Section 1 – Eligibility for Listing

1. Name of the ecological community

Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain (floristic community type 15 as originally described in Gibson *et al*. (1994)). Also known as floristic community type 15 (FCT15) and Swan Coastal Plain community 15 (SCP15).

2. Listing Category for which the ecological community is nominated

		EPBC Act (wholly or as a component)
Current listing category (Please check box)	Current ranking under WA Minister ESA list in policy ☐ Critically endangered ☐ Endangered ☒ Vulnerable ☐ Priority 1-4 ☐ Data Deficient ☐ None – not listed	Name: ☐ Critically endangered ☐ Endangered ☐ Vulnerable ☐ None – not listed
Proposed listing category (Please check box)	WA *Biodiversity Conservation Act 2016* ☐ Collapsed ☒ CR: Critically endangered ☐ EN: Endangered ☐ VU: Vulnerable ☐ Priority 1-4	
Select one or more of the following criteria under which the community is to be nominated for BC Act listing. (Please check box). For further details on these criteria please refer to the Attachment to this form. The information you provide in Section 3 should support the criteria you select here.	☒ Criterion A – Reduction in geographic distribution ☒ Criterion B – Restricted geographic distribution ☐ Criterion C – Environmental degradation based on change in an abiotic variable ☐ Criterion D – Disruption of biotic processes or interactions based on change in a biotic variable ☐ Criterion E – Quantitative analysis that estimates the probability of ecosystem collapse	

Section 2 – Description, Condition, Threats & Recovery

Please answer all the questions, providing references where applicable. If no or insufficient information exists to answer a question, you must indicate this instead of leaving the question blank. The answers may be provided within this form or as attachments, ensuring that responses clearly indicate which question number they refer to.

Classification

3. What is the name of the ecological community?

Note any other names that have been used recently, including where different names apply within different jurisdictions. For example, is it known by separate names in different States or regions?

Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain (floristic community type 15 as originally described in Gibson *et al*. (1994))

4. What authorities/surveys/studies support or use the name?

The ecological community is referred to as above by the Department of Biodiversity, Conservation and Attractions (DBCA), and data collected from the ecological community is saved and stored in the departmental TEC database, including the name.

The community was endorsed under policy by the WA Minister as a TEC under the name 'Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain.

5. How does the nominated ecological community relate to other ecological communities that occur nearby or that may be similar to it?

Does it intergrade with any other ecological communities and, if so, what are they and how wide are the intergradation zones?
Describe how you might distinguish the ecological community in areas where there is overlap (also see Description section below).

This ecological community differs from other wetland floristic community types (Herb rich saline shrublands in clay pans (floristic community type 7 as originally described in Gibson *et al.* 1994 - FCT07, and Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. 1994 - FCT08) on the Swan Coastal Plain as it comprises the deep seasonal wetlands, as opposed to the shallower, generally more ephemeral wetlands of FCT07 and FCT08, which often occur in close proximity to FCT15 wetlands.

Description

6. List the main features that distinguish this ecological community from all other ecological communities.

Characteristic (or diagnostic) features can be biological (e.g. taxa or taxonomic groups of plants and animals characteristic to the community; a type of vegetation or other biotic structure), or associated non-biological landscape characteristics (e.g. soil type or substrate, habitat feature, hydrological feature). Please limit your answer to those features that are specific to the ecological community and can be used to distinguish it from other ecological communities.

See sections 5 and 7.

7. Give a description of the biological components of the ecological community.

For instance, what species of plants and animals commonly occur in the community; what is the typical vegetation structure (if relevant).

This community occurs on alluvial sediments on sites that are inundated for long periods, resulting in more typical aquatic species and flora of deep wetlands. It is dominated by *Melaleuca rhaphiophylla* or *Casuarina obesa*. Other common species include *Melaleuca teretifolia*, *Atriplex cinerea*, *Samolus repens*, *Salicornia quinqueflora* and S*porobolus virginicus*. The community is otherwise known as 'floristic community type 15' as described in Gibson *et al*. (1994).

Gibson *et al.* (1994) lists the following native species as typical for FCT15; *Melaleuca rhaphiophylla*, *Isolepis producta*, *Lemna disperma*, and *Triglochin procerum*, and *Melaleuca teretifolia* as a common species.

Introduced species including **Cotula coronopifolia*, **Crassula nutans*, **Cynodon dactylon* are listed as typical herb species for this community.

8. Give a description of the associated non-biological landscape characteristics or components of the ecological community.

For instance, what is the typical landscape in which the community occurs? Note if it is associated with a particular soil type or substrate; what major climatic variables drive the distribution of the ecological community (e.g. rainfall). Note particular altitudes, latitudes or geographic coordinates

This community consist of low lying seasonally inundated flats, or poorly drained estuarine flats, on clay, sandy clay, or clay loam, as follows;

Occurrence 1 - Beermullah fluviatile deposits (Churchward and McArthur, 1980), Grey sandy clay

Occurrence 2 - Yanga fluviatile deposits (Churchward and McArthur, 1980), Grey sandy clay

Occurrence 3 - Yanga fluviatile deposits, Grey sandy clay/ Brown light clay

Occurrence 5 - Southern River complex and Bassendean sands (Churchward and McArthur soil map), brown sandy loam

Occurrence 6 - Pinjarra Plain, Guildford Unit - Brown clay/loam

Occurrence 7 - Vasse Estuarine Deposits (Chuchward and McArthur, 1980), sandy clay

Occurrence 8 - Bassendean Sands

Occurrence 9 - Bassendean Sands

9. Provide information on the ecological processes by which the biological and non-biological components interact (where known).

