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Section 1 – Eligibility for Listing		
1. Name of the ecological community		
Black Spring organic mound spring community		
2. Listing Category for which the ecological community is nominated		
	Current ranking 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
	Recommended ranking under BC Act IUCN assessment	
Proposed listing category (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?
Black Spring organic mound spring community
4. What authorities/surveys/studies support or use the name?
Halse (2001) described this wetland as considered worthy of conservation based on the particular aquatic

invertebrate fauna present, and its importance as a relatively rich aquatic habitat with a high proportion of northern species. Bennelongia (2017) also considered the community to be of high conservation significance on the basis of their survey results.

The community was recognised and endorsed as an endangered TEC (under criteria EN Bi,ii) by the WA Minister for Environment in 2002. The ranking criteria developed in WA do not match those used in the International Union for the Conservation of Nature's Red List of Ecosystems Criteria (IUCN RLE) that is now the internationally recognised standard. The community is not currently listed under the *Environment Protection and Biodiversity Conservation Act 1999* (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).

Black Spring organic mound spring community occurs in the East Kimberley and the known occurrence consists of a raised central mound supporting a forest of *Melaleuca viridiflora* (broadleaf paperbark), *Ficus* spp., *Timonius timon* and *Pandanus spiralis* (screwpine) over *Colocasia esculenta* (taro) and ferns, including *Cyclosorus interruptus* (swamp shield-fern). The tall *Phragmites karka* (tropical reed) dominates the outer edge of the mound and the entire mound is ringed by a moat of water supporting sedges and grasses. The springs contain a rich assemblage of aquatic invertebrate fauna.

The Black spring community is 35km north of the northern most occurrence of the organic mound spring sedgeland community of the North Kimberley bioregion, that is listed in policy as Vulnerable in WA.

The organic mound spring sedgeland community of the North Kimberley bioregion differs in that it is comprised of sedgelands and grasslands that are almost completely devoid of trees and shrubs due to a waterlogged seepage zone and can also include boggy fernlands. At the margins are associated woodlands. Seven flora are considered useful indicators of mound springs, since their occurrence is almost entirely restricted to mound springs in Western Australia, or their margins: *Cyperus unioloides* (papyrus sedge), *Eleocharis ochrostachys* (spike rush), *Eriocaulon inapertum* (pipewort), *Lobelia leucotos* (blue lobelia), *Rhynchospora gracillima* (thin beaksedge), *Spiranthes* aff. *sinensis* (austral ladies tresses) and *Utricularia circumvoluta* (bladderwort).

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 community is distinguished from other mound springs in the Kimberley region by the invertebrate biota that inhabits it, and also the vegetation that typifies the core seepage zones of the spring. Other mound springs may be vegetated by sedges over herbs and grasses; this spring can be described as a forest on the mound with the outer edge dominated by tall grass, and sedgelands on the moat.

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 occurs in the East Kimberley and the known occurrence consists of a raised central mound supporting a forest of *Melaleuca viridiflora* (broadleaf paperbark), *Ficus* spp., *Timonius timon* and *Pandanus spiralis* (screwpine) over *Colocasia esculenta* (taro) and ferns, including *Cyclosorus interruptus* (swamp shield-fern). The tall *Phragmites karka* (tropical reed) dominates the outer edge of the mound and the entire mound is ringed by a moat of water supporting sedges and grasses. The springs contain a rich assemblage of aquatic invertebrate fauna.

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

The Black Spring organic mound spring community consists of raised peaty soaks or wetlands that occur on saturated peaty black, clay soil with high organic content. It is situated in either low tributaries or associated with floodplains adjacent to rivers and streams (Bennelongia 2017).

The climate of the Kimberley is described as tropical with warm winters and hot, humid summers. In summer (December to February), the average maximum temperature is 33.5°C with an average minimum temperature of 22.8°C. In winter (June to August), the average maximum temperature is 30.2°C with an average minimum temperature of 11.6°C (from 1988 to 2018). The mean yearly rainfall is 1166mm (from 1988 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_001025.shtml; for Doongan Station 1025, 30km to the north).

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

The Black Spring organic mound spring community contains a raised, peaty mound surrounded by a moat or bog, and is fed by permanent freshwater seepage (Bennelongia 2017).

