination for LHSIGIF apply to the study areas.</p>

## Biocertification Assessment of Warnervale Town Centre

Final determination (NSW Scientific Committee 2005)	Comment
<p>13. Approximately 1 600 hectares of Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion occurs within Werakata National Park (Bell 2004). This represents less than 2.5% of the community's modelled pre-1750 distribution (House 2003), is distributed among several separate patches and is predominantly young regrowth forest (Bell 2004). Of an estimated 2 800 ha of the community currently within State Forests, approximately 1 770 ha is excluded from timber harvesting in Forest Management Zone reserves (State Forests of NSW, <i>in litt.</i>), although these areas may be subject to development of service easements, transport infrastructure and mineral exploration. Within the Hunter Employment Zone (HEZ), 460 ha of Lower Hunter Spotted Gum - Ironbark Forest is estimated to occur within zone 7(b) 'Environmental Protection'. However, 7(b) zoning does not exclude development for rural properties (buildings, roads, fences, bushfire hazard reduction) and coal mining.</p>	<p>No additional comments.</p>
<p>14. In view of the above the Scientific Committee is of the opinion that Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion is likely to become extinct in nature in New South Wales unless the circumstances and factors threatening its survival cease to operate, or it might already be extinct.</p>	<p>No additional comments.</p>