Most occurrences of the community are described as occurring in fresh water however surface waters are generally more saline than other related floristic communities. The community has an impeding clay layer and poor drainage. This layer supports retention of surface water, that supports germination and growth of the wetland species that comprise the community.

10. Does the ecological community show any consistent regional or other variation across its extent, such as characteristic differences in species composition or structure?

If so, please describe these.

Structurally, the community varied from low forest A, low forest B, low woodland B and dense thicket in quadrats established for Gibson *et al*. (1994). The species composition varies, in particular, in response to variations in salinity, and depth and timing of seasonal inundation.

11. Does the ecological community provide habitat for any listed threatened species and/or endemic species?

If so, please note the species and whether the species is listed on State and/or national lists and the nature of their dependence on the ecological community.

Occurrences 1 and 2 are in Twin Swamps Nature Reserve for Preservation of Fauna Short Necked Tortoise.

12. Identify major studies on the ecological community (authors, dates, title and publishing details where relevant).

CALM (2004) Western Swamp Tortoise (*Pseudemydura umbrina*) Recovery Plan) by Andrew A. Burbidge and Gerald Kuchling for the Western Swamp Tortoise Recovery Team. Department of Conservation and Land Management Western Australian Threatened Species and Communities, Wanneroo, and Department of Zoology, The University of Western Australia Nedlands, WA.

DEC (2010) [i]Western Australian Wildlife Management Program No. 50. Western Swamp Tortoise (*Pseudemydura umbrina*) Recovery Plan for the Western Swamp Tortoise Recovery Team. Department of Environment and Conservation Swan Coastal District.

Gibson, N., Keighery, B., Keighery, G., Burbidge, A & Lyons, M. (1994) A floristic survey of the Southern Swan Coastal Plain. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Perth, Western Australia.

Government of Western Australia (2000). Bush Forever. Department of Environmental Protection, Perth.

Distribution

13. Describe the distribution across WA and nationally.

State the appropriate bioregions where the ecological community occurs. Attach or provide any maps showing its distribution with details of the source of the maps, or explain how they were created and the datasets used.

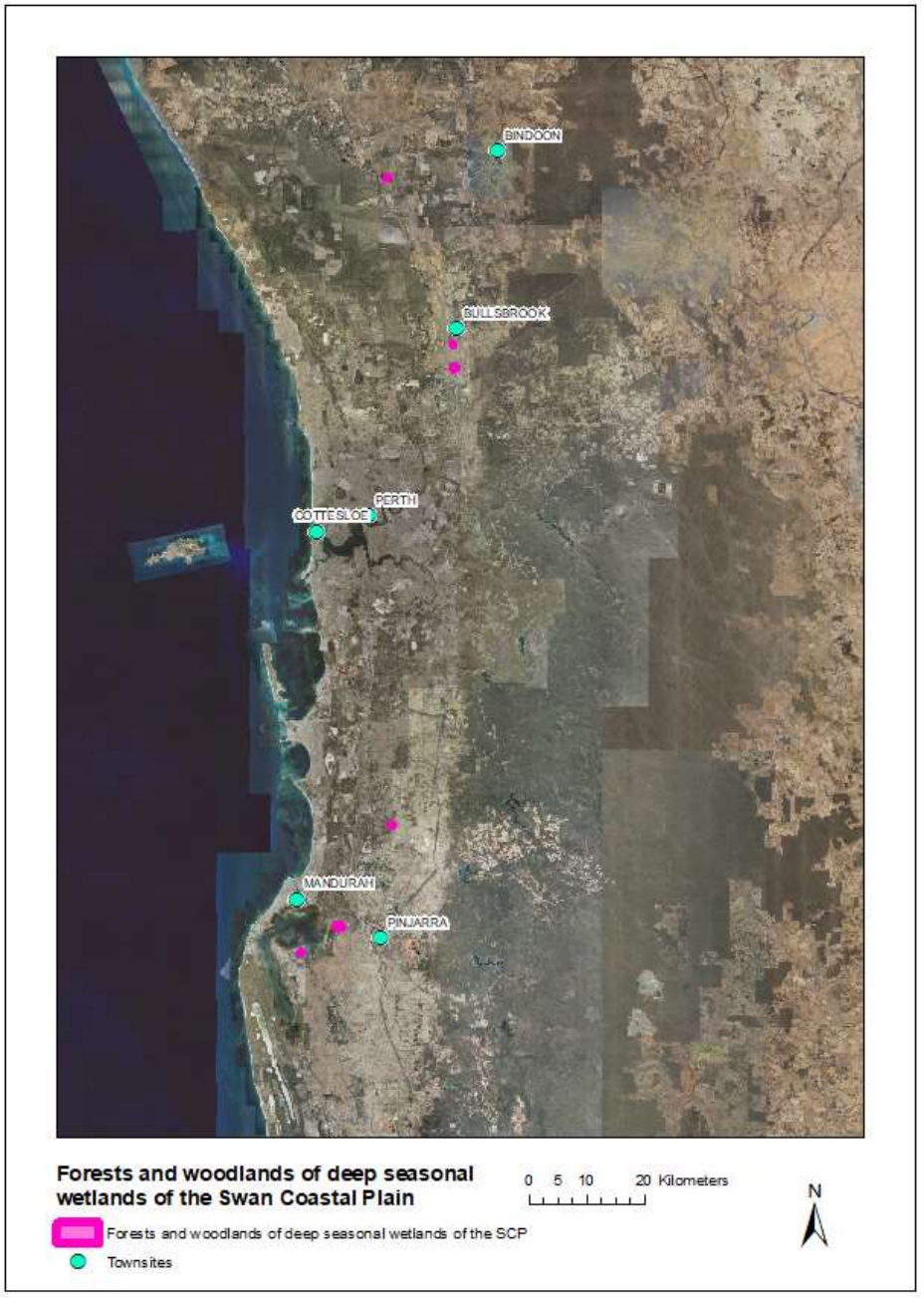

Figure 1: Distribution of occurrences of the Forests and Woodlands of deep seasonal wetlands of the Swan Coastal Plain

14. What is the area of distribution of the ecological community?

For answers to parts a, b, c & d: please identify whether any values represent extent of occurrence or area of occupancy (as described in the Attachment); provide details of the source(s) for the estimates and explain how they were calculated and the datasets used.

