Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Section 1 – Eligibility for Listing		
1. Name of the ecological community		
Assemblages of Big Springs organic mound springs		
2. Listing Category for which the ecological community is nominated		
	Current rank under WA Minister ESA list in policy	EPBC Act (wholly or as a component)
Current listing category (Please check box)	☐ Critically endangered ☐ Endangered ☒ Vulnerable ☐ Priority 1-4 ☐ Data Deficient ☐ None – not listed	Name: ☐ Critically endangered ☐ Endangered ☐ Vulnerable ☒ None – not listed
Proposed listing category under BC Act (Please check box)	☐ 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?
Assemblages of Big Springs organic mound springs.

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

Although the community was not included in the original survey of Kimberley Rainforests by Keneally *et al*. (1991), the plant assemblages recorded at wetland patches sampled in the survey were used to provide a comparison for those on the organic mound springs of Big Springs. Halse (2001) further identified the community as important due to its relatively rich aquatic habitat. A further Kimberley Mound Spring survey that was undertaken in 2017 (Pryde 2017) included Big Spring. The community type was recognised and was endorsed as a vulnerable community by the WA Minister for Environment in 2002. It was ranked vulnerable using ranking criteria developed in WA, that differ from those used for the IUCN RLE. The community is not currently listed under the EPBC Act.

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).

Big Springs occurs at the same latitude as the Bunda Bunda organic mound springs community, listed as Vulnerable in WA:
Description: Organic mound spring communities of Bunda Bunda, Dampierland Bioregion. The site consists of two organic mound springs on tidal mudflats in Carnot Bay on the Dampier Peninsula north of Broome.

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.

The Big Springs organic mound springs community is comparable to the Bunda Bunda organic mound springs community in its near tidal setting however, it has an entirely different physiography and flora. The vegetation found in the Bunda Bunda community also appear to be different from that of wetland rainforest patches described in the Kimberley Rainforest Survey (Keneally *et al*. 1991). Some of the same dominant species also occur at Walcott Inlet, 90km north east of Big Springs; *Ficus* spp., *Nauclea orientalis* and *Celtis philippinensis* (Stoneman *et al*. 1991).

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).

The community comprises a complex system of freshwater seepages and peaty springs with internal moats with broad tidal flats on the seaward margin and cracking clay flats on the landward margin. It occurs in the West Kimberley. A further feature is the scattered clusters of small outlying, densely vegetated mound springs. The main seepage area supports well developed rainforest vegetation dominated by forests of *Terminalia microcarpa* (damson plum). Several mistletoe species (Loranthaceae) have been recorded in the *Terminalia* canopy, which reaches 20 m in places. Other trees present include *Ficus racemosa* (cluster fig), *Ficus virens* (banyan fig), *Melaleuca leucadendra* (paperbark), *Pandanus* sp. (screw palm), *Sesbania formosa* (white dragon tree) and *Timonius timon*. Much less common species noted were *Antidesma ghaesembilla* (Yangu), *Diospyros maritima* and *Nauclea orientalis* (Leichardt tree). The understorey varies from central open glades with turf of Cyperaceae to pure leaf litter under the *Terminalia* canopies. Internal moats support *Acrostichum speciosum* (mangrove fern). The outer perimeter of the large seepage feature is relatively dry in most places with this ring generally dominated by dense thickets of *Melaleuca alsophila* or *Acacia ampliceps* (or both) with scattered *Bauhinia cunninghamii, Dichrostachys spicata* (Chinese lantern) and occasional *Adansonia gregorii* (boab) of small stature. Outlying mound spring islands on tidal flats vary markedly in size and in the diversity of vegetation. Some of the smallest islands consist solely of *Typha domingensis* (bulrush). Larger examples often feature *Pandanus spiralis*, *Sesbania*

formosa, *Acacia neurocarpa* and occasionally *Terminalia microcarpa* and *Ficus* sp. (fig), with a range of Cyperaceae. Several islands were noted with unusual associations such as *Typha* sp. growing with the mangrove *Lumnitzera* sp. The permanent groundwater discharge from the springs provides aquatic habitats (pools and seepages, plus the saturated peat itself) that support distinct assemblages of aquatic invertebrates, often with stygal and restricted elements. The mesic environment in these springs probably also support distinct terrestrial invertebrate fauna assemblages (DBCA 2019).

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

Big Springs organic mound springs are situated on the eastern shore of King Sound, with broad saline coastal tidal flats on the seaward margin at the mouth of the Meda River, and cracking clay flats on the landward margin. Surface geology is supratidal mudflat deposits with a mixture of clay, silt, sand and minor salt, and the substrate varies from peat through to peaty grey clay to grey clay, mostly damp with light to very heavy leaf litter and decaying vegetation (DBCA 2019).

The climate for the nearest town, Derby, located 50km to the southeast, is described as tropical with warm winters and hot, humid summers. In summer (December to February), the average maximum temperature is 35.6°C with an average minimum temperature of 25.8°C. In winter (June to August), the average maximum temperature is 31.4°C with an average minimum temperature of 15.4°C. The mean yearly rainfall is 730.5mm (at Derby Main Road Station 3075; from 1983 to 2018), with the majority occurring during cyclone season from November to April (data obtained from Bureau of Meteorology website: http://www.bom.gov.au/climate/averages/tables/cw_003032.shtml).

