

Gamba grass mapping and monitoring program for Class A (eradication zone)

The methodology to better understand the distribution of gamba grass in the Class A zone and track the progress towards eradication of gamba grass in accordance with the Weed Management Plan for Gamba Grass 2020 - 2030

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Document Control

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Acronyms	Full form
TNRM	Territory Natural Resource Management
WMB	Weed Management Branch

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Glossary

Delimitation / delimit	Surveillance to determine the full extent of an incursion.
Surveillance	The collecting and recording of data on gamba grass presence or absence by survey, monitoring or other procedures.

1. Executive Summary

This mapping and monitoring program has been developed to meet the requirements of the Weed Management Plan for Gamba Grass 2020 – 2030 (the Plan). The Plan requires, a mapping and monitoring program for the Class A eradication zone is developed by July 2021 to understand the distribution of gamba grass across this eradication zone.

Properties with known gamba grass in the Class A zone are documented in this program; the methods proposed to assess gamba grass on each of these properties is also documented. The methodology for monitoring gamba grass in the Class A zone to assess progress towards eradication is also outlined, the results of which can be documented annually in the annual program report which will be made publically available.

Gamba grass is assumed to be absent across the rest of the Class A zone where gamba grass has not been recorded. It is useful to consider how confident we are in these areas being free of gamba grass. For the purposes of this program, the Weed Management Branch is developing a map that presents our confidence in gamba grass absence across the Northern Territory. This confidence in absence is based on a set of factors including for example, proximity to properties with known gamba grass and proximity to high risk activities. This map can be used to help prioritise areas for further surveillance and is planned to be available in 2022.

The Class B properties adjacent the Class A zone have also been considered, as gamba grass in these areas could threaten the Class A zone. A list of properties adjacent the Class A zone with known gamba grass in the 500m buffer have been included in this program, as well as the methods for following up about gamba grass in these areas. In addition, properties bordering the Class A zone will be notified of their revised buffer zone requirements.

2. Aim

This mapping and monitoring program has been developed to meet the requirements of the Weed Management Plan for Gamba Grass 2020 – 2030 (the Plan). The Plan requires, a mapping and monitoring program for the Class A eradication zone is developed by July 2021 to understand the distribution of gamba grass in the Class A zone. The Plan requires this mapping and monitoring program is implemented between July 2021 and July 2022.

3. Objectives

The objectives of this mapping and monitoring program are to:

1. Determine the extent of gamba grass in the Class A zone on properties currently known to have gamba grass.
2. Produce a confidence of gamba grass absence map for the Class A zone which can be used to prioritise surveillance in low confidence areas.
3. Outline the properties in the Class B zone that border the Class A zone and prioritise for surveillance.
4. Provide the methodology for the surveillance of gamba grass for properties outlined in this mapping and monitoring program.
5. Provide the methodology to measure progress towards eradication of gamba grass in the Class A zone.

4. Outcomes

The Plan requires that the mapping and monitoring program is implemented between July 2021 and July 2022. The outcomes of this implementation shall be:

1. By July 2022, the extent of gamba grass has been delimited on land parcels known to have gamba grass and a gamba grass confidence in absence map has been developed for areas where no gamba grass has been recorded.
2. By July 2022, properties bordering the Class A zone have been informed of their new buffer zone requirements and priority properties with gamba grass in the buffer zone have been followed up.
3. A register is maintained by the WMB of all known land parcels with gamba grass in the Class A zone according to their current eradication status at the property level:
 1. unmanaged phase
 2. active management phase
 3. monitoring phase
 4. locally eradicated phase.
4. The eradication status of gamba grass in the Class A zone is tracked each year to assess the eradication objectives outlined in the Plan, (i.e. by July 2026, all gamba grass in the Class A zone is eradicated unless under permit).
5. Results will be produced and made publically available as follows:
 1. a map that shows the confidence in absence of gamba grass across the Class A zone of the Northern Territory
 2. a summary of the progress towards eradication of gamba grass in the Class A zone
 3. annual measurement of gamba grass in the Class A zone in hectares using available spatial data and eradication status information.

5. Legislative Status

Gamba grass is declared a Class A (to be eradicated) and Class B (growth and spread to be controlled) weed in different areas of the Northern Territory. Figure 1 shows the location of the Class A eradication zone and Class B control zone.