Biocertification Assessment of Warnervale Town Centre

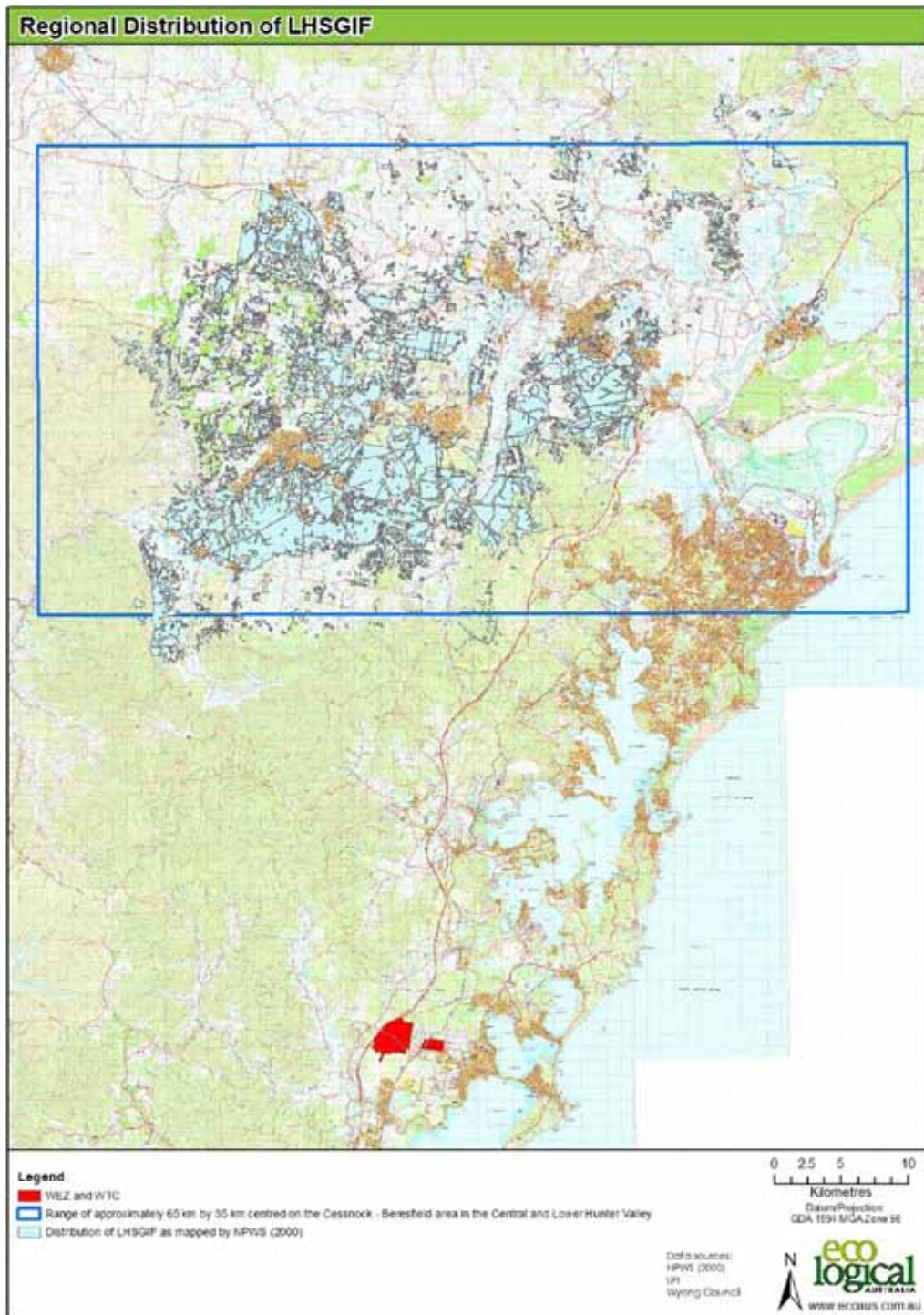


Figure 11: Distribution of LHSGIF

## SECTION 2: DIAGNOSTIC SPECIES FOR SPOTTED GUM-IRONBARK FORESTS

In order to further facilitate the assessment of Spotted-Gum Ironbark vegetation at the WEZ and WTC study sites, a quantitative assessment against diagnostic species lists for LHSGIF and Coastal Foothills Spotted Gum-Ironbark Forest was undertaken. All species recorded within 20m x 20m floristic plots within mapped Spotted-Gum Ironbark vegetation at the WEZ and WTC study sites were utilised for this assessment.

The diagnostic approach has been tested in the Land and Environment Court on a number of occasions (refer *Motorplex (Australia) Pty Limited v Port Stephens Council* [2007] NSWLEC 74 and *Nasser v Roads and Traffic Authority; Millstar Holdings Pty Limited v Roads and Traffic Authority* [2006] NSWLEC 181). The diagnostic approach allows for the delineation of vegetation communities based on the number of diagnostic species recorded in any 20m x 20m floristic plot.

Two sources of diagnostic species lists were utilised:

- NPWS (2000). *Vegetation Survey, Classification and Mapping. Lower Hunter and Central Coast Region*. CRA Unit, Sydney Zone, National Parks and Wildlife Service.
- Bell, S. and Driscoll, C. (2007). *Vegetation of the Cessnock-Kurri region, Cessnock LGA, New South Wales: Survey, Classification & Mapping*. Final report to the Department of Environment and Climate Change, Newcastle.

This approach is particularly important as the Final Determination for LHSGIF relies heavily on NPWS (2000) for species composition and distribution information which are essential for the correct identification of this community according to the legislation.

For the assessment against NPWS (2000), two vegetation communities were assessed including map unit 17. *Lower Hunter Spotted Gum - Ironbark Forest* (EEC) and map unit 15. *Coastal Foothills Spotted Gum - Ironbark Forest*. It is noted that some low lying areas at the WEZ study site have been mapped by NPWS (2000) as map unit 43. *Wyong Paperbark Swamp Forest*, which is floristically similar to and transitions into map unit 15.

For the assessment against Bell and Driscoll (2007), two map units were assessed including 17a (i-iii). *Lower Hunter Spotted Gum – Red Ironbark Forest* (EEC) and map unit 15d (i - iv). *Coastal Foothills Spotted Gum-Ironbark Forest*. While the area of interest of Bell and Driscoll (2007) falls outside the WEZ and WTC study sites, the vegetation communities within are synonymous with those of NPWS (2000).

Results of this analysis are presented in Figure 12 and Figure 13. Data in these graphs is presented as a proportion (the total number of diagnostic species observed against the total number of diagnostic species present in each vegetation community). This is due to the relative difference in total number of diagnostic species between each vegetation community.