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

Big Springs organic mound springs contain a complex system of freshwater seepages, peaty springs and pools with internal moats. Internal moats surround peaty mounds supporting large mature trees. The largest mound (BIGS01) is a heavily vegetated mound to an elevation of approximately 8m. The main seepage area has an extensive outflow swamp on its north west side.

The mound springs occur along the coast where groundwater discharges under pressure from depth through the overlying alluvium to the surface. The springs contain underlying hydrogeology, mineral composition and biogeochemical processes that are likely to be complex and variable. When monitored in 2017, the conductivity of the water was 354 µS/cm which is fresh. Total nitrogen was 0.31mg/L and total phosphorus was 0.042mg/L (from DBCA 2019).

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.

It is likely that variation in physiography and flora assemblage occurs within the Big Springs organic mound springs community. Partial survey of outlier springs showed less developed mounds, mostly with no standing water. Smaller mounds lacked well-developed vegetation structure and appeared low in floral species diversity.

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.

Big Springs organic mound springs community contains six species of invertebrates that have rarely or never been collected in Western Australia, including a water mite, *Arrenurus* sp. WA29, the ostracod *Strandesia* sp. 653 which was recorded from Big Spring in 1999 and 2017 (also occurring in King Gordon Spring), but is not known from elsewhere; *Mesocyclops woutersi* which has rarely been collected in Australia, but is widely distributed in south-east and east Asia; a harpacticoid copepod *Canthacamptus grandidieri* which has rarely been collected in

Australia; *Picropleuroxus quasidenticulatus* which is a new record for WA; and *Phyllognathopus volcanicus* which is the first collection record for Australia but the species is also known from New Zealand (DBCA 2019).

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

Department of Biodiversity, Conservation and Attractions (draft 2019) Biodiversity Survey, Mapping, Delineation and Assessment of Selected Organic Mound Springs of the Kimberley Region. Department of Biodiversity, Conservation and Attractions, Kununurra.

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.

Big Springs organic mound springs are situated on the eastern shore of King Sound, adjacent to the boundary of Meda Station, 12km east of the mouth of Meda River and 50km north-east of Derby. There are 24 known mapped locations, covering a total of 69.8ha, with one large densely vegetated mound, and 23 outlying mounds extending northward for around 3km along the salt margins.

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)? 69.8ha

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 occurrence that is less than 100 000 ha (refer to the Attachment A)

There is no evidence to indicate extent has declined.

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

See above

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

None

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 occurrences.

The Big Springs organic mound springs community was mapped using ArcGIS© and a range of data sources including quadrat and survey data; on ground survey; aerial photography; and topographic maps, and that some of the original boundaries were inaccurate when overlaid on new aerial photography. Minimum patch size is 0.02ha and maximum patch size is 61ha. The mean patch size is 2.9ha (see table below for patch size proportions).

Table 1. Proportion of locations with a certain patch size.

Patch size (hectares)	Number of occurrences
<1	22 (92%)
<10	1 (4%)
<100	1 (4%)
>100	0 (0%)

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.

All areas of the Big Springs organic mound springs community that have been comprehensively surveyed are in good condition. There is no minimum area specified for a patch that could remain viable without active management.

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.

The Big Springs organic mound springs community is naturally fragmented occurring as scattered discrete patches on supratidal mudflat deposits on the eastern shore of King Sound, between broad saline coastal tidal flats on the seaward margin (at the mouth of the Meda River) and cracking clay flats on the landward margin.

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.

The invertebrates and flora in the community are a major part of characterising and differentiating the community. Changes to the vegetation and invertebrate composition are likely to occur through the impacts of introduced herbivores (cattle), introduction of weeds, altered fire regimes, and changes to water quality and quantity.

18 a. If yes, which species are affected?

Native flora species are affected by weed competition. Fire will affect those species that are fire sensitive. Cattle trample the mound springs vegetation and introduce nutrients and weed seed to the sites.

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

Cattle grazing, weed invasion, too frequent fire and hydrological changes can impact on the mound springs through reducing diversity of native flora and invertebrates, and altering hydrologic regimes.

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.

The structure of the Big Springs organic mound springs community is generally freshwater seepages and densely vegetated mound springs with internal moats. When in good condition the community contains well developed rainforest vegetation with a relatively rich aquatic habitat.

A condition class can be applied to the community as a whole based on:

- Proportion of community that is weed taxa, and weed cover
- Evidence of cattle trampling, crushing, and causing nutrient enrichment
- Number of previously recorded natural strata and structure of the vegetation present
- The presence/absence and previously recorded species of flora and fauna
- Hydrological changes within the springs.

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).

An extensive survey of Big Springs organic mound springs community was undertaken in 2017. The survey was undertaken by a team with expertise in identifying assemblages and inventory, biological surveys including flora and vegetation, aquatic invertebrate fauna identification and wetland inventory. The survey was coordinated by the Kimberley District Nature Conservation Coordinator, with collaboration of Traditional owners and Meda Pastoral Station management. Only the largest occurrence (BIGS01) was included due to time constraints. The following was included:

- general vegetation description, condition and structure across the mapped community;
- a flora list for vegetation within the quadrat and at random locations throughout the mound spring community;
- threatening processes noted;
- management recommendations compiled.