14 a. What is the current known area (in ha)?

14 b. What is the pre-industrialisation extent or its former known extent (in ha)? An ecological community is considered to be naturally restricted if it has a pre-industrialisation area of occupancy that is less than 10 000 ha or a pre-industrialisation extent of location that is less than 100 000 ha (refer to the Attachment A)

14 c. What is the estimated percentage decline of the ecological community?

14 d. What data are there to indicate that future changes in distribution may occur?

Statistics for the community calculated from the TEC database May 2019 occurs in table 1 below.

Table 1: Area data for occurrences of the Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain

Number	8
Minimum	1.3 ha
Maximum	7.0 ha
Mean	3.2 ha
Total area	25.5 ha

Patch size

15. What is the typical size (in ha) for a patch of the ecological community (if known)?

Explain how it was calculated and the datasets that are used. Relevant data includes the average patch size, the proportion of patches that are certain sizes, particularly proportions below 10 ha and below 100 ha, (but also below 1 ha and above 100 ha, for example). This could be presented as the range of patch sizes that comprise 90% of the locations.

All 8 occurrences area under 10ha in size, with only 1 larger than 5ha. Occurrences were mainly located through the Gibson *et al* (1994) study of >500 quadrats established across the southern Swan Coastal Plain, and the additional ~1000 quadrats established for Government of Western Australia (2000). Site specific studies of areas such as at Austin Cove later resulted in identification of additional occurrences of the community.

16. Quantify, if possible, the smallest percentage or area required for a patch of the ecological community to be considered viable.

This refers to the minimum size of a remnant that can remain viable without active management. It may be determined through the requirements for dominant native species, level of species diversity, or the nature of invasive weeds.

The minimum viable condition to be considered viable is Good Condition. This refers to a patch in which "Vegetation structure altered but retains basic vegetation structure or ability to regenerate it. Obvious signs of disturbance, e.g. from partial clearing, dieback, logging, grazing. Presence of very aggressive weeds." (Keighery (1994) vegetation condition scale (Government of WA 2000)). No minimum patch size is specified, as future viability will depend on management. Very small areas are known to be able to maintain condition if they are subject to very minimal disturbance. The decline in condition in Bambun02 has been recently noted to have moved below the threshold of Good condition.

Functionality

17. Is the present distribution of the ecological community severely fragmented?

If so, what are likely causes of fragmentation?
If fragmentation is a natural or positive characteristic of this ecological community, please explain this and state the reason.
Severely fragmented refers to the situation in which increased extinction risk to the ecological community results from most remnants being found in small and relatively isolated patches.

Yes, the community is highly fragmented, with the 8 occurrences distributed over a range of ~135 km from north to south. Each occurrence is small and aerial photography indicates that each of the occurrences, while linked to small areas of other intact vegetation, are separated from each other by roads, urban development, and infrastructure.

18. Has there been a loss or decline of functionally important species?

This refers to native species that are critically important in the processes that sustain or play a major role in the ecological community and whose removal has the potential to precipitate change in community structure or function sufficient to undermine the overall viability of the community.

Unknown

18 a. If yes, which species are affected?

Unknown.

18 b. How are the species functionally important and to what extent have they declined?

Unknown.

Reduction in community integrity

19. Please describe any processes that have resulted in a reduction in integrity and the consequences of these processes, e.g. loss of understorey in a woodland. Include any available information on the rate of these changes.

This recognises that an ecological community can be threatened with extinction through on-going modifications that do not necessarily lead to total destruction of all elements of the community. Changes in integrity can be measured by comparison with a benchmark state that reflects as closely as possible the natural condition of the community with respect to the composition and arrangement of its abiotic and biotic elements and the processes that sustain them. Please provide a description of the benchmark state where available. For further information please refer to the Guidelines.

From the perspective of buffering, isolation of the vegetation also amplifies the impacts of clearing, through ability of weeds to infiltrate the occurrences and outcompete native species for resources, resulting in changes in community composition. Weed invasion is recorded for all occurrences.

Survey and Monitoring

20. Has the ecological community been reasonably well surveyed?

Provide an overview of surveys to date, including coverage of different land tenure, and the likelihood of the ecological community's current known distribution and/or patch size being a true reflection of its actual distribution (consider area of occupancy and area of extent, including any data on number and size of patches).

Gibson *et al* (1994) study of >500 quadrats established mainly across public lands the southern Swan Coastal Plain. An additional ~1000 quadrats established for Bush Forever (2000) covered all land tenures including private land, where accessible. Site specific studies of areas such as at Austin Cove later resulted in identification of additional areas of the community.

Table 2: Survey data for the Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain (occurrence numbers are not sequential as are directly from the DBCA Corporate TEC database).

Occurrence No.	ID	No. of quadrats in Occurrence	Year of latest condition survey
1	TWIN05	1	2014
2	TWIN10	1	2014
3	BAMBUN01	1 (and 2 transects)	2019
5	yang01	1	2002

6	xpearce05	1 (Keighery)	2002
7	CARAB01	1	1995
8	AC09	1	2009
9	AC14	1	2009

21. Where possible, please indicate areas that haven't been surveyed but may add to the information required in determining the community's overall viability and quality.