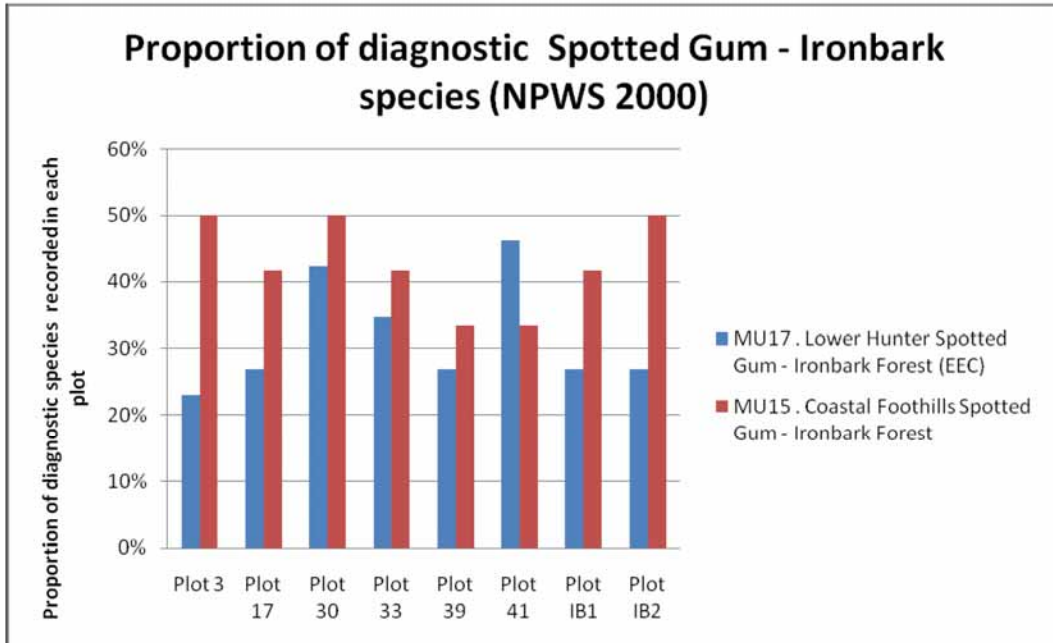


Figure 12: Proportion of Diagnostic Spotted Gum-Ironbark Species (NPWS 2000)