A quadrat was installed and the following data were collected:

- GPS locations;
- vegetation description, stratum and structure;
- soil and landform;
- flora specimens from the mound springs seepage areas and damplands;
- aquatic invertebrate survey and water chemistry in areas of standing water;
- assessment and mapping using a handheld GPS in conjunction with aerial photography;
- photographs taken of the occurrence and surrounding landscape.

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 occurrences.

Boundaries of occurrences of the Big Springs organic mound springs community may require checking or redefining as the majority have not been adequately surveyed.

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

Historically, monitoring of the Big Springs organic mound springs community has been opportunistic. The survey undertaken in 2017 by DBCA staff provided information on condition and threats to the main occurrence of the community (BIGS01), the establishment of permanent quadrats to record flora and vegetation, an inventory of aquatic invertebrates and water chemistry and soils, and an updated boundary. This information can be used as a baseline for future monitoring and procedures for monitoring.

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 occurrence 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. impacts from cattle such as grazing and trampling, partial clearing, hydrological changes, 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 their condition if they are subject to very minimal disturbance.

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?

For the purposes of relating condition to IUCN criteria, good condition relates to WA condition categories 'Very Good to Pristine' as below (see ^ below in Table 2) are considered to be in good condition, so therefore 55.11ha or 78.9% of known occurrences are considered to be in good condition, and contain high native flora and fauna species diversity, maintain integrity of vegetation structure, and have minimal weed/introduced species cover. Many occurrences are subject to ongoing threats, and all require substantial management to protect from pressures such as trampling and grazing from cattle, spread of introduced species, inappropriate fire regimes, and hydrological changes.

Table 2: Vegetation condition of occurrences of Big Springs organic mound springs community

Occurrence number (portion of occurrence estimated as percentage in brackets)	**Total area (ha)***	**Condition when last surveyed**
2 (20)	±0.04	^^^Poor ('degraded', 'completely degraded' using Bush Forever (2000) scale)
1 (10), 2(30)	±6.18	^^Medium ('good' using Bush Forever (2000) scale)
1 (90), 2 (50)	±55.11	^Good ('pristine', 'excellent', 'very good' using Bush Forever (2000) scale)
3-24	±8.44	Unknown

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.

^This includes vegetation ranging from 'Pristine' - with no obvious signs of disturbance and native plant species diversity fully retained or almost so, zero or almost so weed cover/abundance, to 'Excellent' - Vegetation structure intact, with disturbance only affecting individual species, weeds are non-aggressive species, and the area contains high native plant species diversity, with less than 10% weed cover, and 'Very Good' - Vegetation structure altered, obvious signs of disturbance eg: from grazing, inappropriate fire regimes, hydrological changes, and aggressive weeds are present, with moderate native plant species diversity, and typical weed cover is less than 20% (5 – 20%).

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, medium condition relates to WA condition categories 'Very Good to Good' as below (see ^^below and Table 2 above), so therefore 6.2ha or 8.9% of known occurrences (where condition is known) are considered to be in medium condition, and contain medium plant species diversity, reduced of vegetation structure, and a medium level of weed/introduced species cover.

^^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 grazing, trampling, inappropriate fire regimes, partial clearing, hydrological changes are present, and very aggressive weeds are present, with low native plant diversity (5 – 50%).

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?

For the purposes of relating condition to IUCN Criteria, poor condition in this instance relates to WA condition categories 'Degraded' and 'Completely Degraded', (see ^^^below and Table 2 above), so 0.04ha or 0.05% of known occurrences (where condition is known) are considered to be in poor condition, with vegetation containing minimal native flora, presence of aggressive weeds, and evidence of high level disturbance.

^^^This includes vegetation ranging from 'Degraded' Basic vegetation structure severely impacted by disturbance, the vegetation requires intensive management, and disturbance such as grazing, trampling, inappropriate fire regimes, partial clearing, hydrological changes are present, very aggressive weeds are present at high density, and very low native plant species diversity is observed (20 – 70%) to 'Completely Degraded' where vegetation structure is no longer intact and the area is completely or almost completely without native flora, referred to also as 'Parkland Cleared', with very low to no native species diversity (weed species greater than 70%).

29. Please describe how you would identify areas in poor condition 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 climate change as a threat to the ecological community, please refer to the Guidelines for information on how this should be addressed.

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

Past threats include grazing and trampling by introduced herbivores (cattle), spread of introduced flora, and hydrological change, all of which are actual threats.

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

Current threats include grazing and trampling by introduced herbivores (cattle) (actual), increased fire frequency/severity (actual), spread of introduced flora (actual) and hydrological change (actual).

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

Future threats include grazing and trampling by introduced herbivores (cattle) (actual), increased fire (actual), spread of introduced flora (actual) and hydrological change (actual).

For each threat describe:

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

Introduced herbivores (cattle)

Big Springs organic mound springs community occurs adjacent Meda Station, an active pastoral lease for cattle. In 2001 the station fencing, which formerly enclosed the main seepage area, totally collapsed allowing cattle to utilise the water and shelter in the seepage area and mound spring island, resulting in significant trampling of vegetation and churning up of pools, nutrient enrichment and introduction of weed seed. Dead tree stands and vegetation destroyed or impacted by cattle trampling was evident at some of the mounds (DBCA 2019). When monitored in 2017, total nitrogen was 0.31mg/L and total phosphorus was 0.042mg/L (from DBCA 2019). Total phosphorus values were at the higher end for ANZECC/ARMCANZ (2000) default trigger values recommended for wetlands in tropical Australia (0.01 to 0.05mg/L) possibly a result of impacts from cattle faeces.