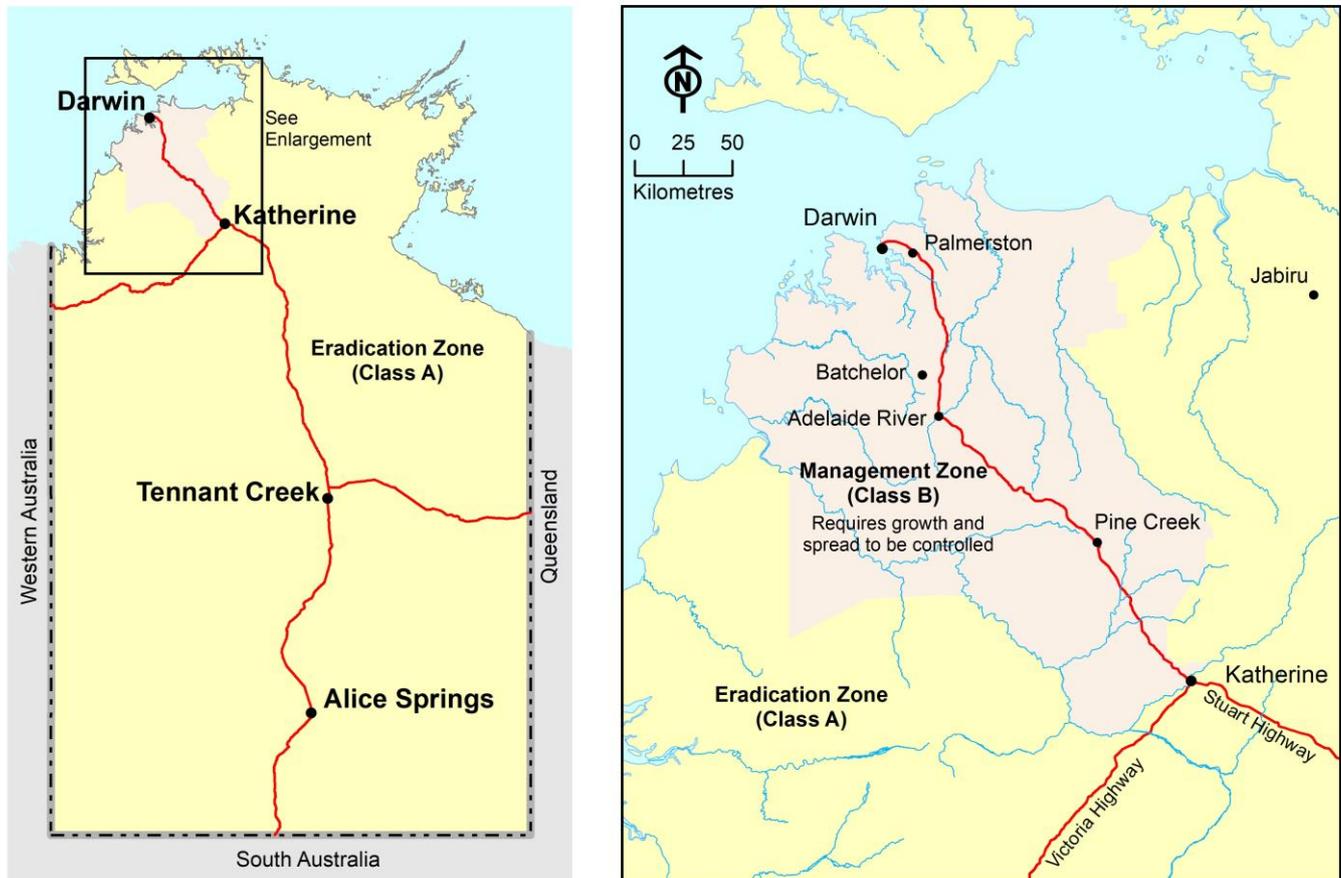


Figure 1 Gamba grass management zones A and B

6. Gamba grass distribution

The current distribution of known gamba grass across the Northern Territory is based on, an aerial survey conducted in 2017 for part of the Class A zone, prior gamba grass records, gamba grass self-reporting, Weed Management Branch (WMB) on ground inspections and liaison with land managers.

Gamba grass across the Class A zone is recorded as being present on the land parcels outlined in Appendix 1. In addition a lot of gamba grass occurs in the road reserves, which are not recorded as land parcels. Recorded gamba grass points are distributed across the Class A zone as shown in Figure 2.

Gamba grass mapping and monitoring program for Class A (eradication zone)

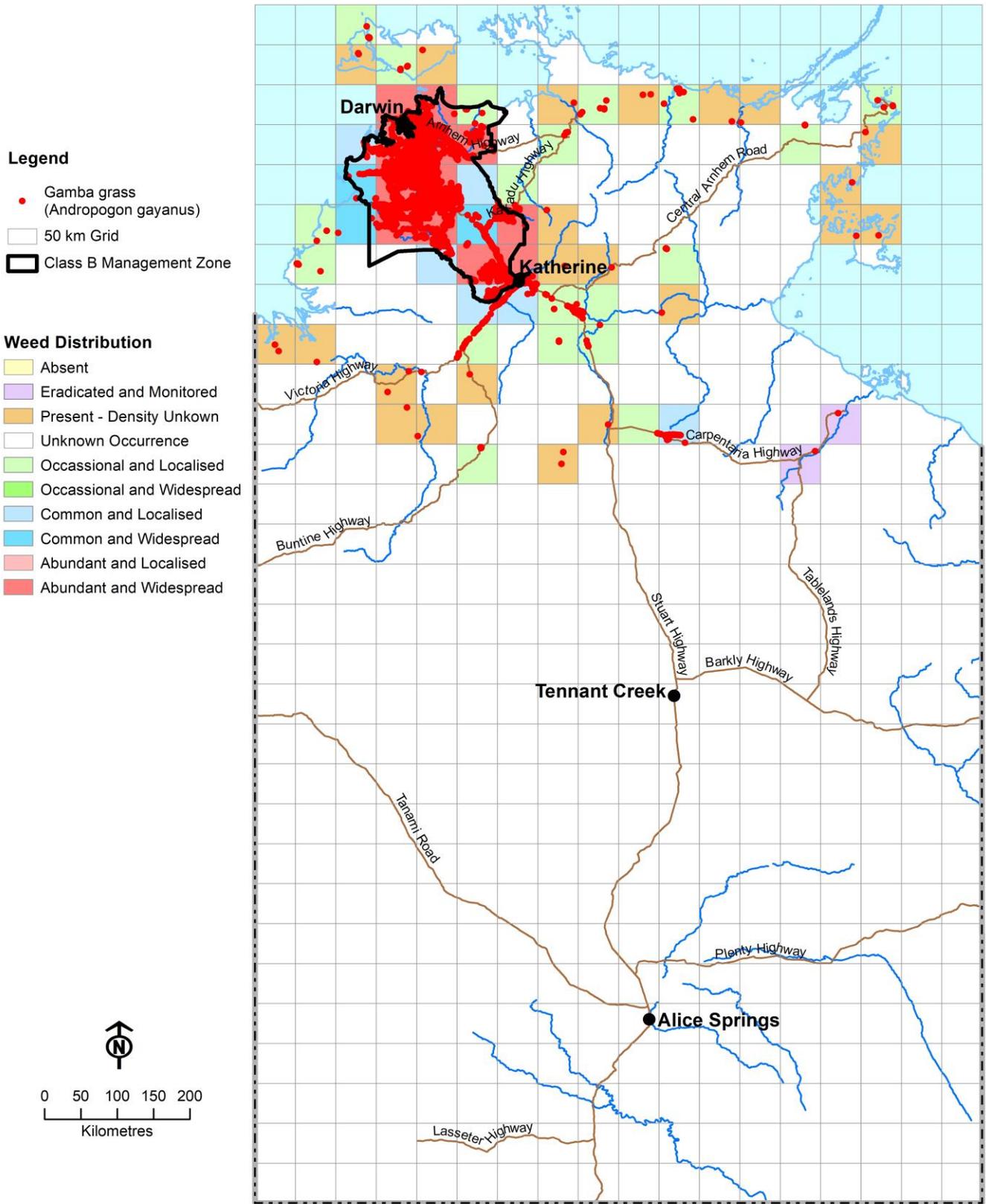


Figure 2 Recorded locations of gamba grass shown across the Class A zone and Class B zone (based on data ranging from 1960 to 2021) (WMB 2021)

6.1. Potential distribution

The potential distribution of gamba grass across Australia has been modelled based on climate data (see Figure 3). Areas scored 7 and above (indicated by yellow, orange and red) are suitable for the growth of gamba grass. This distribution map has been developed based on the climex climate model. Further information on this model can be found: <https://www.hearne.software/Software/CLIMEX-DYMEX/Editions>.