Black Spring occurs where groundwater discharges under pressure from depth through the overlying alluvium to the surface. The spring contains underlying hydrogeology, mineral composition and biogeochemical processes that are likely to be complex and variable. When monitored in 2016, water was found to be fresh and moderately acidic at pH 5.67 *in situ*, which is natural in peat bogs due to the release of organic acids from plant matter decomposition (Bennelongia 2017).

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.

Black spring consists of a well-defined and pronounced central mound of peat surrounded by a moat or bog. Variation exists in the vegetation and aquatic invertebrates across the mound (Bennelongia 2017).

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.

One Priority flora taxon was recorded in the Black Spring community: *Colocasia esculenta* var. *aquatilis* (priority 3) (Bennelongia 2017).

Several rarely collected aquatic invertebrate species also occur within the mound spring community. Bennelongia (2017) recorded a unique and undescribed water mite (referred to as *Arrenurus* sp. WA27 in DBCA 2019); the darwinulid ostracod *Alicenula serricaudata*, a largely groundwater associated species with a Gondwanan distribution was the first record for Australia; the harpacticoid copepod *Canthacamptus grandidieri* which is a pan-tropical species, but has rarely been collected in Australia; and an ostracod from the genus *Chrissia*, that has not previously been recorded in Australia (Bennelongia 2017; DBCA 2019).

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

Bennelongia Environmental Consultants (2017) *Ecological Character of Kimberley Mound Springs*. Bennelongia Environmental Consultants.

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, 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.

The Black Spring organic mound spring community is known from a single mapped occurrence in the North Kimberley bioregion, on Crown reserve 33706 (vested with the Department of Planning, Lands and Heritage for Government requirements), a small area excised from Drysdale River station (PL 49578).

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)? 11.9ha

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)

The Black Spring organic mound spring community is thought to occupy most of its former range.

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 Black Spring organic mound spring community was mapped using ArcGIS© and a range of data sources including quadrat and survey data, on ground survey, aerial photography, and topographic maps. There is only one location of this ecological community known, covering approximately 12 ha.

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.

There is only one location known therefore this question is not relevant.

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.

NA

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 flora in the community are a major part of characterising and differentiating the community. Changes to the floristic composition are likely to occur through the impacts of introduced herbivores, introduction of weeds, changes in fire regimes (frequent and intense) and hydrological change.

18 a. If yes, which species are affected?

Native flora species are affected by weeds. Frequent or extreme fires will affect fire sensitive. Cattle have trampled the mound spring vegetation and introduced nutrients and weed seed to the site.

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

Introduced herbivores, weed invasion, frequent and intense fire, and hydrological changes may impact on the mound spring resulting in changes to composition, and increased drying.

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 Black Spring organic mound spring community is a freshwater seepage and vegetated mound spring with an internal moat. When in good condition the community contains well developed vegetation with a relatively rich aquatic habitat.

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

- few weed taxa, and low weed cover
- no current evidence of introduced herbivores
- all previously recorded natural strata of the vegetation present
- the composition of flora and fauna
- hydrological changes within the spring.

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).

In the late 1990s and early 2000s, a departmental officer inspected numerous reported occurrences of mound springs and interviewed numerous land managers, previous department of Conservation and Land Management and Agriculture WA staff, and other experts, to determine whether any other possible occurrences or similar communities were known.

In 1999, the aquatic invertebrate fauna was sampled at this mound spring. Halse (2001) described this wetland as worthy of conservation based on the particular taxa present and its importance as a relatively rich aquatic habitat with a high proportion of northern species.

An extensive survey of the Black Spring organic mound spring community was undertaken in 2016 by Bennelongia Environmental Consultants to document and describe:

- Physical attributes and water chemistry;
- Wetland vegetation;
- Aquatic invertebrate species and assemblages;
- Observations of bird use of the springs; and
- Conservation status of the species recorded.

Quadrats were installed to further measure:

- GPS locations;
- Habitat description;
- Site features such as topography, soil and lithology;
- Structure of vegetation including height, crown cover, habit and dominant species;
- Vegetation condition;

- Estimated time since fire;
- Flora taxa present, including height and percentage cover.

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.

The boundary of occurrence of the Black Spring organic mound spring community does not require checking or redefining as it was recently surveyed and data updated (Bennelongia 2016).

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

Historically, monitoring of the Black Spring organic mound spring community has been opportunistic. In 2015 DBCA staff surveyed the occurrence to determine threats and condition (Chemello 2015).