Include commentary on issues to do with accessing different land tenures within the area of distribution, including private property, and the likelihood that these areas may include locations.

Further survey of occurrences at Austin Cove should be undertaken if access can be gained to the private lands on which additional likely habitat occurs.

22. Is there an ongoing monitoring program? If so, please describe the extent and length of the program.

There is no strategic monitoring program for this community, however, the boundaries and condition of occurrences are monitored opportunistically. Two 20m point intercept transects were established by Species and Communities program at Bambun02 in 2005. Weed levels were found to be very high, possibly as a consequence of declining periods of inundation associated with drying climate, and fires. A large increase in weed invasion was then recorded, and the program was not continued as the occurrence was considered collapsed. There is no evidence to date to indicate that other occurrences have been subject to similar large increases in weed levels.

Condition Classes and Thresholds

23. Do you think condition classes/thresholds apply to this ecological community? If not, give reasons.

The Committee recognises that ecological communities can exist in various condition states. In reaching its decision the Committee uses condition classes and/or thresholds to determine the patches that are included or excluded from the listed ecological community (see the Guidelines for details of the process of determining condition classes). Relevant here is recognition of different states following disturbance and the natural recovery of the location towards a higher condition class.

The minimum viable condition for this community to be considered viable is Good Condition. This refers to a patch in which "Vegetation structure altered but retains basic vegetation structure or ability to regenerate it. Obvious signs of disturbance, e.g. from partial clearing, dieback, logging, grazing. Presence of very aggressive weeds." (Keighery (1994) Vegetation Condition Scale (Government of WA, 2000)). Occurrences in Degraded or Completely Degraded condition (Bush Forever scales) are no longer considered to be representative of the community.

24. If so, how much of the community would you describe as in relatively <u>good condition</u>,

i.e. likely to persist into the long-term with minimal management?

Good condition relates to WA condition categories 'Very Good to Pristine' as below (see ^ below and Table 2 above) are considered to be in good condition, so therefore 16.1ha or 82% of occurrences with known condition are considered to be in good condition, and contain high native plant species diversity, maintain integrity of vegetation structure, and minimal weed/introduced species cover. All occurrences are in urban areas and are subject to the ongoing pressures and disturbances associated with clearing, trampling, weed infiltration and rubbish dumping.

Table 3: Condition of occurrences of Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain for which condition is known

Condition Ranking (Keighery 1994, from Government of Western Australia 2000)	**Hectares**
Excellent	7.2
Very Good	8.9
Good	2.3
Degraded	1.3
Total	**19.7ha**

25. What features or variables do you consider to be most valuable for identifying a patch of the ecological community in relatively <u>good condition</u>?

Variables for establishing the highest condition class may include: patch size; connectivity; native plant species composition; diversity and cover (for example in overstorey; mid-shrub and/or understorey layers); recognised faunal values; and cover of weeds or other invasive species.

See Section 24 above.

*Condition categories from (Keighery (1994) Vegetation Condition Scale in Bush Forever (Government of WA 2000)) are defined below:

Good ('Pristine', 'Excellent', 'Very Good' using Bush Forever (2000) scale): This includes vegetation ranging from 'Pristine' - with no obvious signs of disturbance, to 'Excellent' - Vegetation structure intact, with disturbance only affecting individual species, weeds are non-aggressive species and 'Very Good' - Vegetation structure altered, obvious signs of disturbance eg: from repeated fires, dieback, logging, grazing.

26. How much of the community would you describe as in relatively <u>medium condition</u>, i.e. likely to persist into the long-term future with management?

*For the purposes of relating condition to IUCN Criteria, condition categories from (Keighery (1994) Vegetation Condition Scale in Bush Forever (Government of WA 2000)) are defined below:

Medium ('Good' using Bush Forever (2000) scale): This includes vegetation categorised as 'Good' - Vegetation structure altered but retains basic vegetation structure or ability to regenerate it, obvious signs of disturbance are present, from activities including partial clearing, dieback and grazing.

* 2.3ha or 12% of known occurrences is considered to be in medium condition, and contain medium plant species diversity, altered vegetation structure, and a medium level of weed/introduced species cover.

27. Please describe how you would identify areas in <u>medium condition</u> using one or a combination of indicators such as species diversity, structure, remnant size, cover of weeds or other invasive species, etc.

See Section 26 above

28. How much of the community would you describe as in relatively <u>poor condition</u>, i.e. unlikely to be recoverable with active management?

1.3 ha or 6% of known occurrences are considered to be in poor condition, with vegetation containing minimal native flora, presence of aggressive weeds, and evidence of high-level disturbance. Bambun03 was in degraded condition in 2012. Dieback observed in Twin Swamps (pers comm [redacted][1]).

^ This includes vegetation ranging from 'Degraded' Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires; the presence of very aggressive weeds; partial clearing; dieback; grazing to 'Completely Degraded' where the structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

29. Please describe how you would identify areas in <u>poor condition</u> using one or a combination of indicators such as species diversity, structure, remnant size, cover of weeds or other invasive species, etc.

See section 28 above

Threats

Note: If you plan to identify <u>climate change</u> as a threat to the ecological community, please refer to the Guidelines for information on how this should be addressed.

30. Identify <u>PAST</u> threats to the ecological community indicating whether they are *actual* or *potential*.

Historical, current, and ongoing threats recorded for this community include weed invasion, fire, grazing, hydrological change (occurrence 1), weed invasion and grazing (occurrence 2), weed invasion and grazing (occurrence 3), weed invasion (occurrence 6 and 7). All are actual threats.

