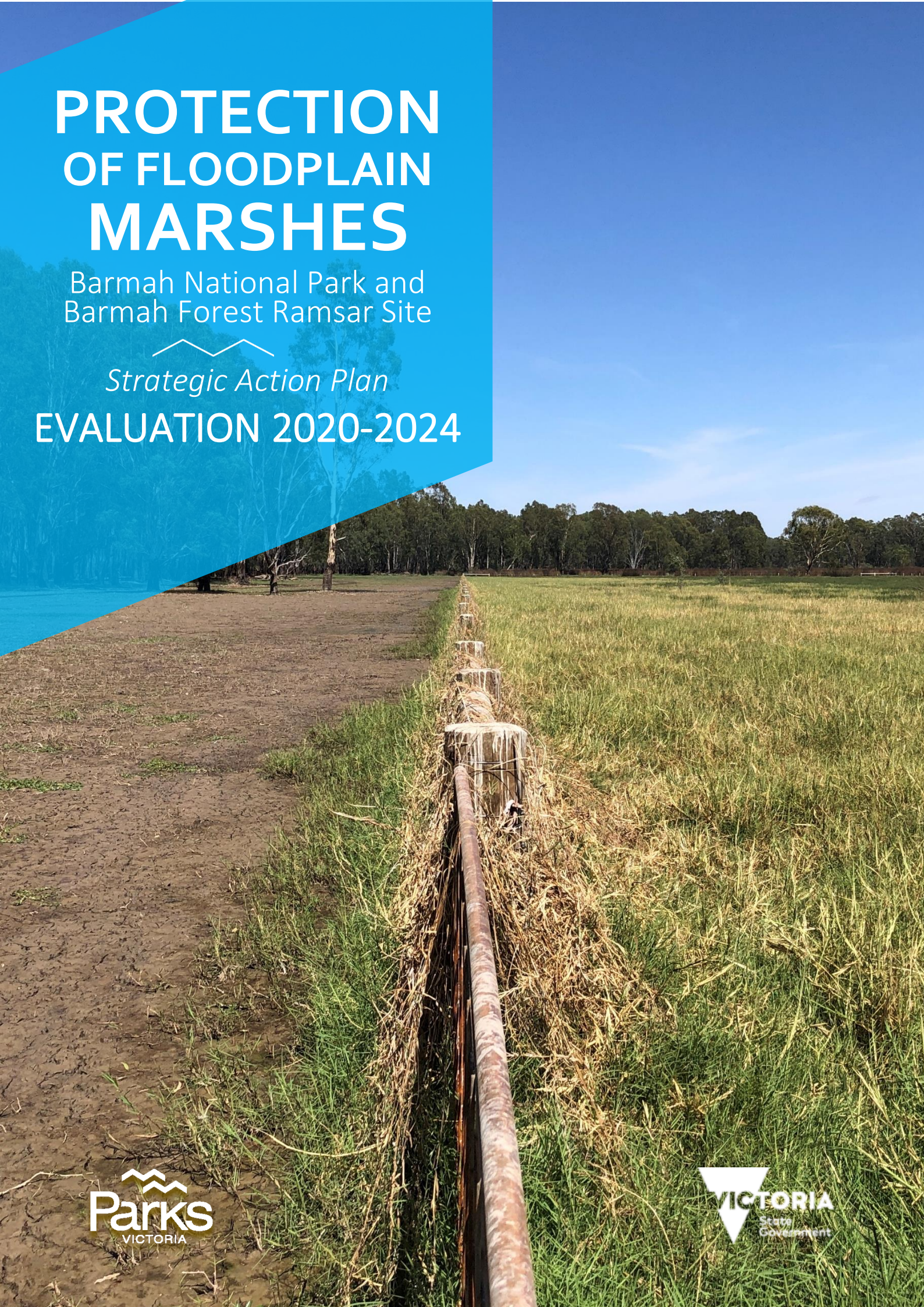
PROTECTION OF FLOODPLAIN MARSHES

Barmah National Park and Barmah Forest Ramsar Site

Strategic Action Plan

EVALUATION 2020-2024



Parks VICTORIA

VICTORIA State Government

Acknowledgement of Country

Victoria's network of parks and reserves form the core of Aboriginal cultural landscapes, which have been modified over many thousands of years of occupation. They are reflections of how Aboriginal people engaged with their world and experienced their surroundings and are the product of thousands of generations of economic activity, material culture and settlement patterns. The landscapes we see today are influenced by the skills, knowledge and activities of Aboriginal land managers. Parks Victoria acknowledges the Traditional Owners of these cultural landscapes, recognising their continuing connection to Victoria's parks and reserves and their ongoing role in caring for Country.

Imagery

Front cover: Grazing exclosure at Streamer Plain showing Moira Grass growth in the ungrazed section, and bare ground in the unprotected area, February 2023 (Photo credit: Tim Barlow).
Page 6: Yellow-billed Spoonbill nesting at Top Island (Photo credit: Keith Ward, GBCMA)
Page 9: Juvenile Common Long-necked Turtle at Bunyip Waterhole (Photo credit: Keith Ward, GBCMA)
Page 10: Spotted Marsh frogs breeding after rain (Photo credit: Keith Ward, GBCMA)
Page 14: Flooding on Hut Lake in January 2023 (Photo credit: Keith Ward, GBCMA)
Page 18: Steamer Plain in March 2024 (Photo credit: Keith Ward, GBCMA)
Page 21: Feral pig raiding Australian White Ibis nest (Photo credit: Keith Ward, GBCMA)
Page 23: Arrowhead at Top Island (Photo credit: Keith Ward, GBCMA)
Page 25: Shallow freshwater marsh at Little Rushy Swamp
Page 28: Muellers Daisy carpet at Grinters Ridge (Photo credit: Keith Ward, GBCMA)
Page 30: Spotted Marsh Frog eggmass at Steamer Plain (Photo credit: Keith Ward, GBCMA)
Back cover: Moira grass cover in 2024, showing cover of Moira grass merging inside and outside of one of the herbivore exclosures.