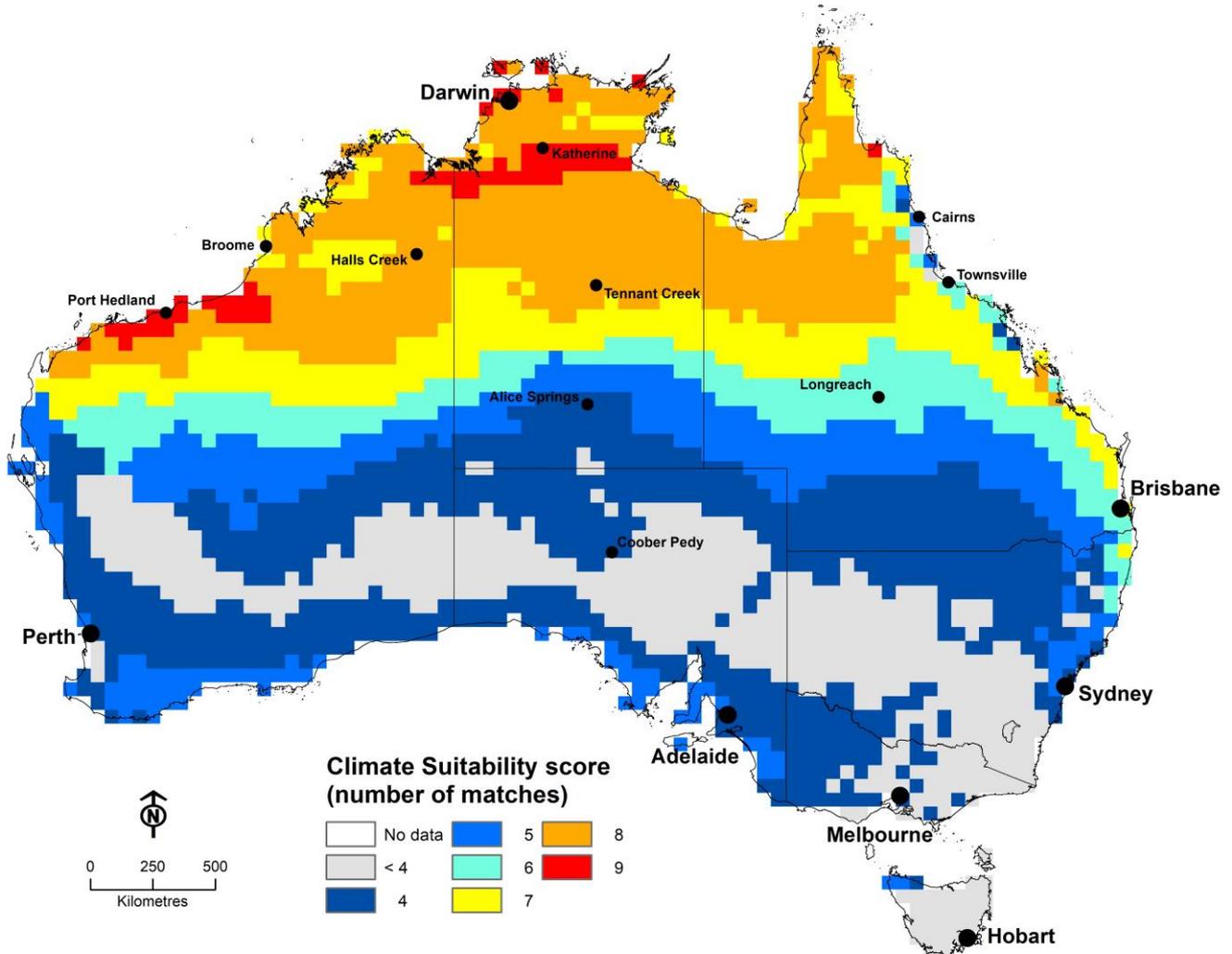


Figure 3 Gamba grass potential distribution across Australia (suitable areas for growth are indicated by yellow, orange and red) (WMB 2021)

7. Methodology for monitoring gamba grass in the Class A zone

The Weed Management Branch has developed a monitoring methodology for eradication targets derived from protocols described by Wilson et al (2017).

This section summarises the methodology used to track the eradication of gamba grass across the Class A zone:

1. for each gamba grass unit assigned to a property, and
2. at an overall property level.

7.1. Gamba grass units

Gamba grass units will be determined for each property in the Class A zone that has recorded a gamba grass point(s). Using GIS, a grid of 1 Hectare cells is applied across the entire Class A zone, each cell represents an individual gamba grass unit. Where no gamba grass is recorded in the 1ha area of the unit it (the unit) will be assigned as 'null', if a gamba grass record occurs in a unit it will be assigned a value based on the management stage.

Figure 4 demonstrates how the gamba grass units will proceed through three stages. Further case scenarios that demonstrate progression are included in Appendix 2.

- **Active** - Gamba grass units with a recorded gamba grass point, are initially assigned as an 'active' unit.
- **Monitoring** - 'Active' Gamba grass units can move from 'Active' to 'Monitoring' when absence of gamba plants has been reported in the unit at least 12 months after the last detection. This implies a search must be conducted at least 12 months after detection, an 'Active' unit will not move to 'Monitoring' unless absence is reported.
- **Locally eradicated** - Gamba grass units can move from 'Monitoring' to 'Locally Eradicated' when absence of gamba plants has been reported in the unit at least 24 months after the last detection. This implies a search must be conducted at least 24 months after detection, a 'Monitoring' unit will not move to 'Locally Eradicated' unless absence is reported.

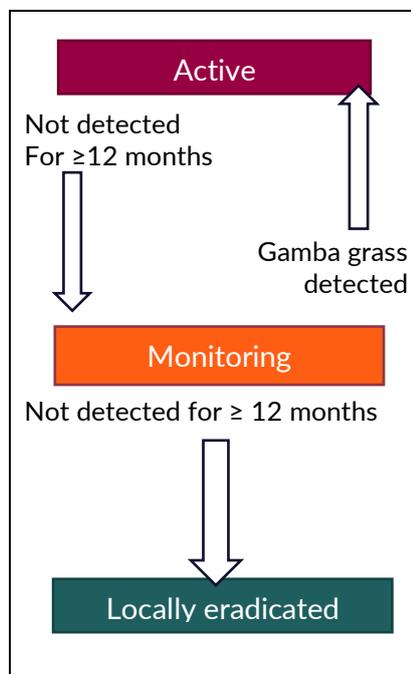


Figure 4 Gamba grass unit stages proceeding from 'Active' through to 'Locally Eradicated' (Adapted from Wilson et al 2017)

7.2. Evaluating historic gamba grass sites

There are areas in the Class A zone where gamba grass has been recorded and controlled in the past which no longer have gamba grass present because it has been effectively controlled. Here we consider sites where all gamba grass records are greater than 10 years old. To evaluate these sites requires an inspection of the immediate vicinity where the historic gamba grass record is located. Depending on how old the records are, if no gamba grass is found then the gamba grass unit can progress into either the monitoring or locally eradicated status, see (Figure 5).