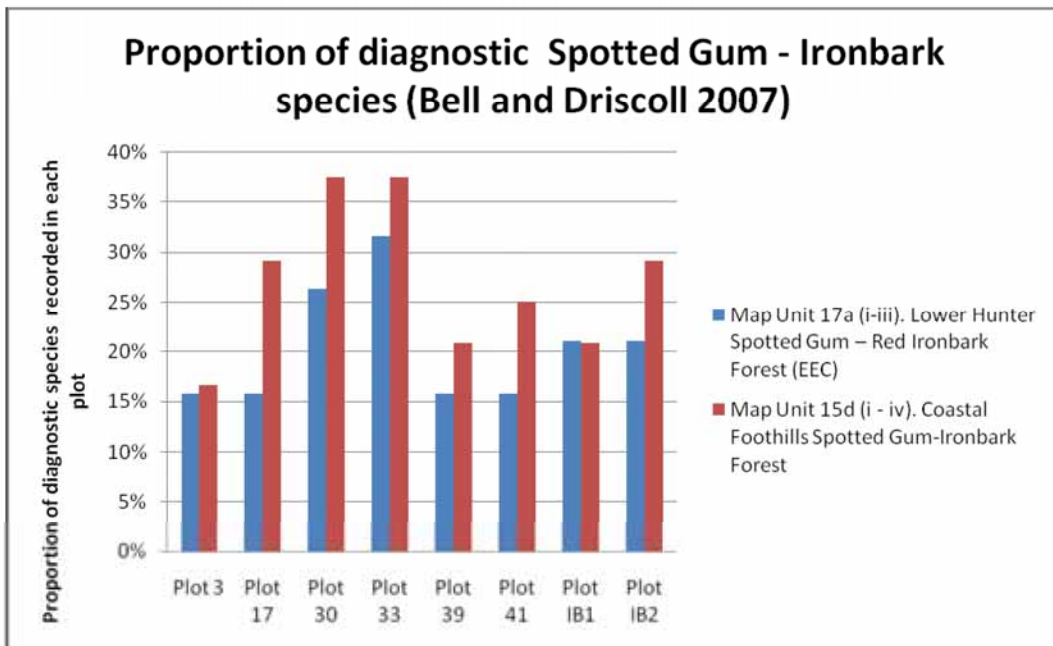


Figure 13: Proportion of Diagnostic Spotted Gum - Ironbark Species (Bell and Driscoll 2007)

## Results

As can be seen in Figure 12, the proportion of diagnostic species for each vegetation plot within Spotted Gum Ironbark forests at the WEZ and WTC study sites is higher for *Coastal Foothills Spotted Gum - Ironbark Forest* than for LHSIGIF in all plots except for Plot 41 which is located at the WTC study site. On average 10% more positive diagnostic species were recorded for *Coastal Foothills Spotted Gum - Ironbark Forest* than LHSIGIF when compared against NPWS (2000).

As can be seen in Figure 13, the proportion of diagnostic species for each vegetation plot within Spotted Gum Ironbark forests at the WEZ and WTC study sites is higher for *Coastal Foothills Spotted Gum - Ironbark Forest* than for LHSIGIF in all plots except for Plot IB1 and Plot 3 which have an equal proportion from each community. On average 7% more positive diagnostic species were recorded for *Coastal Foothills Spotted Gum - Ironbark Forest* than *Lower Hunter Spotted Gum – Red Ironbark Forest* when compared against Bell and Driscoll (2007).

The quantitative assessment of diagnostic species has shown that the Spotted Gum Ironbark forests at the WEZ and WTC study sites are more closely aligned to *Coastal Foothills Spotted Gum - Ironbark Forest* than to LHSIGIF. These results align well with the description of *Coastal Foothills Spotted Gum - Ironbark Forest* in NPWS (2000) which states:

*“Coastal Foothills Spotted Gum - Ironbark Forest is a moderately tall open forest dominated by Corymbia maculata in combination with one or several ironbark species Eucalyptus siderophloia, E. paniculata or E. fibrosa. E. acmenoides, E. umbra and Syncarpia glomulifera are common associate trees.*

The vegetation in the Spotted Gum Ironbark forests at the WEZ and WTC study sites consists of a complex mosaic of vegetation with the constant presence of *Corymbia maculata* (Spotted Gum) and a range of other canopy species including *E. siderophloia*, *E. fibrosa*, *E. umbra*, *E. capitellata* and *Angophora costata*. Within the confines of the WEZ and WTC study sites, the distribution of areas co-dominated by *C. maculata* and *E. fibrosa* within the broader Spotted Gum-Ironbark forests are small.

*“The upper mid-storey is often composed of an open stratum of Allocasuarina torulosa. Depending on recent fire history mesic understorey elements can be present or absent. Typically the shrub layer is open with species such as Persoonia linearis, Polyscias sambucifolia, Breynia oblongifolia and Daviesia ulicifolia....In the southern extent around Wyong the shrub layer often contains Melaleuca nodosa. The ground cover is dominated by a number of common grasses including Imperata cylindrica var. major, Entolasia stricta, Themeda australis and Microlaena stipoides var. stipoides.”*

Within the WEZ and WTC study sites, these species are all common components of the Spotted Gum-Ironbark forests. While having a similar canopy structure in some small areas, the groundcover species characteristic of LHSIGIF are different, being characterised by:

*“the frequent occurrence of Cheilanthes sieberi subsp. sieberi, Entolasia stricta, Pomax umbellata, Pratia purpurascens, Themeda australis, Phyllanthus hirtellus, and Dianella revoluta var. revoluta”*