The 2016 survey by Bennelongia Environmental Consultants provided information on condition and threats to the community, established 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. disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing" (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 related to WA condition categories 'Very Good to Pristine' as below (see ^ below in Table 2) are considered to be in good condition, so therefore 3.58ha or 30% of the known occurrence was considered to be in good condition when last surveyed in 2019, and contains high native flora and fauna species diversity, maintains integrity of vegetation structure, and minimal weed/introduced species cover. The community is subject to ongoing threats and requires 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 Black spring mound spring in 2019

Occurrence number (portion of occurrence estimated as percentage in brackets)	**Total area (ha)***	**Condition when last surveyed**
1 (20%)	±2.38	^^^^Beyond recovery ('completely degraded' using Bush Forever (2000) scale)
1 (20%)	±2.38	^^^Poor ('degraded' using Bush Forever (2000) scale)

1 (30%)	±3.58	^^Medium ('good' using Bush Forever (2000) scale)	
1 (30%)	±3.58	^Good ('pristine', 'excellent', 'very good' using Bush Forever (2000) scale)	

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 3.58ha or 30% of the community is 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' (see ^^^below and Table 2 above), to 'Completely degraded' (see ^^^^ below) so therefore 4.76ha or 40% of the community is considered to be in poor condition to beyond recovery, with little to no vegetation, presence of aggressive weeds, and evidence of much disturbance.

^^^Basic vegetation structure is severely impacted by disturbance such as partial clearing, dieback, logging and grazing. Scope for regeneration but not to a state approaching good condition without intensive management. Very aggressive weeds are present at high density, and very low native plant species diversity is observed (20 – 70%).

^^^^A collapsed state (Beyond recovery under IUCN condition ranking) is considered '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 IUCN Red List of Ecosystem 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, intense or too frequent fire, weed invasion, hydrological change, all of which are also 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 (actual), increased fire frequency (actual), weed invasion (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 (actual), increased fire frequency or intensity (potential), weed invasion (actual) and hydrological change (actual).

For each threat describe:

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

Introduced herbivores (cattle, feral pigs)

Feral pigs and free ranging cattle access the Black Spring organic mound spring community. The area was fenced in 2001 and repairs undertaken since. The department has a Memorandum of Understanding with the adjacent pastoral lease holders to maintain the fence. Cattle can cause physical damage to the vegetation of the mound spring and the peat based substrates through trampling as well as grazing the regenerating vegetation, altering the species composition by selectively removing edible species and potentially causing an increase in drying of the mound springs through vegetation removal (see figure 1 below). In 2019, a tree limb fell on the fence and cattle accessed the spring. Water temperatures may also subsequently rise, with potential concomitant effects on aquatic invertebrates. In addition to physical disturbance, faeces of cattle contaminate the soil and water, particularly in open water, causing nutrient enrichment. This may enhance the introduction and spread of weeds as well as elevate nutrient levels in the groundwater. This adversely affects the aquatic invertebrates that rely on the water supply.