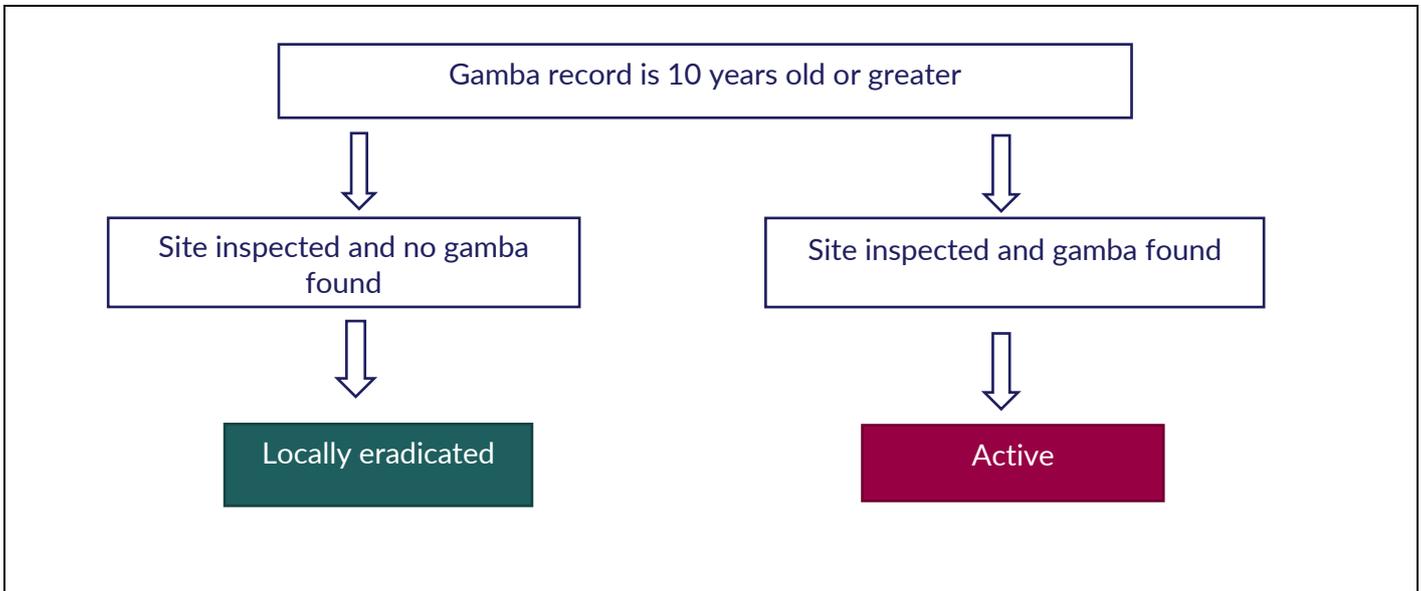


Figure 5 - The evaluation of historic gamba sites

7.3. Gamba grass property status

The gamba grass property status is an overall eradication status that will be applied to each property in the Class A zone which has recorded gamba grass. The property status describes the overall gamba grass eradication status for the property based on all the gamba grass units.

For properties with gamba grass the four status stages are:

- unmanaged phase
- active management phase
- monitoring phase
- locally eradicated phase.

Table 1 shows the relationship between the property status and the gamba grass units on a property.

Table 1 How gamba grass property status corresponds to gamba grass units

Gamba grass property phase	Gamba grass units
Unmanaged phase	Gamba grass units within a property are 'active' and no recorded gamba points are being managed.
Active management phase	Gamba grass units within a property are 'active' and where gamba grass control is occurring for (at least) some recorded gamba points on the property.
Monitoring phase	All gamba grass units for the property are assigned as 'Monitoring' or as 'Locally eradicated'

Gamba grass property phase	Gamba grass units
	#Note if new gamba grass is detected when in the 'Monitoring Phase' the gamba grass unit(s) with gamba grass return to 'Active' and the gamba grass property status returns to either 'Unmanaged Phase' or 'Active Management Phase', depending on whether controlled or not.
Locally eradicated phase	All gamba grass units for the property must be assigned as 'Locally Eradicated.'

7.4. Gamba grass eradication register

A gamba grass eradication register will be developed for the Class A zone and will track the eradication status of properties in this zone.

It is noted that the gamba grass status of roads in the Class A zone will also be tracked in the eradication register. Roads are not properties but will be tracked on the same basis as properties. Roads will be broken into segments as per the practice in road maintenance and the segments tracked.

Table 2 Information that will be tracked in the gamba grass property register

Item	Information to be tracked in register
Property's	The register will track for each property: <ul style="list-style-type: none"> • The total number of gamba grass units • The status of each gamba grass unit • The overall property status.
Roads	Roads in the Class A zone will be broken down into segments which will be included in the register.

The finding of the eradication register will be reported annually for the Class A zone in the annual gamba grass reporting. The following will be reported:

1. The number of gamba grass units (hectares) that are:
 - active
 - monitoring
 - locally eradicated.
2. The number of properties with gamba grass that are in each of the following phases:
 - unmanaged phase
 - active management phase
 - monitoring phase
 - locally eradicated phase.

8. Delimitation of gamba grass in areas with recorded gamba

8.1. Possible methods for delimitation of gamba grass

In order to track the eradication of gamba grass across the Class A zone and apply the methodology above, delimitation of gamba grass is required.

“Delimitation is the process of determining the full extent of an invasion” (Sheehan et al 2018). For gamba grass in the Northern Territory this will require intensive surveys around known gamba points on properties as well as surveillance in areas where gamba grass is not recorded. Methods that may be used for delimiting gamba grass are included in Table 3.