This document may be cited as:

Parks Victoria 2024. Protection of Floodplain Marshes in Barmah National Park and Barmah Forest Ramsar Site – Strategic Action Plan EVALUATION 2020-2024. Parks Victoria: Melbourne, Australia

Disclaimer

This plan is prepared without prejudice to any negotiated or litigated outcome of any native title determination applications covering land or waters within the plan's area. It is acknowledged that any future outcomes of native title determination applications may necessitate amendment of this plan; and the implementation of this plan may require further notifications under the procedures in Division 3 of Part 2 of the Native Title Act 1993 (Cwlth).

The plan is also prepared without prejudice to any future negotiated outcomes between the Government/s and Traditional Owner Communities. It is acknowledged that such negotiated outcomes may necessitate amendment of this plan.

This publication may be of assistance to you but Parks Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

Authorised and published by Parks Victoria
Level 10, 535 Bourke St, Melbourne

Strategic Action Plan

Protection of Floodplain Marshes

Barmah National Park and Barmah Forest Ramsar Site

2020 – 2024

PLAN EVALUATION

July 2024

Contents

EXECUTIVE SUMMARY

Barmah National Park, north-east of Echuca on the Murray River, is jointly managed by Parks Victoria and the Traditional Owners, the Yorta Yorta people. The ecological health of the area is essential to Traditional Owners' cultural and spiritual connections to the land, and it supports valuable recreation and tourism activity.

Barmah National Park covers most of the area of the Barmah Forest Ramsar site which supports nearly 300 native species of birds, fishes, reptiles, frogs and other animals and more than 500 native plant species. This includes endangered or vulnerable species such as the Australasian Bittern, Superb Parrot, Murray Cod, Silver Perch, Trout Cod, Mueller Daisy and River Swamp Wallaby-grass.