Weeds

Date palms were recorded at the main occurrence (BIGS01) in 2017. These were all mapped and cut stumped in September 2019 and will be revisited in March 2020. Stinking passionflower (*Passiflora foetida*) was recorded in 2019 mainly on the fringes of BIGS01 (see figure 1) but also at occurrences 2, 3, 4, 5, and 14. *Passiflora foetida* is is currently limited in extent but is highly invasive and has potential to become a major threat in the community.

Physalis sp. and *Mesosphaerum suaveolans* have both been recorded in a drainage line at the margin of occurrence BIGS01 and require management. These species both have the potential to become significant threats

in the spring. A single plant of *Mimosa* sp. was also recorded along the eastern fenceline of the spring in 2019 and was immediately cut stumped (pers. comm. [redacted][1]).

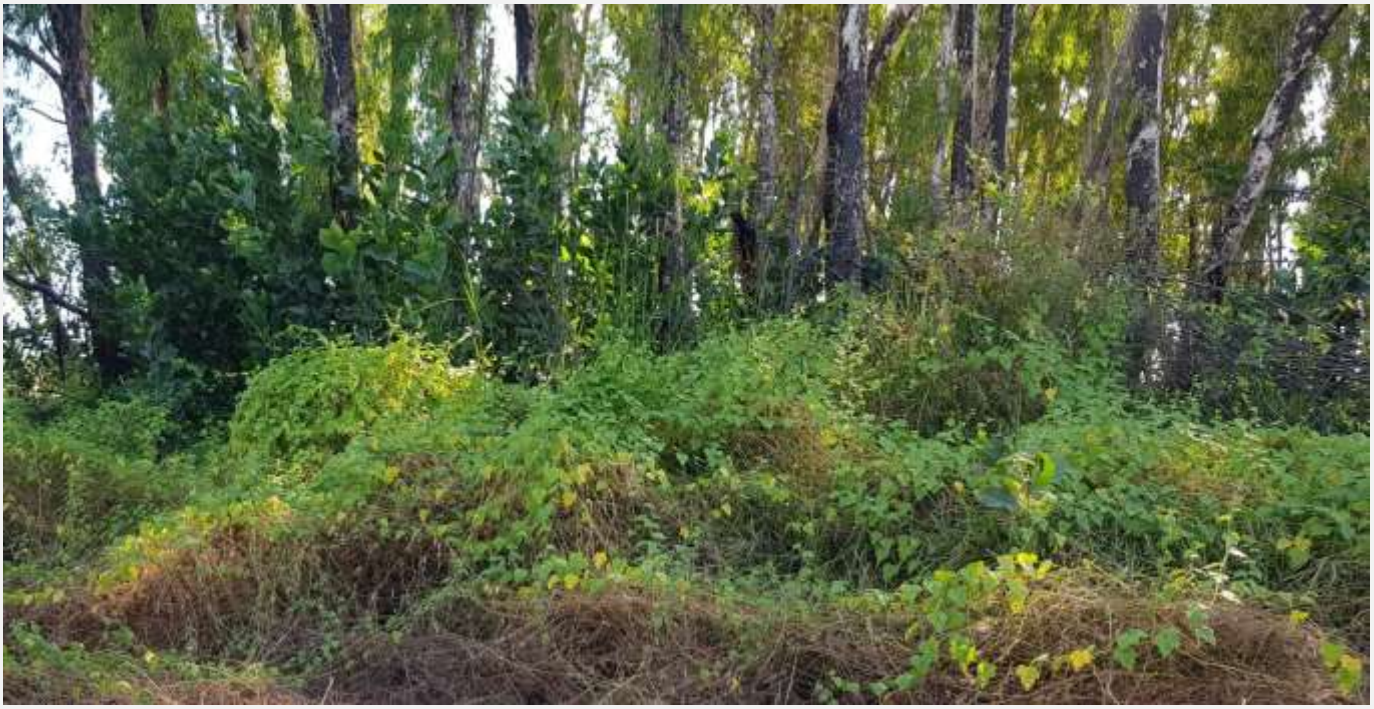

Figure 1. Invasion of the weed *Passiflora foetida* at BIGS02 following a fire in 2017-18 (photo: [redacted]).

Hydrological changes

The mound springs are dependent on a constant supply of fresh groundwater. Increasing future abstraction of groundwater for domestic and industrial use has the potential to impact the community due to drawdown. Some developments proposed for the area involve groundwater abstraction, and have potential for saltwater intrusion, interface up coning and subsequent impacts to groundwater dependent ecosystems. Where abstraction proposals do occur within the area there will need to be particular management considerations in relation to the springs.

Inappropriate fire regimes (to frequent and intense)

In the Kimberley Region and across northern Australia, inappropriate fire regimes pose a significant threat to biodiversity. Fire management regimes have changed since settlement from small scale, patchy burning by Aboriginal people, which resulted in small scale mosaics of burnt and unburnt vegetation, thereby providing buffers against unplanned wildfires to more recent reoccurring extensive and intense fire patterns in the mid to late dry season (Carwardine *et al*. 2011; Rangelands NRM 2011).