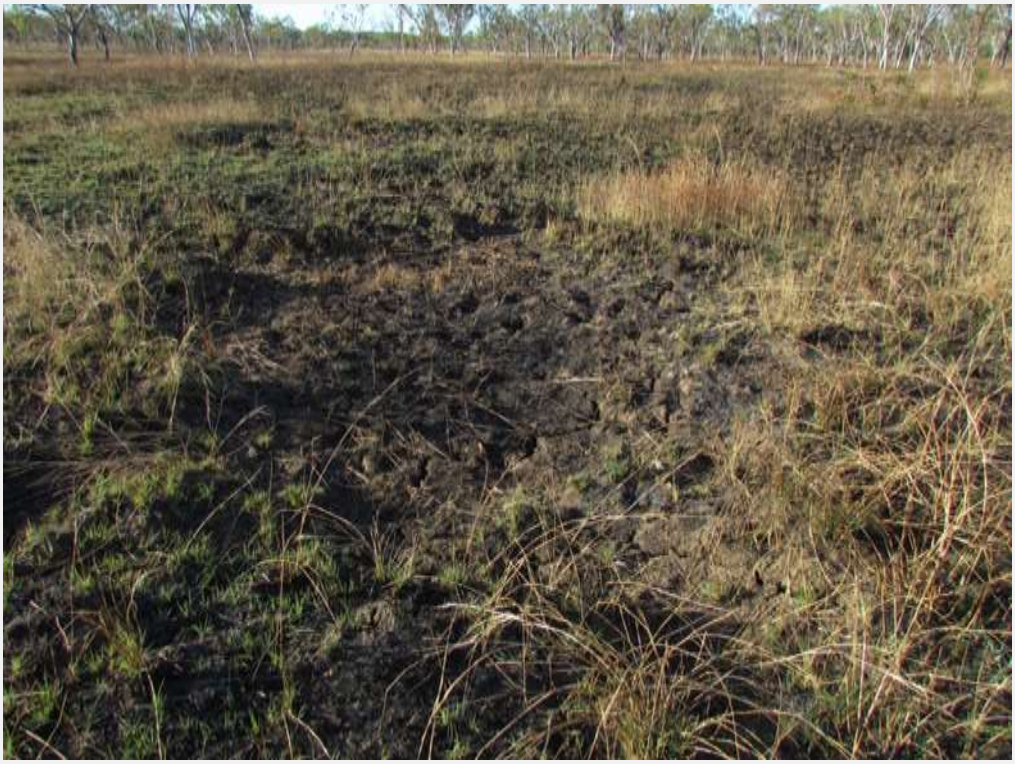

Figure 1. Heavy cattle and fire impact noted in 2015 in the area originally fenced at Black Spring (from Chemello 2015).

Weed invasion

Weeds displace native plants and compete with them for light, nutrients and water. Weeds can also prevent recruitment, cause changes to soil nutrients, and affect abundance of native fauna. They can also impact on other conservation values by harbouring pests and diseases and increasing the fire risk.

The community also contains a fruiting mango tree (*Mangifera indica*) growing in the centre of the spring (Chemello 2015).

Hydrological changes

The mound springs are dependent on a constant supply of fresh groundwater. However, there is no information available about the aquifer that supports the ecosystem, or about the ecological water requirements of the mound springs. At a local scale, groundwater is exploited to provide drinking water for stock. Water is piped out of the core seepage zones for stock usage however (Chemello 2015), and this helps to minimise potential impacts associated with this usage. The extent of impacts of this usage to the mound springs flora and fauna that depend on the constant supply of freshwater is not clear.

Further development of stock usage of the station has the potential to increase water usage and has potential to result in an increase in water abstraction. Where abstraction proposals do occur within the area there will need to be additional management considerations.

Inappropriate fire regimes (too 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 European settlement from small scale, patchy burning by Aboriginal people that resulted in small scale mosaics of burnt and unburnt vegetation. This fire regime provided buffers against unplanned wildfires. This has recently been changed to more recurring 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 Black Spring organic mound spring community. Historically, fires in the mound spring were probably only very occasional and the majority of the community was long unburnt. Despite being inundated, the spring is still able to carry a fire, as was observed in 2015 when evidence of a fire was visible in the edge of the spring (Chemello 2015) and in 2019 when fire burnt up to the central moat (Chemello

2019; see figure 2). An increase in the fire intensity or frequency in the community may alter the structure and composition, removing the vegetation and the organic soil. The peat soils of the mound spring require particular fire management considerations as they can be damaged or destroyed by fires that smoulder for long periods.