31. Identify <u>CURRENT</u> threats to the ecological community indicating whether they are *actual* or *potential*.

Table 4: Current threats (occurrence numbers are not sequential as they are taken directly from database)

Occurrence	Weed invasion	Clearing	Grazing	Hydrological changes	Too frequent fire	Reduced rainfall
1. TWIN05	Actual		Actual	Actual	Potential	Actual
2. TWIN 10	Actual		Actual	Actual	Potential	Actual
3. BAMUBUN02	Actual		Actual	Actual	Actual	Actual
5. Yang01			Actual	Actual		Potential
6. Mypearce06	Actual				Actual	Potential
7. CARAB01	Actual	Potential			Potential	Potential
8. AC09	Actual	Potential		Potential		Potential
9. AC14	Actual	Potential		Potential		Potential

See section 30 above.

[1] [redacted]: Previously, Senior Principal Botanist DBCA

32. Identify FUTURE threats to the ecological community indicating whether they are *actual* or *potential*.

Reduced rainfall and too frequent fire are potential threats to most occurrences. Weed invasion is an ongoing threat in all occurrences.

See also section 30 above.

For <u>each</u> threat describe:

322 a. How the threat has impacted on this ecological community in the past.

Clearing has likely historically reduced the habitat of this community by 90%, resulting in complete destruction of occurrences of the community.

322 b. What its expected effects are in the future. Include or reference supporting research or information.

Reduced rainfall and too frequent fire are potential threats to most occurrences. Weed invasion is an ongoing threat in all occurrences.

322 c. Identify whether the threat only affects certain portions or locations. Give Details.

The threats listed in Table 3, Section 32 above are expected to affect occurrences both at the edges, and within each of the occurrences. Drying climate and associated reduced water levels and seasonality are expected to alter composition to dominance by increasingly drought tolerant flora over time. Weed invasion is associated with disturbance and is also likely to be affected by hydrological change, however the overall results of the latter changes are not yet known. Stock grazing has been recorded historically in some occurrences, but should not occur in future due to ownership changes. Fire may occur at any area, particularly with vandalism/disturbance and is likely to be increasingly common in the urbanised habitats.

33. Identify any natural catastrophic event/s

Explain its likely impact and indicate the likelihood of it occurring (e.g. a drought/fire in the area every 100 years). Catastrophic events are those with a low predictability that are likely to severely affect the ecological community.

(Source: Australian Government Department of Climate Change and Energy Efficiency Fact Sheet, as referred to in DRAFT IUCN Banksia woodlands Case Study 30 April, 2013) The incidence of more frequent and intense fires is likely in the South West of Western Australia. Projections indicate that the annual average number of days above 35°C in Perth could increase from the 28 currently experienced to up to 67 days by 2070 without global action to reduce emissions. Projections also indicate an increase in the intensity and frequency of bushfires. The 2010-11 WA bushfire season was one of the most devastating and destructive in the state's history, and followed the driest winter on record.

34. Additional biological characteristics

Identify and explain any additional biological characteristics particular to the community or species within it that are threatening to its survival (e.g. low genetic diversity). Identify and explain any models addressing survival or particular features.

None are known.

344 a. How does it respond to disturbance?

Grazing by stock, and a hot summer fire, have resulted in increases in weed invasion in occurrences of the community.

34 b. How long does it take to regenerate and/or recover?

As hot fire resulted in high level weed invasion and recovery was not recorded following that specific disturbance.

Threat Abatement and Recovery

35. Identify key management documentation available for the ecological community, e.g. recovery plans, biodiversity management programmes, or site specific management plans (e.g. for a reserve).

Several recovery plans have been developed for the Western Swamp Tortoise at Twin Swamps Reserve (see Section 12 above).

36. Give an overview of how threats are being/potentially abated and other recovery actions underway and/or proposed. Identify who is undertaking these activities and how successful the activities have been to date.

With regard to Occurrence 2, a commitment by DBCA to exclude fire in this occurrence, protects it from the threat of too frequent fire, which can favour weeds and resprouters, and alter the community structure. Limited information is available with regard to threat abatement for the remaining occurrences.

37. What portion of the current extent of the ecological community is protected in a reserve set aside for conservation purposes, and what proportions are private land, or other tenure? Give details including the name of the reserves, and the extent the ecological community is protected within these reserves.

- Occurrences 1 and 2 are both located within Twin Swamps Nature Reserve, Warbrook Rd, Bullsbrook and on the Register of National Estate as at December 1994 (9ha)
- Occurrence 3 is within Reserve 22831 Bambun Rd, Gingin, and is vested as 'Recreation' with the Shire of Gingin. Adjacent vegetation within the reserve forms a small buffer around the occurrence (1.3ha)
- Occurrence 5 YANG01 is in Keysbrook has been acquired for conservation is planned for transfer to management by DBCA (1.78ha).
- Occurrence 6 is within Pearce Airbase land, which is on National Heritage List as at December 2000 as Indicative Place. The purpose is 'For Defence', and it is managed by the Commonwealth Department of Defence (2.4ha).
- Occurrence 7 is within Carabungup Nature Reserve, on the south side of Peel Inlet, and is listed as 'Crown Reserve - Nature Reserve Land Tenure Number - A4990' (6.34ha). Approximately 0.7ha of Occurrence 7 occurs on private land.
- Occurrence 8 and 9 are located on private land (1.64ha, 2.43ha)
- Occurrence 1, 2, 5 and 6 are all included in Bush Forever (Government of Western Australia 2000).

378 a. Which of the reserves are actively managed?
Note which, if any, reserves have management plans and if they are being implemented.