Table 3 Possible methods for delimitation of gamba grass

Method	Limitations
Contacting land owners / occupiers and requesting they report gamba grass data	Land owners / occupiers may not provide information on gamba grass.
Ground survey is a reliable surveillance method where access is available	Limited WMB resources exist for survey effort across the full extent of the Class A zone.
Remote sensing	Remote sensing is resource intensive in terms of costs and staffing resources that are required to process the data. On the ground survey is also required after remote sensing has been conducted to verify the results. Overall the confidence in remote sensing results across the Class A is low when compared with on the ground survey. Remote sensing may be useful in selected situations, for e.g. to narrow down a search area on a property proposed to be surveyed and suspected of having 'hidden gamba'.
Aerial surveillance is an effective way of gamba grass survey and has been used as a method by the Weed Management Branch to map areas of gamba grass in the Class A zone previously.	Funding would need to be sourced to carry out aerial surveillance.

8.2. Proposed delimitation methods for areas with recorded gamba grass

A list of properties where gamba grass is known to occur is included in Appendix 1. To understand the full extent of gamba grass on these properties, delimitation of gamba grass must be carried out. Delimitation is the process of verifying the full extent of gamba grass around a gamba grass plant or infestation. It is recommended that in order to delimit gamba grass up to a 50m radius is searched around recorded gamba grass. If a new gamba grass plant is detected the 50m radius restarts around the new plant.

Land managers of properties with gamba grass in the Class A zone need to delimit and manage gamba grass on their property.

The Weed Management Branch will assess the status of gamba grass on properties in the Class A zone through a range of methods including:

- liaising with all properties in the Class A zone with recorded gamba grass and requesting gamba grass data (see Appendix 3 for example letter)
- conducting gamba grass inspections
- if required, remote sensing may be a useful tool to detect gamba grass in remote areas.

The proposed methods for assessing the status of gamba grass for each property known to have gamba grass is included in Appendix 1.

8.3. Results

The information obtained through this process will be used to update the gamba grass eradication register that will be reported on annually (see Section 7.4 above).

9. Surveillance of gamba grass in the Class A zone in areas believed to be free of gamba grass

There are large areas of the Northern Territory where gamba grass has not been recorded and that are assumed to not have gamba grass. It is useful to consider how confident we are in these areas being free of gamba grass. A series of factors have been identified as contributing to the risk of gamba grass occurring. These factors are identified in Table 4 and are defined further below.

The factors in Table 4 and the scoring system will be used to develop a confidence in gamba grass absence map for all properties in the Class A zone.

Table 4 Criteria to determine gamba grass confidence in absence map

Factors	Score	Comments
Presence record	10 (red)	Within the A zone, a 1km grid cell around historical gamba points is designated as at exceptional risk of continued infestation or re-establishment and is scored 10, indicating very low confidence of absence.
Infested premises (IP)	3	
Adjacent to an IP	1	
High risk activity	2	
Suitable climate area	1	
Unsuitable climate area	0 (white)	Areas with unsuitable climate for naturalisation are scored 0 regardless of other factors, indicating a very high confidence in absence.

These factors are defined further below:

Presence record: Historical record of gamba grass that have occurred in a naturalised setting. A 1km grid cell is intersected with the weed record to indicate very low confidence of absence applies to the area surrounding the record. A weed point of a large size may be expanded to for e.g. 100m and may intersect several grid cells. The grid cell area is directly assigned a score of 10 and no further weighting is applied.

Infested premises (IP): A parcel which contains a gamba grass IP record is at high risk of further gamba grass occurrence by human and natural spread processes. These parcels are assigned a 3 weight which can combine with other weight factors.

Adjacent to an IP: Parcels which adjoin an IP are at an elevated risk of further gamba grass occurrence, most notably by human spread but also by natural spread processes. This also applies where the parcel is itself an IP as the external spread risk is in addition to the internal risk. These parcels are assigned a 1 weight which can combine with other weight factors.

High risk activity: Parcels which are near or on areas with activities known to cause increased risk of weed spread and introduction have an elevated risk of further gamba grass occurrence. This applies to corridors where maintenance activities intersect existing gamba grass and to project footprints where there is ground disturbance and large amounts of goods, machinery and infrastructure being transported in from the B zone. A 'report' criteria exists for instances where an event is known to have occurred on a parcel that could lead to gamba grass introduction but no survey has occurred to determine if introduction occurred.

Current criteria considered as high risk are:

- rail corridors where gamba grass has been recorded
- road segments where gamba grass has been recorded
- areas where significant infrastructure projects are occurring (no instances)
- areas where gamba grass or high risk events have been reported but the area has not been surveyed (no instances).

Note that 'project' and 'event' are data deficient and there are no instances included in the current analysis.

These parcels are assigned a 1 weight which can combine with other weight factors.

Climate Zone: Parcels which are fully south of the 18th parallel are deemed to have a climate unsuitable for the naturalisation of gamba grass. Those north of the 18th parallel may have a suitable climate and are therefore deemed to be at risk. These parcels are assigned a 1 weight which can combine with other weight factors.

9.1. Results

This map can be used to determine areas where we are the least confident in gamba grass being absent and therefore areas that should be prioritised for further surveillance. The final map will be made publicly available at nt.gov.au/gamba. This map will be updated over time and can be included in the annual gamba grass report.

Properties currently under active surveillance are included in Appendix 4.

10. Class B zone properties bordering the Class A zone

10.1. Surveillance of gamba grass in the Class B zone bordering the Class A zone

Gamba grass located in the Class B zone may be a threat to the Class A zone. Gamba grass is located close to the Class A zone boundary in some locations of the Class B zone (see Figure 6).

To protect the Class A zone from gamba grass, the Plan requires a 500m gamba grass free buffer within the Class B zone when the Class B zone adjoins the Class A zone boundary. It is proposed that letters be sent to all properties outside of the Katherine Municipality that border the Class A zone informing about the revised buffer zone requirements. Land owners / occupiers will be notified that are revised gamba grass requirements in accordance with the Gamba Grass Communication Plan 2021 - 2024.

In addition, it is proposed to follow up with each property in the Class B zone that has gamba grass in their 500m buffer adjoining the Class A zone, see Appendix 5.

11. Future gamba detections in the Class A zone

It is possible that gamba grass will be detected in the Class A zone in the future. If new properties are detected with gamba grass are reported to the WMB these properties will be added to this program and the gamba grass eradication register. All new detections will be followed up to ensure that the objectives of the Plan continue to be met.