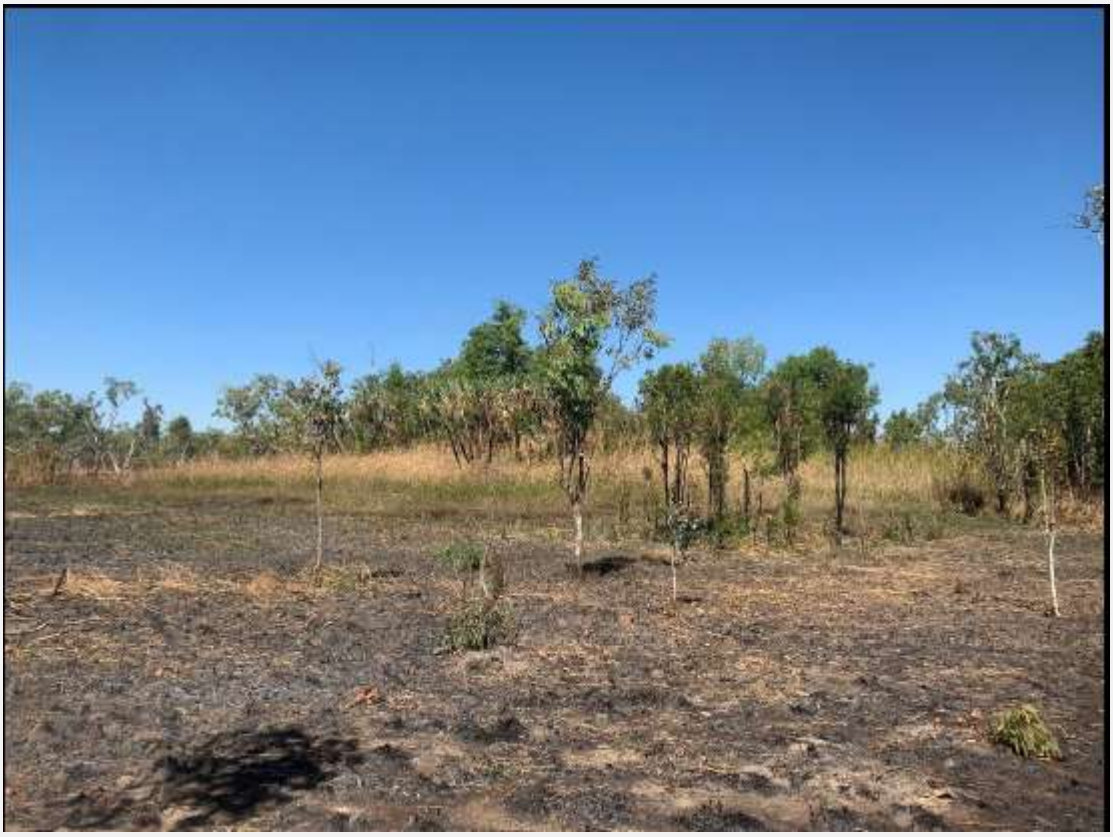

Figure 2. Black spring burnt to periphery of central wet moat (photo from Chemello 2019).

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

The impact of cattle and feral pig disturbance on the springs is likely to continue unless fencing is constantly maintained to prevent access.

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.

Increasing future abstraction of groundwater for domestic and industrial use has the potential to impact the community due to drawdown of aquifers that support the community.

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

The threats listed above are likely to impact on the whole occurrence.

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, increasing weed invasion and destroying the peat substrate that is crucial habitat for the community.

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.

34 a. How does it respond to disturbance?

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

Physical disturbance, such as from cattle and feral pig 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?

In other mound spring communities, personal observations ([redacted]) and photographic evidence have indicated that core seepage zones have recovered remarkably well within four years of fencing, where previously the impact from stock was high (Barrett and English 2017). It is assumed that Black Spring may recover similarly.

Threat Abatement and Recovery

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

Management documentation for the community is as follows:

- Chemello, D. (2015) Mound Spring Survey August 2015. Department of Parks and Wildlife. Kununurra, WA.

Management recommendations are also made in the following reports:

- Bennelongia Environmental Consultants (2017) *Ecological Character of Kimberley Mound Springs*. Perth WA.

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.

- The site has been fenced to exclude cattle and the pastoralists inspect and repair the fences when requested by DBCA.
- A portion of Drysdale River Station Pastoral Lease (PL 49578) was excised and vested with the Department of Planning, Lands and Heritage for Government requirements in 2015.
- A Memorandum of Understanding between pastoralists and DBCA to protect the mound spring has been signed.
- A biodiversity survey was undertaken for Black spring in 2016. The survey collected information on:
    - composition, condition and threats;
    - permanent quadrats to record flora and vegetation
    - inventory of aquatic invertebrate and water chemistry and soils;
    - update of the status of wetland assemblages; recommendations for management.

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.

The Black Spring organic mound spring community is known from a single mapped occurrence on Crown reserve 33706 (vested with the Department of Planning, Lands and Heritage for Government requirements), which is a small area excised from Drysdale River station (PL 49578).

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

The area is managed by DBCA, in conjunction with the adjacent pastoralists. The pastoralists are responsible for inspecting and repairing the fences when requested by DBCA.

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

None

38. 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 intersect with the community. The Traditional Owners are Wilinggin.

38 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 2004 by Wanjina-Wunggurr Wilinggin (refer WAD6015/1999).

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 Chemello (2015) include:

- Ongoing inspection and repair of fence lines to exclude cattle;
- Monitoring for pig presence and assessment of impact, noting management actions taken if present (eg. trapping, shooting);
- Protect from frequent and intense fires through a prescribed early dry season burning regime;
- Remove weed species found from spring areas, continue to monitor for weed incursions and maintain strict hygiene standards; and
- Continue photo monitoring points to establish any trends.