Inappropriate fire regimes are a potential risk to the Big Springs organic mound springs community. Historically, fires in the mound springs were probably only very occasional and the majority of the occurrences have long been unburnt. A tall grassland (unidentified) flanks BIGS01 and is flourishing as a consequence of the fencing that excludes cattle. The grassland vegetation is highly flammable. An increase in the fire frequency within the community may alter the structure and composition, removing the vegetation and the organic soil. A bushfire in 2017-18 burnt the fringing *Melaleuca alsophila* over sedges but didn't appear to penetrate far into the spring. BIGS02 however was completely burnt out and now has a dense understorey of *Passiflora foetida* (see figure 1 above). Similar effects in other sections that were burnt were observed at the site (pers. comm. [redacted]). The peat soils of the mound springs require particular fire management considerations as they can be damaged or destroyed by fires that smoulder for long periods.

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

[1] [redacted], Operations Officer, DCBA West Kimberley District

- Fencing was constructed in 2016 to control impacts of cattle disturbance to BIGS01 and 13 smaller occurrences (BIGS02, 03, 04, 05, 06, 09, 10, 11, 12, 13, 14, 15, 16; see figure 2). As a result, the cattle were prevented from accessing the springs and the vegetation was recorded in excellent condition at BIGS01.

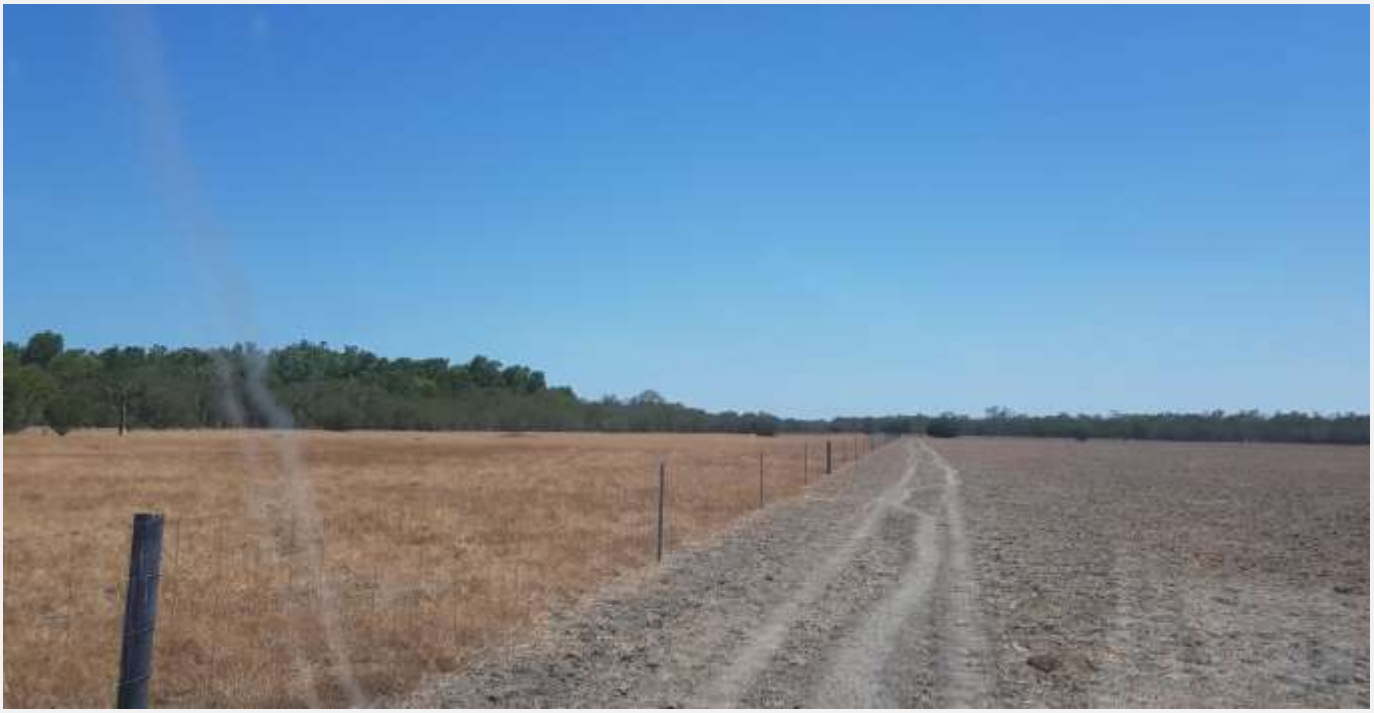

Figure 2. Contrast of effects of cattle with Big spring community to the left of the fence and the area to the right where cattle can access (photo: [redacted]).

- It is likely that frequent intense fires will continue to threaten the integrity of the community through impacting on species diversity and encouraging weed invasion. Date palms that had potential to become a major threat to the community were cut stumped in 2019. *Passiflora* is likely to become a major threat.
- A tall grassland (unidentified species) flanks BIGS01 and is flourishing as a consequence of the fencing installed in 2016 for excluding cattle. There is potential for the grassland to increase the fire risk to the community, although following a hot fire in 2017 damage to the spring vegetation was limited to the margin.
- Increasing future abstraction of groundwater for domestic and industrial use has the potential to impact the community due to drawdown.

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

The threats listed above are likely to impact on all occurrences.

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.

The incidence of more frequent and intense fires is likely. Major fires can occur any time and have potential for major impacts to the structure of the community, and increasing weed invasion.