Gamba grass mapping and monitoring program for Class A (eradication zone)

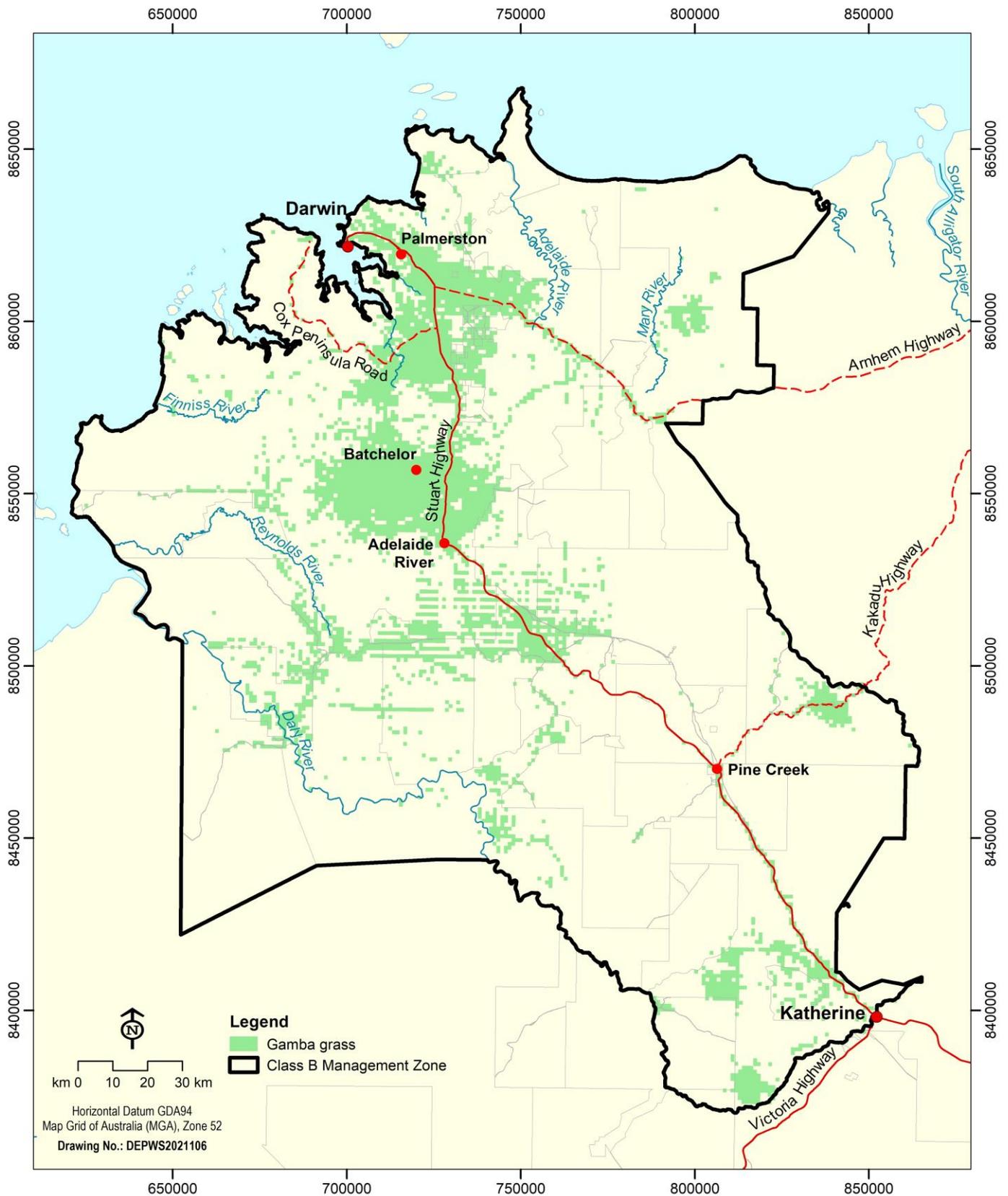


Figure 6 Gamba grass presence in the Class B zone showing gamba grass close to the Class A zone boundary (based on data ranging from 1960 to 2021 (WMB 2021))

12. Performance Indicators

To assess performance against this program the following performance indicators in Table 5 will be measured.

Table 5 Performance Measures

Performance indicator	What will be measured	Timeframe
Extent of gamba grass in Class A zone	The extent of gamba grass has been assessed (via inspection, letters sent and follow up liaison conducted) for land parcels known to have gamba grass.	Target: 30% by end of 2021 60% by end of 2022 100% by July 2023
Eradication register has been developed	The eradication register has been developed for gamba grass with all known gamba parcels. The register has been separated into management units for the larger land parcels.	July 2021
Gamba grass management units assessed	Assessment of the number of gamba grass units for each property. The units for each property are assessed as 'active', 'monitoring' or 'locally eradicated'.	July 2021
Monitoring protocol developed	Northern Territory Government Weed Management Branch Monitoring Protocol for Eradication in the Northern Territory has been developed. The monitoring protocol will include the methods for reporting gamba grass absence data including historic gamba grass points that he been assessed and determined absent.	October 2021
All known gamba properties are aware of requirements and mapping and monitoring program	All properties known to have gamba grass have been either inspected or contacted via letter informing of requirements of plan and this mapping and monitoring program.	October 2021
Properties under active management	All known land parcels with gamba grass in the class A zone are classified as 'active management phase'. (All gamba grass in the Class A zone is under an active eradication program and all gamba grass plants have been destroyed).	July 2023
Properties under monitoring phase	All known land parcels with gamba grass in the class A zone are clarified as c) monitoring phase.	July 2025
Properties that have eradicated gamba grass	All known land parcels with gamba grass in the Class A zone are clarified as d) locally eradicated phase.	July 2026

13. References

Sheehan, M., James, R. and Blood, K. (2018) *Looking for weeds: search and detect guide (2nd Edition)*. A guide for searching and detecting weeds at the early stage of invasion on public land in Victoria. Department of Environment, Land, Water and Planning, Victoria. Accessed online on 12 May 2021:

<https://www.environment.vic.gov.au/data/assets/pdf_file/0024/49173/WESI-Guide-2ndEd-01_search-and-detect_PRINT.pdf>

Wilson, J., Panetta, D. and Lindgren, C. (2017). *Detecting and Responding to Alien Plant Incursions*. University Printing House, Cambridge.