While some of these groundcover species are common to both *Coastal Foothills Spotted Gum - Ironbark Forest* and LHSIGIF, the groundcover species which delineate the vegetation at the WEZ and WTC study sites as *Coastal Foothills Spotted Gum - Ironbark Forest* include the dominant occurrence of *Imperata cylindrica* var. major (Blady Grass) and general absence of *Cheilanthes sieberi* subsp. sieberi

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(Rock Fern), *Pomax umbellata* and *Dianella revoluta* var. *revoluta* (Blue Flax-lily) within the Spotted Gum-Ironbark vegetation.

### SECTION 3: OEH IDENTIFICATION GUIDELINES FOR LOWER HUNTER SPOTTED GUM-IRONBARK FOREST

To enable the accurate identification of endangered ecological communities, the Office of Environment and Heritage (OEH, formerly DECCW) have produced EEC identification guidelines for LHSGIF which includes three key characteristics to help identify LHSGIF (DECC 2007, Table 17):

**Table 17: DECC LHSGIF Identification “Key Characteristics”**

Characteristic#	Response
Is the site in the central or lower Hunter Valley?	No
Is the vegetation open forest or woodland or consist of a dense thicket of saplings?	Yes
Does the tree layer contain Spotted Gum or Broad-leaved Ironbark?	Yes

# if you answer yes to the above questions, the area is likely to be Lower Hunter Spotted Gum –Ironbark Forest.

As can be seen from the OEH identification guidelines, one of the key characteristics in determining the presence of LHSGIF is the geographical location of the community – a factor which is outlined on a number of separate occasions in the Final Determination and stated in the *Threatened Species Act 1995* (TSC Act), which defines an ‘ecological community’ as ‘**an assemblage of species occupying a particular area**’ (s 4(1) of the Act).

In the case of LHSGIF, the particular area in question is clearly the Lower Hunter Valley (as included in the title of the ecological community itself) and specifically within a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area).

As the Final Determination for LHSGIF (NSW Scientific Committee 2005) clearly defines the assemblage of species and the particular area of occupancy (i.e. central to lower Hunter Valley and more specifically a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area), it can be concluded that the Spotted Gum-Ironbark Forests at the WEZ and WTC study sites do not constitute the LHSGIF EEC based purely on the location of the sites.

### SECTION 4: CONCLUSION AND DISCUSSION

Despite some areas of Spotted Gum-Ironbark forests within the WEZ and WTC study sites being dominated by either *C. maculata* or *E. fibrosa* or both, there are a number of factors to suggest that the LHSGIF EEC does not occur, including:

- The WEZ and WTC study sites are geographically isolated from the known distribution of LHSGIF (NPWS 2000) by the Watagan National Park and associated mountain ranges and are located outside the core area where this community occurs (Cessnock – Beresfield);
- The WEZ and WTC study sites do not occur on the primary geological formation identified in the Final Determination (Permian);
- Many of the LHSGIF ‘characteristic’ species are also common components of the Coastal Foothills Spotted Gum - Ironbark Forest (i.e. they are not unique to LHSGIF);
- The vegetation within the Spotted Gum-Ironbark forests of the WEZ and WTC study sites has a greater proportion of diagnostic species for Coastal Foothills Spotted Gum - Ironbark Forest than LHSGIF;

- While some areas of vegetation in the study are dominated by *C. maculata* and *E. fibrosa*, these areas are generally small and are not representative of the remainder of the Spotted Gum-Ironbark vegetation in the WEZ and WTC study sites. The Spotted Gum-Ironbark vegetation in the study areas constitutes a complex mosaic of canopy species which is attributable to Coastal Foothills Spotted Gum - Ironbark Forest. Common co-occurring species include *Angophora costata*, *E. amplifolia*, *E. capitellata*, *E. globoidea*, *E. paniculata* and *E. resinifera* subsp. *resinifera*. The description of Coastal Foothills Spotted Gum - Ironbark Forest in NPWS (2000) is a testament to this.
- The main risks to the community associated with the listing of LHSGIF do not apply to the WEZ or WTC study areas as they are specifically located in the lower Hunter Valley (Paragraph 12 of the Final Determination).