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.

344 a. How does it respond to disturbance?

Intense, frequent fires within the community can alter its structure and composition, removing the vegetation and the organic soil and increasing weed invasion. The peat soils of the mound springs may also be damaged or destroyed by fires as it is likely they would smoulder for long periods.

Physical disturbance, such as from cattle grazing and trampling, can alter the floristic composition of the community by selectively removing edible species, as well as causing physical damage.

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

It is not known how long the community will take to regenerate and/or recover from a fire. Where a new fence was constructed in 2017 to keep cattle out, the surrounding vegetation has regrown.

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).

No management documentation is available for the community. However, recommendations are made in the following report:

Department of Biodiversity, Conservation and Attractions (2019) Biodiversity Survey, Mapping, Delineation and Assessment of Selected Organic Mound Springs of the Kimberley Region (*draft)*. Department of Biodiversity, Conservation and Attractions, Kununurra.

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.

- Fencing was constructed in 2016 to control impacts of cattle disturbance to 14 occurrences (including the main occurrence BIGS01).
- A biodiversity survey, utilising funding from the Kimberley Science Conservation Strategy, was undertaken for selected organic mound springs of the Kimberley Region in 2017. The survey collected information on:
    - the flora assemblage, including description, condition and threats;
    - establishing permanent quadrats to record flora and vegetation
    - inventory of aquatic invertebrates and water chemistry;
    - update of the wetland community boundaries as required; recommendations for management.
- Date palms were mapped and cut-stumped in September 2019 with follow-up assessment due early in 2020 to determine success. Other weed species (*Hyptis*, *Mesosphaerum* and *Mimosa* were mapped and assessed for possible future control efforts).

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.

Meda Pastoral Station is an active cattle station surrounding a strip of UCL which contains the Big Springs organic mound springs community.

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

Four occurrences occur on Meda Pastoral lease 050375; 20 occurrences occur within UCL which is actively managed by DBCA.

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

None

378. 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.

There are no culturally significant sites that occur on the area containing the community. Traditional owners are the Warwa people.

378 a. 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.

A Native Title Claim was registered with the Native Title Tribunal in 2014 by WARRWA combined (refer WC2014/004).

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).

Recommendations made in DBCA 2019 include:

- Design and implement a project to determine the hydrological drivers of the mound spring community and further investigate historical report that the spring is man-made.
- Design and implement a monitoring program that utilises quadrats established during the current survey. This will probably require establishment of a more comprehensive network of quadrats, and should be designed to provide information about the success of land management in the sensitive environment of the mound spring assemblage.
- Map weeds across the community and seek ways to control the most invasive weeds.
- Devise management of the grassland occurring between BIGS01 and the cattle exclusion fence to limit fire risk to the adjacent mound spring.
- Determine if the small mounds constitute the community. This would require vegetation survey and hydrological investigation.

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

No

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.

Surveys should be undertaken in August when the area is accessible. The following methods describe surveys of vegetation and invertebrates, taken from DBCA (2019):

Vegetation

A permanent 50x50m^2 quadrat should be established upland from a seepage zone. The quadrat should be permanently marked with one 1.6m star picket at NE corner site. Quadrat data collected should include:

- GPS location;
- vegetation description, stratum and structure;
- soil and landform;
- collection of flora specimens from the mound springs seepage areas and damplands surrounding the springs. The flora specimens will be provided for lodging where suitable to the WA Herbarium.

Physico-chemical sampling

Measurements of pH, temperature and conductivity should be made where surface water is most substantial. From the same location three water samples should also be collected; a 150ml sample collected for analysis of total nitrogen and phosphorus (and ideally frozen if possible); another water sample filtered through a glass fibre filter paper for chlorophyll (with the filter paper frozen for later analysis of chlorophyll) and the filtrate further filtered (through a 0.45um filter paper) and frozen for analysis of total filterable phosphorus and nitrogen; and a third water sample used for analysis of major ion composition. The depth at which the benthic invertebrate sample is collected should be recorded which usually equates to the maximum depth of the water body.

Invertebrate sampling

Three types of invertebrate sample should be collected, depending on the amount of water present. Where possible, two samples of surface water aquatic invertebrates (a benthic and a plankton sample) should be taken at each site. Plankton (water column) samples are collected by scooping up water in 900ml jugs and passing this through a 50um mesh net, to give a total of 10L of collected water. All benthic samples should be collected by sweeping a 250um mesh net through the water column and stirring up the substrate and benthic debris for a distance of 10m. Coarse inorganic sediment and coarse organic matter should be removed from the benthic sample prior to sample preservation by washing debris and elutriating in buckets before passing the water back through the net. Samples are then preserved in 100% ethanol in the field and returned to the laboratory for processing.

Samples of interstitial fauna are normally taken in areas of saturated peat without significant surface water. An auger is used to extract an approximately 0.5m deep core of 8cm diameter and the resultant hole allowed to fill with water. Using a manual bilge pump, 80L of water (8 x 10L buckets) is pumped out through a 110µm mesh net and the contents of the net placed into 2 litre pots and preserved with 100% ethanol. Where ingress of surface water is a problem it can be impeded by creating a bund around the top of the hole. Samples are then processed and microfauna identified in a laboratory.