Twin Swamps Nature Reserve is actively managed for the Western Swamp Tortoise. The site has a fox proof fence. The management regime does not allow for weed control, and the supplemental water may alter the composition of the community. The swamps are significantly affected by drought and drying climate. Water quality varies between swamps. Some swamps receive run-off from surrounding land and have relatively high levels of phosphates and nitrogen and others have good quality water. In 1994, the Western Australian Water Corporation installed a bore and pipelines in Twin Swamps Nature Reserve as sponsorship of the Western Swamp Tortoise Recovery Plan which is managed by DBCA. Pumping of groundwater into the north west swamp has taken place every year since 1994. In recent years rather than supplementing water levels late in the season as intended, pumping has been required throughout the winter and spring. An upgrade of the bore and pump system to sustain key swamps was completed in 2008 to reduce the effects of reduced rainfall (Burbidge *et al*. 2008).

Weed control and fencing occurred at Carrabungup NR in 2013.

378 b. Give details of any other forms of protection, such as conservation covenants, and whether the protection mechanisms are permanent.

378 c. Indigenous interests

Is the nominated ecological community or parts thereof known to occur on any culturally significant sites? If so comment on any issues with respect to aboriginal interests, in particular with regard to management of the ecological community.

Occurrences of this community fall within the following agreement areas;

- Yued Indigenous Land Use Agreement Wi2015/009
- Whadjuk People Indigenous Land Use Agreement Wi2017/015
- Gnaala Karla Booja Indigenous Land Use Agreement Wi2015/005

378 d. Native Title

Do Native Title or Indigenous Protected Areas apply to any parts of the community? If so comment on any issues with respect to exclusive possession and rights to plants and animals, in particular with regard to management of the ecological community.

See Section 38d above.

39. Give details of recovery actions that are or could be carried out at the local and regional level, e.g. develop and implement management plan for the control of specific weed species (regional), undertake weeding of known sites (local).

Some occurrences require fencing. Weed monitoring and control should be established. Hydrological monitoring should be established and linked with monitoring of vegetation composition.

40. Is there an existing support network for the ecological community that facilitates recovery? e.g. an active Landcare group, Conservation Management Network.

The Swan Region Threatened Flora and Ecological Communities Recovery Team coordinates the management of all threatened flora and ecological communities in the DBCA's Swan region.

41. Describe methods for identifying the ecological community including when to conduct surveys.

For example, season, time of day, weather conditions; length, intensity and pattern of search effort; and limitations and expert acceptance; recommended methods; survey-effort guide. Include references.

The community should be sampled early and late peak flowering seasons. 10 x 10m quadrats should be established to sample vegetation of the southern Swan Coastal Plain. This can be altered to a varying shape that constitutes 100m² where fringing vegetation is not of sufficient width. Comprehensive quadrat data should be compared statistically to the original quadrat data from Gibson *et al* (1994) and the best matches determined for the floristic community type, including consideration of habitat, and key combinations of species.

42. Are there other any aspects relating to the survival of this ecological community that you would like to address?

Section 3 - Justification for this nomination

In order for the nomination to be considered further, one or preferably more of the following criteria need to be fulfilled and substantiated. A clear case for why the ecological community is eligible for listing under the criteria is required, including evidence as to how it meets the requirements for listing under a particular listing category, e.g. 'David *et al*. (1999) finding of 95% decline in geographic distribution suggests it should be listed as critically endangered'. The type of data available will determine which criteria will be used to justify the application of a listing category.
At least one criterion must trigger the thresholds of a listing category as indicated in the Attachment. Criteria may be of different levels of listing category e.g. Criterion 1 = CR and Criterion 3 = VU.

43. Provide data that demonstrates why the ecological community meets at least one of the following criteria for the nominated listing category.

Please use data provided in previous sections to demonstrate how it specifically meets at least one of the following criteria. Advice on how to interpret the listing criteria is in Attachment A. Provide a response for every sub-criterion.

Criterion A: Reduction in geographic distribution.

Criterion A	
☒ CR ☐ EN ☐ VU ☐ not eligible	☐ **A1** ☐ **A2a** ☐ **A2b** ☒ **A3**

Justification for assessment under Criterion A:

For criteria A and B, the community is assumed to collapse when the mapped distribution declines to zero.

Gibson *et. al*. (1994) provides an analysis of the level of clearing of the lands and geomorphological types that support the floristic community types identified in their study. They also state which floristic community types are regionally rare. Table 23 in Gibson *et al.* (1994) indicates that the range contraction for this community is likely to be >90% based on the reduction through clearing of the two major geomorphological units on which it occurs – the swamp deposits and lagoonal and estuarine deposits. The report states "…data were used to indicate which of the floristic units are likely to have suffered major range contractions (Table 23)." Gibson *et al.* (1994) also noted this community is likely to be regionally rare.

The level of reduction of the geomorphological or geological units that support the community is assumed to reflect the reduction in distribution of the community. Gibson *et al*. (1994) noted that, based on the level of clearing of the geomorphic units that support this community, its range was estimated to be reduced by > 90%. This assumption is utilised in the application of this criterion. As no data were sourced about the timing of the clearing of the community, the reduction in distribution is conservatively assumed to be since 1750. The community therefore meets critically endangered under A3, with an estimated historical reduction in geographic distribution of ≥ 90%.

- **Meets criteria for Critically Endangered under criterion A3**

Criterion B: Restricted geographic distribution.