Appendix 1 Properties known to have gamba grass and proposed delimitation

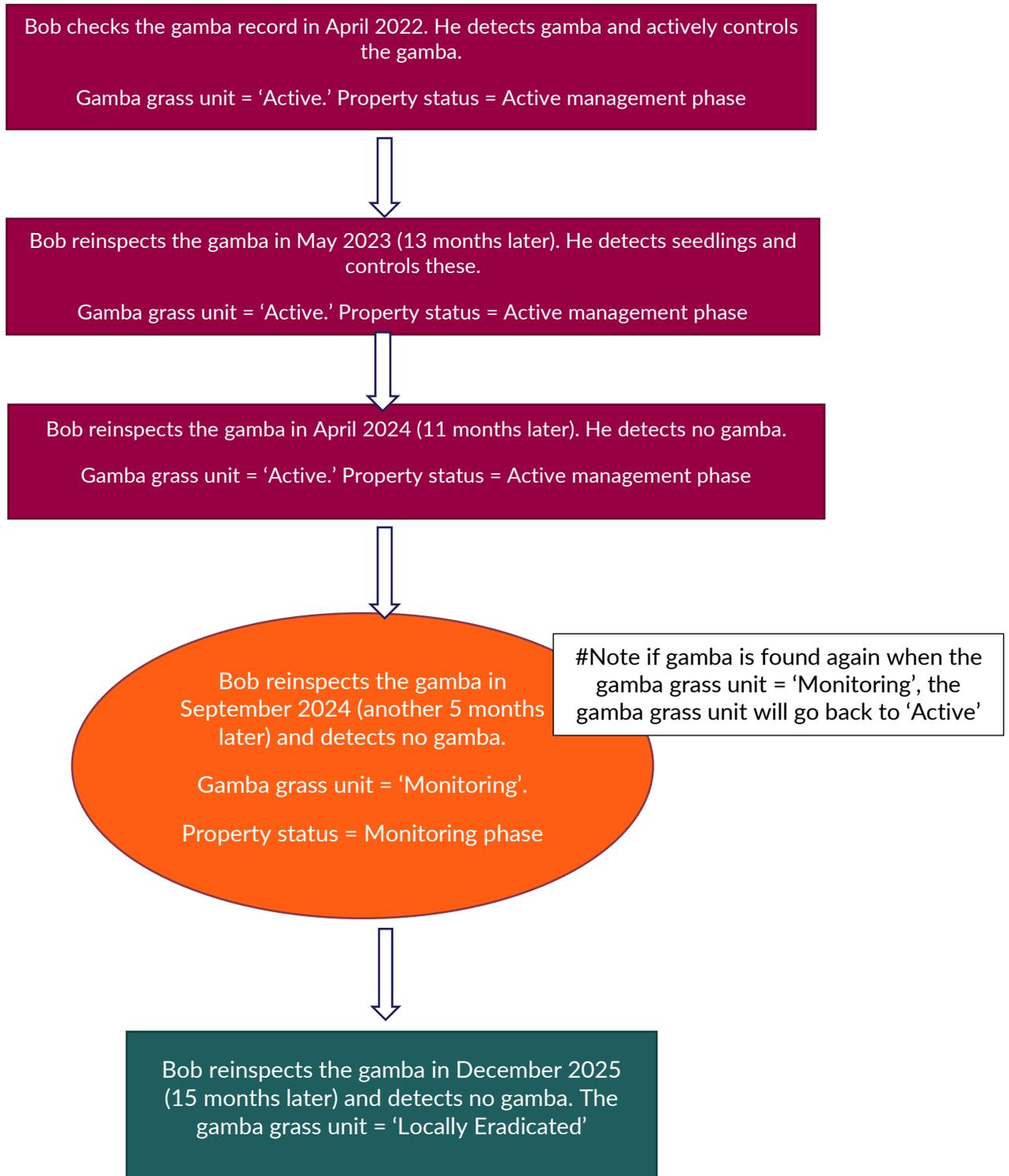
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Appendix 2 Case Scenarios

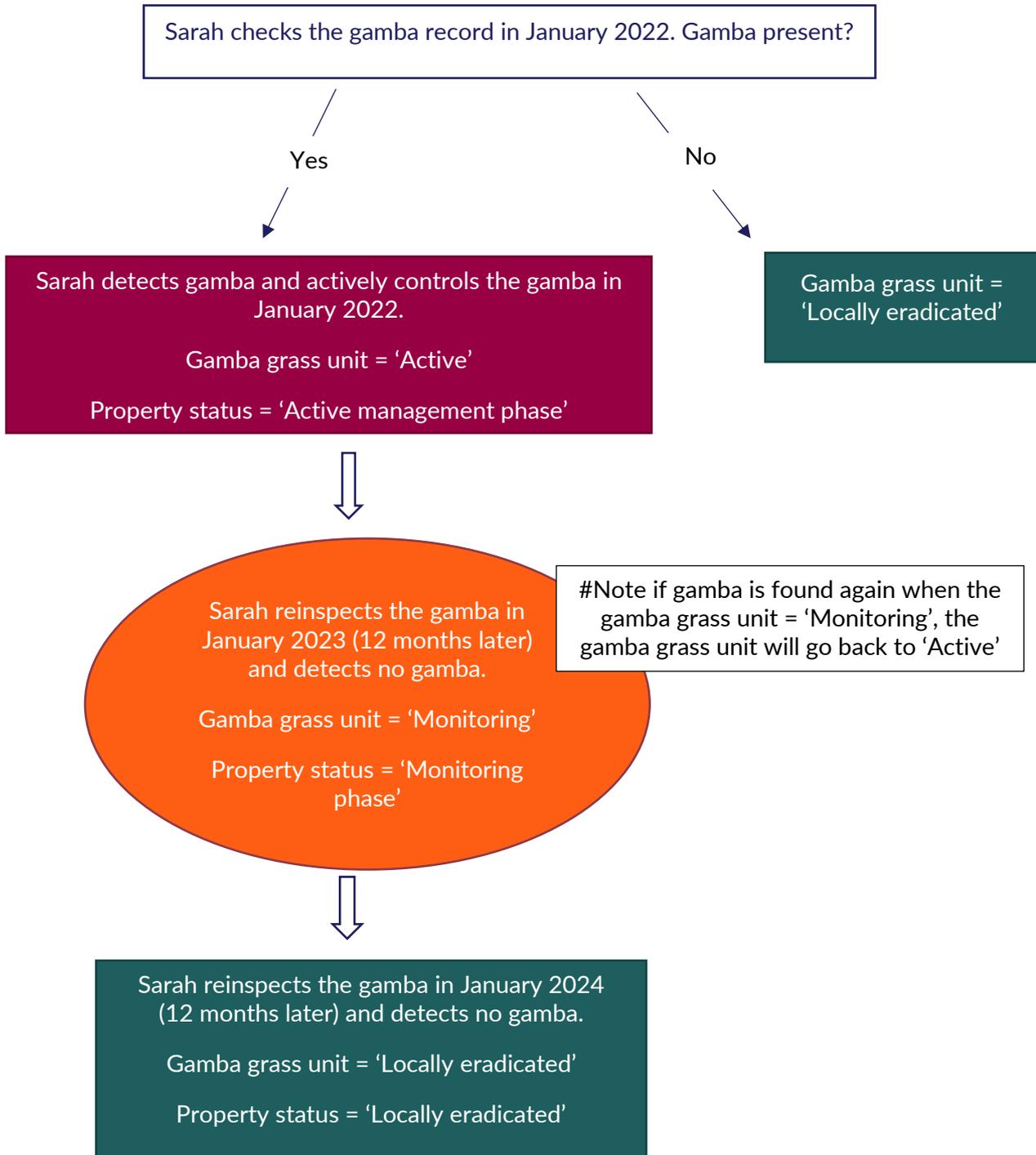
Scenario 1

Bob is located in the Class A zone and has gamba on his property. He has been asked to check a gamba record on his property that is 2 years old.