Samples are washed with tap water and sieved through either 250µm, 90µm and 50µm sieve sizes (for the core and plankton samples) or 2mm, 500µm and 250µm sieve sizes (benthic samples). Each sieve fraction was examined separately (except for the 50µm fractions from plankton and core samples), and representatives of each discernible species removed and preserved in 100% ethanol.

Identification of specimens is by comparison with known specimens, or via an expert. Taxa should be identified to the lowest taxonomic level possible using keys and voucher specimens and undescribed taxa assigned morphospecies names based on previous survey work.

All specimens removed from samples should be retained and stored in ethanol in glass vials with the Western Australian Museum and a subset representing most species set aside for deposition.

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

No

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 criterion A, the ecosystem was assumed to collapse when the mapped distribution declines to zero.

There is no evidence that the geographic distribution of the Big Springs organic mound springs community has declined. The community therefore has not incurred a ≥30% reduction in geographic distribution over any 50-year time period, or a ≥50% reduction since 1750 (ie. the minimum requirements to meet the category VU under criterion A).

Does not meet criterion A

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:

For criterion B, the ecosystem was assumed to collapse when the mapped distribution declines to zero.

B1: The extent of a minimum convex polygon enclosing the occurrences of the Big Springs organic mound springs community is 5.75km^2 (≤2,000km^2, which is the less than the threshold for CR).
B2: The Big Springs organic mound springs community is estimated to occupy one 10 × 10km square grid cell (threshold for EN is 20 and for CR is two grid cells). For Criterion B1 and B2, there is evidence of continuing decline in the community from the impacts of cattle and weed invasion and inferred from future changes to the hydrological regime associated with groundwater abstraction. Therefore, the status under criterion B1b is critically endangered.
a): Inadequate data are available to indicate an observed or inferred continuing decline in a measure of spatial extent, environmental quality or disruption to biotic interactions to support ranking under B1a or B2a.
b): Historically, decline was observed from the impacts of cattle. Currently threat from cattle in the largest occurrence is minimal and condition had improved when last surveyed in 2018 due to fencing in 2016. A number of weeds are invading occurrences and have potential for major impacts. Other current observed threats are cattle damage at other occurrences, too frequent or intense fires and inferred future changes to the hydrologic regime associated with groundwater abstraction. The condition of the other 21 other occurrences is not known, but it is likely condition is in decline as they are not fenced and therefore accessible by cattle.
c): Community exists at two threat-defined locations based on the impacts of introduced fauna, where one location includes the 13 occurrences that are fenced to protect them from cattle impacts, and the remaining 11 occurrences that aren't fenced (threshold for CR is one and for EN is five threat-defined locations).

B3: Known from two threat-defined locations and prone to effects of human activities or stochastic events within a very short time period in an uncertain future and thus capable of collapse or becoming CR within a very short time period (meets VU as <5 threat defied locations).

Meets CR under B1b; B2b. Meets EN under B1c, B2c. VU is plausible under B3.

Criterion C: Environmental degradation based on change in an abiotic variable.

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

Justification for assessment under Criterion C:

A significant abiotic variable affecting the community is loss of peat substrate from frequent or intense fire. Collapse is defined as complete loss of the peat substrate that supports the community. An increase in the fire frequency or intensity within the community has the potential to alter the structure and composition of the vegetation, and to deplete the organic soil that supports both the flora and invertebrate assemblages. The peat substrate of the mound spring requires particular fire management considerations as it can be damaged or destroyed by fires that smoulder for long periods. The impact of future fires is unknown.

Inadequate data are available to indicate if the community meets the minimum thresholds for proportion of the extent (≥30%) or proportional severity of degradation (≥30%) over any 50-year period; or proportional severity of disruption of abiotic processes (≥50%) since 1750 to meet VU under criterion C.

Inadequate data to assess 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: A significant biotic variable affecting the community is the physical impacts of grazing and trampling by cattle. Collapse under criterion D is defined as a decline in vegetation condition to totally degraded (Bush Forever scales; ie. beyond recovery) as a consequence of grazing and trampling by introduced fauna. Although only 0.05% of the occurrences surveyed were in poor condition, other occurrences have not been comprehensively surveyed and their condition is unknown. Eleven occurrences are also unfenced and are likely impacted by cattle.

It is estimated that 78.9% of the community is in good condition. However only 3 occurrences have been comprehensively surveyed. Therefore there are inadequate data to determine if the community meets the minimum thresholds to meet vulnerable under criterion D: ie 30% % of the extent of the community affected to at least 30% severity over any 50-year period to meet D1, D2.

D3: Current data are inadequate to indicate if the community meets the minimum proportion of the extent (50%) or proportional severity of disruption of biotic processes (50%) since 1750.

Inadequate data to assess if community meets 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:

The ecosystem wa**s** not assessed under Criterion E as no quantitative estimates of the risk of ecosystem collapse have been completed.