Criterion B	
☒ CR ☒ EN ☒ VU ☐ not eligible	☒ **B1** (specify at least one of the following) ☐ **a)(i)** ☐ **a)(ii)** ☐ **a)(iii)** ☒ **b)** ☒ **c);** ☒ **B2** (specify at least one of the following) ☐ **a)(i)** ☐ **a)(ii)** ☐ **a)(iii)** ☒ **b)** ☒ **c);** ☐ **B3** (only for Vulnerable Listing)

Justification for assessment under Criterion B:

B1: EEO (extent of a minimum convex polygon) for this community is 1640.31km², so an EEO of ≤2000km² which is the threshold for critically endangered.

Occurrence 3 has shown a continuing decline in vegetation condition (recorded using the Keighery condition scale shown in Bush Forever 2000), with condition having been recorded as excellent in 1994 (8/12/1994), then recorded as Good in 2010 (4/10/2010), then as Degraded in 2012 (11/10/2012). This reduction in vegetation condition illustrates how weed invasion is associated with ongoing decline. Where weeds levels were evaluated, the assessments demonstrate ongoing decline. All occurrences are have been observed visually and are inferred to be affected by weed invasion, according to data in the DBCA corporate TEC database. Occurrences are not known to be subject to ongoing active weed management.

Hydrological change is also ongoing in response to drying climatic regime in the south west of the state. This is likely to adversely impact this community. The following climatic model details the predictions for changing rainfall for the South West of Western Australia: https://www.climatechangeinaustralia.gov.au/en/climate-projections/future-climate/regional-climate-change-explorer/sub-clusters/?current=SSWSW&tooltip=true&popup=true.
"Early in the century (2030) and under all emission scenarios, winter rainfall is projected to decrease by up to 15%. Late in the century, intermediate emissions (RCP4.5) lead to a projected decrease in winter rainfall of up to around 30%, and under high emissions (RCP8.5) winter rainfall decline is projected to decrease by up to 45%."
Reduced rainfall and altered hydrology are likely to favour terrestrialisation of the community. Fire frequency and intensity are also likely to increase as a consequence of reduced rainfall, and are inferred threats.

Weed invasion, declining surface and groundwater levels are observed and inferred threatening processes that are likely to cause continuing decline in environmental quality and biotic interactions within the next 20 years. The community is eligible for critically endangered under B1b.

This community exists at six threat defined locations ≤10, and therefore meets criterion for Vulnerable under B1c.

B2: The AAO for this community is 4 10x10km grid cells. The distribution actually falls into 7 grid cells, however several spatially grouped occurrences would fall within a single 10x10km grid cell if the grid layout were to be moved (as is advised in the IUCN RLE Guidelines), hence the community is considered to occupy 4 grid cells. This falls within the threshold of ≤20 to meet Endangered under B2.

Weed invasion, and declining surface and groundwater levels are observed and inferred threatening processes that are likely to cause continuing decline in environmental quality and biotic interactions within the next 20 years. The community is eligible for endangered under B2b.

This community is considered to exist at 6 threat defined locations, and therefore meets the vulnerable under criterion B2c.

B3: The number of threat-defined locations for this ecological community is 6, which is greater than the thresholds of 5 required to meet B3. The community does not meet this criterion.

Meets CR B1b, EN under B2b, VU under B1c, B2c.

Criterion C ☐ CR ☐ EN ☐ VU ☐ not eligible	☐ **C1** ☐ **C2** ☐ **C3**

Justification for assessment under Criterion C:

C1, C2: Reduced surface water and potentially groundwater as a result of drying climate is a significant abiotic variable affecting the community. Monitoring of occurrence 3 indicates a link between decreased surface water and increased weed invasion, with a massive increase in weed invasion associated with a large reduction in inundation with surface water. Collapse is defined as reduction in surface water that results in complete loss of native species in the community and replacement with weeds.

Although occurrence 3 is considered to have reached a collapsed state, there are inadequate monitoring data to link the level of reduction in surface water to vegetation composition in the community. This would be required to determine a collapse point for surface water levels.

Inadequate evidence is available to indicate if the community meets the minimum thresholds for proportion of the extent (≥30%) or proportional severity of degradation (≥30%) over past 50 years, or ≥50% of the extent and ≥50% relative severity since 1750 to meet VU.

- **Inadequate data available to determine if community meets criterion C**

Criterion D: Disruption of biotic processes or interactions based on change in a biotic variable.

Criterion D ☐ CR ☐ EN ☐ VU ☒ not eligible	☐ **D1** ☐ **D2** ☐ **D3**

Justification for assessment under Criterion D:

- D1, D2: Weed invasion is a significant biotic variable that has potential to impact the community. Weed invasion is a significant biotic variable affecting the community. The severity of weed invasion associated with collapse is uncertain, but it is assumed conservatively that the community reaches a collapsed state when only 10% (plausible range 0–20%) of the vegetation cover is native plant species. Quantifiable data were only available for one occurrence with regard to weed invasion.

- Occurrence 3 has shown a continuing decline in vegetation condition (recorded using the Keighery condition scale shown in Bush Forever 2000), with condition having been recorded as Excellent in 1994 (8/12/1994), then recorded as Good in 2010 (4/10/2010), then as Degraded in 2012 (11/10/2012). This reduction in vegetation condition illustrates how in this occurrence weed invasion has caused ongoing decline, through greater numbers of individuals and/or diversity of introduced species outcompeting native species between assessments. Where weed levels have been evaluated in the community, the assessments demonstrate ongoing decline. All occurrences have been observed visually to be affected by weed invasion, however insufficient data exists to provide a quantified measure of weed invasion across occurrences.
- Insufficient available data available to indicate if the community meets the threshold for 30% severity over 30% of the extent of the community in any 50 year time period, or 50% thresholds since 1750t to meet VU.

- **Does not meet criterion D**.