Scenario 2

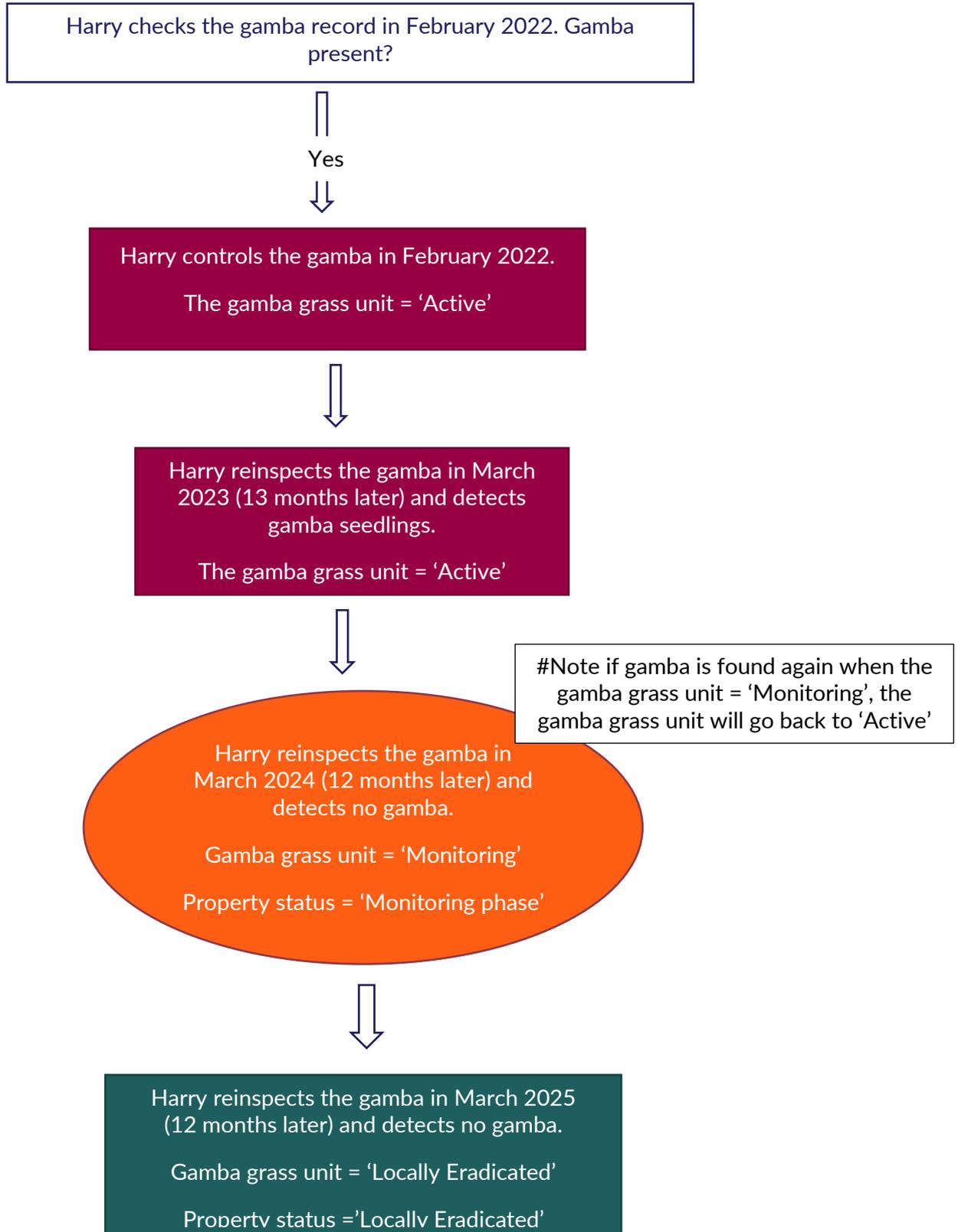
Sarah is located in the Class A zone and has a gamba record on her property that is 10 years old. She has been asked by the WMB to check this location for the presence of gamba.



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Scenario 3

Harry is located in the Class A zone and has ten gamba records on her property (within 1 gamba grass unit) that are between 1 – 10 years old. He has been asked by the WMB to check this location for the presence of gamba.



Appendix 3 Example Letter to landholders

1 April 2022

<Position title>
Department of <NAME>
GPO Box <XXXX>
<Suburb NT Postcode>

Dear Sir/Madam

Re: Gamba grass mapping and monitoring program for Class A (eradication zone)

The Weed Management Branch in conjunction with the Gamba Grass Weed Advisory Committee has recently completed the new Weed Management Plan for Gamba Grass 2020 – 2030.

As a landowner in the Class A gamba grass eradication zone your requirements are:

- All gamba plants are destroyed by July 2023.
- Detect and destroy all gamba grass regrowth prior to seedling (July 2023 – July 2025).
- Monitor and destroy regrowth and any new gamba grass introductions annually.

These requirements aim to meet the objective of eradicating gamba grass in the Class A zone by July 2026 (unless under permit).

Our records indicate that gamba grass is located on your property at the locations provided in Appendix A. <GPS points for gamba on property will be provided> The Weed Management Branch (WMB) request that you survey these locations and provide updated data to the WMB about gamba grass present at these locations. An instructional guide is attached to assist. If any other gamba grass is present on your property you are also required to report these locations to the WMB.

For further advice about this or managing weeds in general, please feel free to contact your local regional weed management branch on Darwin – 8999 4567 and Katherine – 8973 8857.

Yours sincerely

xxxxxx
Regional Manager

Appendix 4 Properties with no recorded gamba under active surveillance

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Appendix 5 Class B zone priorities for surveillance

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