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.

The community is identified based on presence of the habitat of peat mound springs that are permanently moist, in association with a particular invertebrate assemblage.

The following describes survey methods for vegetation, habitat and invertebrates:

Vegetation (from Bennelongia 2017)

Surveys should be undertaken between May and June. Two quadrats were installed at the spring, one on the mound and the other in the surrounding vegetation. The north-west and south-east corners of each quadrat were marked with a galvanised star picket. The following data was recorded for each quadrat:

- Coordinates of each corner (GDA94);
- Panoramic photograph from the north-west corner (facing south-east);
- Habitat description;
- Site features such as topography, soil and lithology;
- Structure of the vegetation (using NVIS methodology), including the height, crown cover, habit and dominant species within each stratum;
- Vegetation condition and disturbance details;
- Estimated time since fire; and
- Flora taxa present, including height and percentage cover.

Physico-chemical sampling (from Bennelongia 2017)

Physico-chemical information consists of electrical conductivity (EC), pH and temperature (measured in-situ), water samples (collected for laboratory analysis), and analytes (TDS, pH, EC, major ions, ammonia, nitrate, nitrite, soluble reactive phosphorous (P_SR), total N and total P).

Invertebrate sampling (from Bennelongia 2017)

Aquatic invertebrates are collected with a bilge pump. A 1m length core of consolidated peat is extracted and the hole allowed to fill with porewater. Water is then pumped through a 53µm net using the bilge pump and retained material preserved in 100% ethanol. Owing to the low transmissivity of the mound substrate (mostly detritus and peat) it is necessary to dig a small well (i.e. 30cm x 30cm) around the base of the pump to allow water to infiltrate the pumping zone. This results in the possibility of collecting incidental 'wash-in' surface water taxa. Sorting is carried out in the laboratory under dissecting microscopes and all aquatic invertebrates identified to species level where possible. Animals dissected and examined under the compound microscopes as necessary. Species are identified using relevant keys, where available; otherwise, appropriate anatomical features from keys are used to characterise undescribed species, to which voucher codes are assigned.

Some samples can be collected by sweep-netting through a range of surface water habitats.

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 criteria A and B, the ecosystem was assumed to collapse when the mapped distribution declines to zero.

Black spring organic mound spring community has not incurred a ≥30% reduction at least in geographic distribution over any 50-year 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:

B1: The extent of a minimum convex polygon enclosing the Black spring community is 0.27km^2 (≤2,000km^2, which is less than the threshold for CR).
B2: The Black spring community is estimated to occupy one 10 × 10km square grid cell (threshold for EN is 20 and for CR is two grid cells). As for criterion B1, there is evidence of continuing decline in the community resulting from the impacts of introduced herbivores, frequent fire and weeds, with 40% of the community in poor condition when last surveyed in 2019 and inferred from future changes to the hydrological regime and cattle incursion.
The status under criterion B2 is Critically Endangered.
a): Inadequate data are available to measure decline in spatial extent, environmental quality or disruption to biotic interactions.
b): Continuing decline observed from impacts of introduced herbivores; and inferred from future changes to the hydrologic regime associated with groundwater abstraction, weed invasion and too frequent or intense fire (damaging late season fires).
c): Ecosystem exists at one threat-defined location based on the impacts of introduced herbivores (threshold for CR is one and for EN is five threat-defined locations).
B3: Known from one threat-defined location 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 defined locations).

Criteria B1, B2: Meets CR B1b,c; B2b,c

Criterion B3: meets VU 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:

C1, C2, C3: The most significant abiotic variable affecting the community is considered to be loss of substrate from frequent or intense fire. Collapse is defined as complete loss of the peat substrate that supports the community. Evidence of fires in the spring was visible in 2015 and 2019 (Chemello 2015; 2019). An increase in the fire regime within the community has the potential to alter the floristic structure and composition, removing the vegetation, and the organic soil that support 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. Available data indicate that degradation of the peat substrate is minimal and unlikely to meet the minimum thresholds for proportion of the extent (≥30%) or proportional severity of disruption of abiotic processes (≥30%) over any 50-year period, or since 1750 to meet VU under criterion C. The impact of future fires is unknown.