Criterion E: Quantitative analysis that estimates the probability of ecosystem collapse.

Criterion E	
☐ CR ☐ EN ☐ VU ☒ not eligible	

Justification for assessment under Criterion E:

- No quantitative estimates of the risk of ecosystem collapse have been completed.
- **Unable to assess**

Section 4 – References/Standard of Scientific Evidence/Critical habitat

Note: The opinion of appropriate scientific experts may be cited (with their approval) in support of a nomination. If this is done the names of the experts, their qualifications and full contact details must also be provided in the reference list below. Harvard style of referencing is preferred.

44. Please provide copies of key documentation/references used in the nomination.

Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. (1994) A floristic survey of the Southern Swan Coastal Plain. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Perth, Western Australia.

Government of Western Australia (2000). Bush Forever. Department of Environmental Protection, Perth.

45. Statement on the Standard of Scientific Evidence

The occurrences have not been subject to a strategic monitoring program therefore a series of data required to support assessment against some criteria were not available. Unpublished information and survey data were sufficient to apply some of the Red List of Ecosystem criteria. For the criteria applied for assessment, the outcomes are considered robust.

Uncertainties exist in aspects of the hydrological status in relation to composition of the occurrences. A well designed, systematic, long term monitoring program with spatially and temporally linked data for parameters including floristics, hydrology, and invasive species is required to better understand the relationships between changes in the community and the most significant threatening processes.

46. Has this document been reviewed and/or have relevant experts been consulted?
If so, indicate by whom and provide their contact details.

Yes, the document has been reviewed within the Department.

47. Do you wish to propose any areas of habitat for consideration as Critical Habitat for the nominated community?
If so, refer to Ministerial Guideline No 5 and attached a separate nomination proposal addressing the matters required under that guideline. Indicate location/s including a map, and attached shapefiles.

No

Summary assessment against IUCN RLE Criteria

Criterion	Rank indicated	Overall conclusion
A1	-	• Available data do not indicate community meets criterion
A2a	-	• Available data do not indicate community meets criterion
A2b	-	• Available data do not indicate community meets criterion
A3	CR	• Reduction in geographic distribution likely to be ≥90% • Meets criterion for CR
B1a	-	
B1b	CR	• EOO is 1640.3131 km² (≤2,000km^2) • Weed invasion, and declining surface and potentially groundwater levels are likely to cause continuing decline in environmental quality and biotic interactions within the next 20 years.
B1c	VU	• EOO is 1640.3131 km² (≤2,000km^2) • Community exists at 6 threat-defined locations (ie ≤10, therefore meets VU) • Meets criterion for VU
B2a	-	

B2b	EN	• AOO is four grid cells • Weed invasion, and declining surface and potentially groundwater levels likely to cause continuing decline in environmental quality and biotic interactions within the next 20 years • Meets criterion for EN
B2c	VU	• AOO is four grid cells • Community exists at 6 threat-defined locations (ie ≤10, therefore meets VU) • Meets criterion for VU
B3	-	• Known from >5 threat-defined locations • Does not meet this criterion
C1	-	• Insufficient data available to determine if community meets the criterion.
C2	-	• Insufficient data available to determine if community meets the criterion.
C3	-	• Insufficient data available to determine if community meets the criterion.
D1	-	• Insufficient data available to determine if community meets the criterion.
D2	-	• Insufficient data available to determine if community meets the criterion data available to determine if community meets the criterion.
D3	-	• Insufficient data available to determine if community meets the criterion data available to determine if community meets the criterion.
E	NA	• No quantitative estimates of the risk of ecosystem collapse.
		Meets CR under A3, B1b. Meets EN under B2b. Meets Vulnerable under B1c, B2c. *'The highest risk category obtained by any of the assessed criteria will be the overall risk status of the ecosystem'* (IUCN RLE Guidelines V1.1 page 42). Meets CR A3, B1b.

Section 5 - Nominator Details & Declaration

48. Contact Details

Note: Nominator details are subject to the provision of the *Privacy Act 1988*

Title/Full Name	[redacted]
Organisation or Company name	DBCA
Postal address	DBCA Kensington

Email	[redacted]@dbca.wa.gov.au
Phone	9219 [redacted]
Fax	
49. Declaration	
Signature (Or insert electronic signature)	***I declare that the information in this nomination form and any attachments is true and correct to the best of my knowledge.***
Date signed	

Section 6 – Completed nomination form checklist

Please check all items on this list have been completed or are included with your nomination.

- ☐ I have read and applied the further information and guidelines for completing this nomination form in Attachment A
- ☐ Nominator details including name, address contact phone number included
- ☐ Name of the EC
- ☐ Any other names it is known by
- ☐ Map included or attached
- ☐ References cited
- ☐ If questions are left unanswered, a statement indicating that insufficient information is available

A description of:

- ☐ Biological components of the ecological community
- ☐ Non biological components of the ecological community
- ☐ Key interactions and functional processes
- ☐ Characters distinguishing it from other ecological communities
- ☐ Key species (dominant, characteristic or diagnostic, threatened etc)
- ☐ Known or estimated current extent of the ecological community
- ☐ Past/current/future threats including actual/potential, how/ where, how being/how could be abated
- ☐ Which listing category/categories it should be listed under and why

How to lodge your nomination

Completed nominations may be lodged either:

1. by email to: **communities.data@dbca.wa.gov.au**

If submitting by email, please also mail hard copies of attachments that cannot be emailed.

OR

2. by mail to: Species and Communities Program
Department of Biodiversity, Conservation and Attractions, WA Government
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

If submitting by mail, please include an electronic copy on memory stick or CD.

[i] [redacted]