To further support these main conclusions, a number of legal precedents have been set in relation to the definition and identification of EECs. These are outlined below.

In the case of Motorplex (Australia) Pty Limited v Port Stephens Council [2007] NSWLEC 74, Justice Preston found that:

*"12 Each of the Final Determinations describe the endangered ecological communities using a variety of descriptors but of particular relevance are the floristic descriptors of the assemblage of species constituting the ecological communities and the locational descriptors of each ecological community. This accords with the definition of an "ecological community" as "an assemblage of species occupying a particular area" (s 4(1) of the Act)."*

This finding is of particular relevance, as the Final Determination for LHSGIF (NSW Scientific Committee 2005) clearly defines the assemblage of species and the particular area of occupancy (i.e. central to lower Hunter Valley and more specifically a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area).

In the case of VAW (Kurri Kurri) Pty Ltd v Scientific Committee (Established under s127 of the Threatened Species Conservation Act 1995) [2003] NSWCA 297, Justice Spigelman found that:

*"7 The terminology directly relevant to the present case is the definition of an ecological community as "an assemblage of species in a particular area". The use of the word "assemblage" does not suggest that either the nomination of species or identification of an area requires a high degree of specificity: c/f Genkem Pty Ltd v Environment Protection Authority (1994) 35 NSWLR 33 at 44. To satisfy the requirement of certainty to an appropriate standard, the terms of the Scientific Committee's final determination must enable a citizen to decide whether a specific location falls within it."*

Justice Spigelman clearly states that in order to obtain certainty, the final determination must enable a citizen to decide whether a specific location falls within it. In the case of LHSGIF, the final determination clearly states the location of the ecological community. Justice Spigelman also found that:

*"8 In my opinion, the Kurri Sand Swamp Woodland ("KSSW") final determination satisfies the requirement of reasonable certainty of expression. As to the "particular area" to which it applies, the community must be found on certain specified soils in the Sydney Basin Bioregion. It was noted that the community had been known to occur in the Kurri-Kurri – Cessnock area in the Cessnock local government area, but may occur elsewhere in that general area, but not in the specific local government area. The restriction to the Kurri-Kurri - Cessnock area is, in*

***my opinion, sufficient. The assemblage of species listed must be found within this area and on the type of soils identified, in order to constitute the KSSW.***

This additional finding is of further significance, as the common addition to the distribution information in the Final Determination of "may occur elsewhere" is inconsequential when the area of occupancy is so well defined, as in the case of LHSGIF.

So in order for vegetation to be identified as LHSGIF, the vegetation must be characteristic of LHSGIF (refer section 3), must be found within the central to lower Hunter Valley (more specifically a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area) and occur on Permian geology. The findings of Justice Spigelman align well with the OEH identification guidelines for LHSGIF and the definition of an ecological community as an "*an assemblage of species occupying a particular area*".

The relatively small areas of vegetation within the Spotted Gum-Ironbark Forests at the WEZ and WTC study sites dominated by *C. maculata* and *E. fibrosa* may very well constitute a unique assemblage of species in the Wyong and central coast region, although they are more likely to represent variation within the Coastal Foothills Spotted Gum - Ironbark Forest vegetation community. The Spotted Gum-Ironbark Forests at the WEZ and WTC cannot be included within LHSGIF under the current definition of the ecological community for the reasons outlined in this assessment.

Note that it is also stated by Bell and Murray (2007), that:

***"Data analysis has clearly shown that the Spotted Gum forests from the Warnervale area is more akin to the Coastal Foothills Spotted Gum – Ironbark Forest of NPWS (2000), and in fact form a distinct sub-group of that community which may well be differentiated out as a distinct community with further work (S. Bell, unpubl. data)."***