

Notice of and reasons for the Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to list *Eucalyptus aquatica* (Blakely) L.A.S.Johnson & K.D.Hill as a CRITICALLY ENDANGERED SPECIES in Part 1 of Schedule 1 of the Act and, as a consequence, to omit reference to *Eucalyptus aquatica* (Blakely) L.A.S.Johnson & K.D.Hill in Part 3 of Schedule 1 (Vulnerable species). Listing of Critically Endangered species is provided for by Part 4 of the Act.

The NSW Threatened Species Scientific Committee is satisfied that *Eucalyptus aquatica* (Blakely) L.A.S.Johnson & K.D.Hill has been duly assessed by the Commonwealth Threatened Species Scientific Committee under the Common Assessment Method, as provided by Section 4.14 of the Act. After due consideration of Commonwealth DCCEEW (2024), the NSW Threatened Species Scientific Committee has made a decision to list the species as Critically Endangered.

Summary of Conservation Assessment

Eucalyptus aquatica (Blakely) L.A.S.Johnson & K.D.Hill was found to be Critically Endangered in accordance with the following provisions in the *Biodiversity Conservation Regulation 2017*: Clause 4.3(a)(d)(e iii) because: 1) the species has a very highly restricted geographic distribution with an estimated extent of occurrence of 36 km²; 2) it is known from a single threat-defined location; and 3) there is an inferred continuing decline in the area, extent and quality of habitat due to increased frequency of extreme temperatures, droughts and fire danger weather, and changes in precipitation due to climate change; altered hydrology; adverse fire regimes; and competition with weed species.

The NSW Threatened Species Scientific Committee has found that:

1. *Eucalyptus aquatica* (Blakely) L.A.S.Johnson & K.D.Hill (family Myrtaceae) is described as a small tree or multi-stemmed (lignotuberos) mallee to 9 m tall with smooth, grey or grey-brown bark that sheds in long ribbons (Shepherd and Keyzer 2014; PlantNET 2022). The juvenile leaves are glossy green and broad to rounded in shape, 5 cm long by 3 cm wide with edges that sometimes have blunt or rounded teeth (crenulate). Adult leaves may be a similar shape to juvenile leaves or may be lance-shaped but can be larger and measure up to 8 cm long and 3.5 cm wide. Both sides of the adult leaf share the same, dull sometimes bluish to glossy-green colour (concolorous). Flower buds are in clusters of seven with each bud 6–7 mm long and 3–4 mm in diameter topped by a pointed cap (operculum). Fruiting capsules are flat-topped or raised, with a broad summit that tapers to the stem (Johnson and Hill 1990).
2. *Eucalyptus aquatica* is endemic to the Southern Highlands region of New South Wales (NSW). It is found in localised montane swamps and river flats on tributaries of Paddys River at Hanging Rock Swamp, Stingray Swamp and Webbers Creek Swamp within or near Penrose State Forest (SF) (Shepherd and Keyzer 2014; Whieldon 2017) and from private land at Long Swamp, Sutton Forest (a tributary of the Wollondilly River) (KMA 2018; DPE 2021).