Summary assessment against IUCN RLE Criteria

Criterion	Rank indicated	Overall conclusion
A1	-	• Does not meet criterion
A2a	-	• Does not meet criterion
A2b	-	• Does not meet criterion
A3	-	• Does not meet criterion
B1a	-	• EOO is ≤2,000km^2 • Inadequate available data to indicate observed or inferred continuing decline in a measure of spatial extent, environmental quality or disruption to biotic interactions that would meet lowest thresholds of the criterion (VU) • Does not meet criterion
B1b	CR	• EOO is ≤2,000km^2 • Threat from cattle impacts, weed invasion, too frequent or intense fire, and inferred future changes to hydrology • Meets criterion B1b.
B1c	EN	• EOO is ≤2,000km^2 • Ecosystem exists at two threat-defined locations based on differences in the threat from cattle • EOO and number of threat-defined locations indicate rank EN.
B2a	-	• AOO is one grid cell • Inadequate information available to indicate observed or inferred continuing decline in a measure of spatial extent, environmental quality and disruption to biotic interactions that would meet lowest thresholds of the criterion (VU) • Does not meet criterion
B2b	CR	• AOO is one grid cell • Threat from grazing, trampling, weed invasion, too frequent or intense fire, and inferred future changes to hydrology • Meets criterion B2b.
B2c	EN	• AOO is one grid cell • Ecosystem exists at two threat-defined locations based on differences in level of threat from cattle • AOO and number of threat-defined locations indicate rank EN.
B3	VU	• Known from two threat-defined locations • Prone to the effects resulting from introduced fauna, weed invasion, and frequent fire, and inferred future changes in hydrology • Meets criterion for VU
C1	-	• Inadequate data to assess if meets the minimum thresholds for proportion of the extent (≥30%) or proportional severity of degradation (≥30%) over past 50 years to meet VU.
C2	-	• Inadequate data to assess if meets the minimum thresholds for proportion of the extent (≥30%) or proportional severity of degradation (≥30%) over any 50-year period to meet VU.
C3	-	• Inadequate data to assess if meets the minimum thresholds for proportion of the extent (≥50%) or proportional severity of disruption of abiotic processes (≥50%) since 1750 to meet VU.
D1	-	• Inadequate data to assess if meets the minimum thresholds for proportion of the extent (≥30%) and proportional severity of disruption of biotic processes (≥30%) over past 50 years to meet VU.
D2	-	• Inadequate data to assess if meets the minimum thresholds for proportion of the extent (≥30%) or proportional severity of disruption of biotic processes (≥30%) over any 50-year period to meet VU.

D3	-	• Inadequate data to assess if meets the minimum thresholds for proportion of the extent (≥50%) or proportional severity of disruption of biotic processes (≥50%) since 1750 to meet VU.
E	NA	• No quantitative estimates of the risk of ecosystem collapse.
		Meets CR under B1b; B2b. Meets EN under B1c, B2c. VU is plausible under B3. *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 under B1b; B2b.**

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.

ANZECC (2000) National Water Quality Management Strategy. Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volume 1: The Guidelines. Australian and New Zealand Environment and Conservation Council, Canberra.

Carwardine, J., O'Connor, J.T., Legge, S., Mackey, B., Possingham, H. and Martin, T. (2011) Priority threat management to protect Kimberley wildlife. CSIRO Ecosystem Sciences, Brisbane.

CSIRO and Bureau of Meteorology (2015) *Climate Change in Australia Information for Australia's Natural Resource Management Regions*: Technical Report, CSIRO and Bureau of Meteorology, Australia.

Department of Biodiversity, Conservation and Attractions (draft 2019) Biodiversity Survey, Mapping, Delineation and Assessment of Selected Organic Mound Springs of the Kimberley Region. Department of Biodiversity, Conservation and Attractions, Kununurra.

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

Keighery, B.J. (1994) Bushland Plant Survey. A Guide to Plant Community Survey for the Community. Wildflower Society of Western Australia (Inc.), Nedlands, Western Australia.

Keneally, K.F., Keighery, G.J. and Hyland, B.P.M. (1991) Floristics and phytogeography of Kimberley rainforests, Western Australia. In: Kimberley Rainforests of Australia. McKenzie N.L., Johnston, R.B. and Kendrick, P.G. (eds) Surrey Beatty and Sons, Norton, NSW.

Pryde J (2017) Survey of assemblages of Bunda Bunda, and Big Springs organic mound springs of the west Kimberley threatened ecological communities: a report to the Kimberley Region - August 2017 survey of Bunda Bunda and Big Springs organic mound springs TECs. Department of Biodiversity, Conservation and Attractions, Kensington, WA. 26 p.

Rangeland NRM Western Australia (2011) The Kimberley Project Group 2009−2011. Caring for Our Country.

Stoneham, T.C., McArthur, W.M. and Walsh, F.J. (1991) Soils and landforms of Kimberley rainforests, Wester Australia. In: Kimberley Rainforests of Australia. McKenzie N.L., Johnston, R.B. and Kendrick, P.G. (eds) Surrey Beatty and Sons, Norton, NSW.

45. Statement on the Standard of Scientific Evidence

Published data on the Big Springs organic mound springs community was sufficient to apply the Red List of Ecosystem criteria, although there are likely to be inaccuracies in various aspects of the assessment. However, the outcomes of the assessment are robust.

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

The document was reviewed by the following people:

Principal Ecologist, DBCA Species and Communities Program.

Operations Officer, DBCA West Kimberley District; Parks and Wildlife Service.

DBCA Principal Research Scientist, Biodiversity and Conservation Science.

Ecologist, DBCA Species and Communities Program.

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.

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	Department of Biodiversity, Conservation and Attractions
Postal address	17 Dick Perry Avenue, Kensington Post: Locked Bag 104, Bentley Delivery Centre, WA 6983.
Email	[redacted]
Phone	[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 Branch
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.

Appendix 1. Big Springs organic mound springs community (blue)