Criterion C: Does not meet

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: The most significant biotic variable affecting the community is considered to be physical impacts of grazing and trampling by cattle. It is likely that continuous grazing has resulted in changes to floristic and soil composition within the community. The assumption is made that degradation by cattle has occurred mainly over the last 50 years and that grazing and trampling have caused the majority of degradation of vegetation. Vegetation condition is considered to reflect a combination of species richness, species composition and dominance, abundance of key species, and other biotic interactions. In this community, vegetation condition is assumed to be mainly negatively impacted by grazing and trampling by introduced herbivores. In this context vegetation collapse is assumed conservatively to occur when vegetation condition reaches completely degraded (Bush Forever scales: defined as 'the structure of the vegetation is no longer intact, and the areas are completely or almost completely without native species'). 60% of the community was considered in 'Good' condition (condition ratings have been converted to IUCN scales; see definitions of condition categories in questions 23 to 28) and 40% in poor condition (including half of this considered beyond recovery) when last surveyed in 2019. It is conservatively assumed that 'good condition' (IUCN condition scales) relates to a 30% severity of degradation and 'poor' to 80% severity. Based on the above assumptions the community does meets the minimum thresholds for vulnerable to endangered under criterion D – ie. at least 40% of the area of the community affected (threshold 30%) to at least 80% severity (80% threshold) of degradation over any 50-year period and therefore meets VU under D1, D2.

D3: Does not meet the minimum proportion of the extent (≥50%) or proportional severity of disruption of biotic processes (≥50%) since ~1750.

D1, D2: Meets VU under criterion D1, D2

D3: Does not meet

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 could not be assessed under Criterion E as there were no quantitative estimates of the risk of ecosystem collapse.

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	-	• Available data do not indicate community meets criterion
B1a	-	• EOO is ≤2,000km^2 • Inadequate available data to indicate if decline in 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 • Impacts observed from grazing, trampling and increasing nutrients from introduced herbivores, weeds, and altered fire regimes; and inferred from future changes to the hydrological regime • Meets CR as level of threat considered 'non-trivial'
B1c	CR	• EOO is ≤2,000km^2 • Ecosystem exists at one threat-defined location • Meets CR as level of threat considered 'non-trivial'
B2a	-	• AOO is one grid cell • Inadequate information available to indicate decline in 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 • Observed continuing decline from grazing, trampling and increasing nutrients from introduced herbivores, weeds, and altered fire regimes; and inferred from future changes to the hydrological regime • Meets CR as threats considered 'non-trivial'
B2c	CR	• AOO is one grid cell • Ecosystem exists at one threat-defined location • Meets CR as threats considered 'non-trivial'
B3	VU	• Known from one threat-defined location • Prone to the effects resulting from introduced herbivores, weeds, and altered fire regimes; and inferred from future changes to the hydrological regime • Meets criterion for VU
C1	-	• Inadequate evidence to indicate the community 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 evidence to indicate the community 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	-	• Does not meet the minimum thresholds for proportion of the extent (≥50%) or proportional severity of disruption of abiotic processes (≥50%) since 1750 to meet VU.
D1	VU	• Evidence to indicate the community 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	VU	• Evidence to indicate the community 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	-	• Does not meet 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,c; B2b,c

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.

Barrett, M. and English, V. (2017) A flora and vegetation survey of North Kimberley mound springs, Mt Elizabeth Station. Department of Parks and Wildlife, WA.

Bennelongia Environmental Consultants (2017) Ecological Character of Kimberley Mound Springs. Bennelongia Environmental Consultants.

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.

Chemello, D. (2015) Mound Spring Survey August 2015. Department of Parks and Wildlife. Kununurra, WA.

Chemello (2019) Mound Spring Visit July 2019. Department of Biodiversity, Conservation and Attractions. Kununurra, WA.

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, Perth.

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

Halse, S. (2001) Comments on Kimberley Mound Springs sampled by Sally Black. Unpublished Report to Department of Conservation and Land Management.

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.

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

45. Statement on the Standard of Scientific Evidence

Published data on the Black spring organic mound spring community was sufficient to apply some of the Red List of Ecosystem criteria. The outcomes of the assessment are robust for the criteria that have been applied. The assumption was made that impacts to vegetation condition are generally associated with grazing, and this was supported by field survey.

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:

Nature Conservation Coordinator, DBCA East Kimberley District; Parks and Wildlife Service;

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. Black Spring organic mound spring community (boundary in red)