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3. *Eucalyptus aquatica* has a very highly restricted geographic distribution. The area of occupancy (AOO) is estimated to be 36 km² based on 2 x 2 km grid cells, the scale recommended by IUCN (2024). The extent of occurrence (EOO) is based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2024) and was estimated to be 24 km². However, where EOO is less than or equal to AOO, then IUCN (2024) recommend EOO estimates be changed to be equal to AOO to ensure consistency with the definition of AOO as an area that fits within EOO. Therefore, the EOO for *E. aquatica* is also estimated to be 36 km².
4. The total number of mature individuals of *Eucalyptus aquatica* is estimated to be 35,000–50,000. This includes approximately 25,000 individuals at Stingray Swamp, over 12,000 individuals at Hanging Rock Swamp, over 1,000 individuals at Webbers Creek Swamp and 250 individuals at Long Swamp.
5. The montane swamps of Penrose are a type of peat swamp (mire) that are naturally restricted to poorly drained and cold, relatively low parts of the landscape. *Eucalyptus aquatica* occurs in low to moderate acidity mires, where the wettest sites support *Sphagnum* peat (moss) deposits up to 4.5 m deep (Shepherd and Keyzer 2014; Whieldon 2017). *Eucalyptus aquatica* is most abundant at sites where peats and sediments reach their greatest depth, but there are likely to be other important factors associated with the species' habitat (Whieldon 2017). At the Webbers Creek Swamp subpopulation, *E. aquatica* is concentrated in areas of deep peat but also occurs on sandstone ledges up to 3 m above the upper peat-bed limit. These plants at a higher level may indicate a former, more extensive swamp distribution that has eroded or contracted in response to historic climatic or hydrological changes (Shepherd and Keyzer 2014). In densely vegetated swamps, *E. aquatica* is emergent above the surrounding shrubs and sedges. The understorey structure comprises dense thickets of *Chorizandra sphaerocephala*, *Gleichenia dicarpa* and *Gymnoschoenus sphaerocephalus*, and shrubs such as *Hakea teretifolia*, *Leptospermum juniperinum* and *L. obovatum* (Shepherd and Keyzer 2014).
6. *Eucalyptus aquatica* is capable of resprouting from its basal underground (lignotuberous) and above-ground (epicormic) parts (Shepherd and Keyzer 2014; Whieldon 2017). Aerial stems separated by up to 2 m but growing from the same lignotuber (Shepherd and Keyzer 2014) highlight how *E. aquatica* thickets may be joined below-ground and therefore may comprise few genetically distinct individuals. The clumped distribution of plants suggests that vegetative growth is the dominant form of reproduction currently (L. Wilmott pers. comm. July 2022 in Commonwealth DCCEEW 2024).
7. The main threats to *Eucalyptus aquatica* include increased frequency of extreme temperatures, droughts and extreme fire danger weather due to climate change; altered hydrology in the species' peat swamp habitat; adverse fire regimes; and competition from weed species, especially radiata pine (*Pinus radiata*). 'Anthropogenic climate change' and 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and competition' are listed as Key Threatening Processes under the Act.

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8. *Eucalyptus aquatica* is known from one threat-defined location. This is based on known distribution records and the most plausible serious threat of climate-induced fires across the entire species range that may cause peat fires. Subpopulations are separated by forest and woodland habitats and are therefore not a singular, connected swamp system despite being highly localised to Penrose. Fires in the peat may be initiated by bushfires from surrounding areas during prolonged droughts that reduce peat moisture content below combustion thresholds (Prior *et al.* 2020; Mason *et al.* 2025). Projected increases in fire severity and frequency, along with time spent in drought (AdaptNSW 2025), means that a single climate-induced season of fires could cause peat fires that rapidly impact the entire range of the species.
9. The potential for ecosystem collapse at the Penrose swamps is considerable, given the multiple, interacting stressors currently present and likely to increase over coming decades (Keith *et al.* 2023). The habitat of *Eucalyptus aquatica* is a groundwater-dependent *Sphagnum* peatland sensitive to changes to groundwater and regional climate, in particular the rate of evaporation relative to precipitation (Whinam and Chilcott 2002, Keith *et al.* 2014). There are increasing fire-related risks to the swamps and significant risks associated with severe substrate (peat) fires, noting that these are greatest in swamps that have altered hydrology. Groundwater drawdown and changes to surface water flows are therefore likely to have a major effect on the risk profile of the Penrose swamps and habitat of *E. aquatica*, and this may result from friable sandstone mining, plantation forestry, and potable water extraction that are current or likely future extractive land uses in the areas surrounding the Penrose swamps (S. Douglas pers. comm. June 2022 in Commonwealth DCCEEW 2024). Drying of *E. aquatica* habitat is also likely to create opportunities for the growth and spread of weeds (S. Douglas pers. comm. June 2022 in Commonwealth DCCEEW 2024), especially radiata pine. Penrose State Forest has been recognised as having one of the highest levels of radiata pine infestations in NSW (Williams and Wardle 2009), and the species is highly invasive across a range of susceptible habitat types and can have a significant effect on natural systems (White *et al.* 2022). The combined effects of climate change – increased frequency of extreme temperatures, droughts and fire danger weather, and changes in precipitation – altered hydrology associated with surface water and groundwater changes, and the increasing risk of severe peat fires, and weed competition are therefore inferred to be contributing to continuing decline in the area, extent, and quality of habitat for *E. aquatica*.
10. *Eucalyptus aquatica* (Blakely) L.A.S.Johnson & K.D.Hill is eligible to be listed as a Critically Endangered species as, in the opinion of the NSW Threatened Species Scientific Committee, it is facing an extremely high risk of extinction in Australia in the immediate future as determined in accordance with the following criteria as prescribed by the *Biodiversity Conservation Regulation 2017*:

Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome:

Critically Endangered under Clause 4.3(a)(d)(e iii)

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Clause 4.2 – Reduction in population size of species

(Equivalent to IUCN criterion A)

Assessment Outcome: Data Deficient

(1) - The species has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of the taxon:			
	(a)	for critically endangered species	a very large reduction in population size, or
	(b)	for endangered species	a large reduction in population size, or
	(c)	for vulnerable species	a moderate reduction in population size.
(2) - The determination of that criteria is to be based on any of the following:			
	(a)	direct observation,	
	(b)	an index of abundance appropriate to the taxon,	
	(c)	a decline in the geographic distribution or habitat quality,	
	(d)	the actual or potential levels of exploitation of the species,	
	(e)	the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.	

Clause 4.3 – Restricted geographic distribution of species and other conditions (Equivalent to IUCN criterion B)

Assessment Outcome: Critically Endangered under Clause 4.3(a)(d)(e iii)

The geographic distribution of the species is:			
	(a)	for critically endangered species	very highly restricted, or
	(b)	for endangered species	highly restricted, or
	(c)	for vulnerable species	moderately restricted.
and at least 2 of the following 3 conditions apply:			
	(d)	the population or habitat of the species is severely fragmented or nearly all the mature individuals of the species occur within a small number of locations,	
	(e)	there is a projected or continuing decline in any of the following:	
		(i)	an index of abundance appropriate to the taxon,
		(ii)	the geographic distribution of the species,
		(iii)	habitat area, extent or quality,
		(iv)	the number of locations in which the species occurs or of populations of the species.
	(f)	extreme fluctuations occur in any of the following:	
		(i)	an index of abundance appropriate to the taxon,
		(ii)	the geographic distribution of the species,
		(iii)	the number of locations in which the species occur or of populations of the species.

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Clause 4.4 – Low numbers of mature individuals of species and other conditions (Equivalent to IUCN criterion Clause C)

Assessment Outcome: Not met

The estimated total number of mature individuals of the species is:			
	(a)	for critically endangered species	very low, or
	(b)	for endangered species	low, or
	(c)	for vulnerable species	moderately low.
and either of the following 2 conditions apply:			
	(d)	a continuing decline in the number of mature individuals that is (according to an index of abundance appropriate to the species):	
		(i)	for critically endangered species very large, or
		(ii)	for endangered species large, or
		(iii)	for vulnerable species moderate,
	(e)	both of the following apply:	
		(i)	a continuing decline in the number of mature individuals (according to an index of abundance appropriate to the species), and
		(ii)	at least one of the following applies:
		(A)	the number of individuals in each population of the species is:
		(I)	for critically endangered species extremely low, or
		(II)	for endangered species very low, or
		(III)	for vulnerable species low,
		(B)	all or nearly all mature individuals of the species occur within one population,
		(C)	extreme fluctuations occur in an index of abundance appropriate to the species.

Clause 4.5 – Low total numbers of mature individuals of species (Equivalent to IUCN criterion D)

Assessment Outcome: Not met

The total number of mature individuals of the species is:			
	(a)	for critically endangered species	extremely low, or
	(b)	for endangered species	very low, or
	(c)	for vulnerable species	low.

Clause 4.6 – Quantitative analysis of extinction probability (Equivalent to IUCN criterion E)

Assessment Outcome: Data Deficient

The probability of extinction of the species is estimated to be:			
	(a)	for critically endangered species	extremely high, or
	(b)	for endangered species	very high, or
	(c)	for vulnerable species	high.

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Clause 4.7 – Very highly restricted geographic distribution of species–vulnerable species

(Equivalent to IUCN criterion D2)

Assessment Outcome: Vulnerable under Clause 4.7

For vulnerable species,	the geographic distribution of the species or the number of locations of the species is very highly restricted such that the species is prone to the effects of human activities or stochastic events within a very short time period.
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Professor Angela Moles, FRSN
Chairperson
NSW Threatened Species Scientific Committee

Supporting Documentation:

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