The *Strategic Action Plan: Protection of Floodplain Marshes in Barmah National Park and Barmah Forest Ramsar Site, 2020-2023* (hereafter the *Strategic Action Plan*) was developed in response to a decline in the wetland vegetation classification 'floodplain marshes', and Barmah is one of the few places in south-east Australia where extensive swards of Moira Grass (*Pseudoraphis spinescens*) are found. Moira Grass, a critically important native wetland grass species, once dominated the extensive floodplain marshes in the area but has since suffered a significant decline.

The principal factors that are likely to have contributed to the decline in Moira Grass extent are:

- Changes to the natural flooding regime due to river regulation
- Grazing and trampling pressure by introduced animals, particularly by feral horses (and previously, cattle)
- Encroachment by invasive plant species.

The *Strategic Action Plan* has been implemented since its release in February 2020 to address these issues. This document reports on the evaluation of the implementation of the *Strategic Action Plan* over the period between 2020 and 2024, and provides recommendations for on-going management of floodplain marshes.

The overarching objective of the *Strategic Action Plan* is to:

Improve the health of the floodplain marshes of Barmah Forest, increasing the extent and cover of Moira Grass plains and associated wetland vegetation.

The five component strategies of the *Strategic Action Plan* have the following aims:

1. To maintain and, if possible, improve the water regime for floodplain marshes, particularly Moira Grass plains.
2. Reduce the feral horse population to a maximum of 100 over four years, and over the long-term, to zero, thereby alleviating the total grazing and trampling pressure caused by this introduced species.
3. To reduce total grazing pressures and other impacts exerted by feral pigs and introduced large herbivores on Moira Grass, other floodplain marsh communities, and Aboriginal Cultural sites.
4. To reduce the encroachment of invasive native flora species (giant rush and river red gum), and control arrowhead invasion, to support Moira Grass recovery.
5. To aid the re-establishment of Moira Grass in areas where it no longer occurs, a re-establishment program will be implemented.

Achieving conservation outcomes for the floodplain marshes, and to progress re-instatement of more suitable habitat conditions, regeneration, or reduced competition, has been dependent on the simultaneous delivery of each of the conservation strategies to address the threat objectives below.

Threat objectives

Progress status icons

1. Maintain and, if possible, improve current water regimes of floodplain marshes

Overall the management of the water regimes over the four years covered by the *Strategic Action Plan* has benefited the Moira Grass plains, acknowledging some late summer flood events extending the natural period of inundation of some of the floodplains. Although late summer flooding can be

detrimental to Moira Grass plains by encouraging Giant Rush incursions, in this period, the late flooding extended the duration of beneficial flooding which commenced in the preceding spring.

Recommendations: 1.1 Strengthen the adoption of water management that best reflects the natural flood regime of the floodplain marshlands through maximising flood depth in late-winter through to end of spring (within recognised operating river release constraints), and promote floodplain drying regime in late-summer and autumn.

1.2 Encourage Murray Darling Basin Authority to reduce the current level of e-water delivery flow constraint (currently 3.0 metres at Tocumwal) to enhance the opportunity for increasing managed flood depth on the floodplain marshlands in Barmah Forest.

2. Reduce the feral horse population to a maximum of 100 over four years, and over the long-term, to zero.

The management of feral horses has achieved the overall feral horse population targets over the four years covered by the *Strategic Action Plan*, while meeting animal welfare objectives. Reconnaissance flights over likely horse-occupied habitats in October 2023 observed 40 horses, and while these observations can only be regarded as a minimum number, there is a high level of confidence that fewer than 100 horses remain.

Recommendations: The objective of feral horse control is now to reduce the feral horse population to zero.

2.1 This will be achieved by removing feral horses from Barmah National Park primarily through targeted ground-shooting by appropriately accredited professionals under strict protocols and oversight. Feral horses will only be trapped and rehomed if it is feasible, safe and humane to do so, and if there is sufficient demand from organisations or individuals that can suitably care for the captured horses. Aerial shooting may be considered as an appropriate technique for removing small numbers of remaining horses, provided that specific standard operating procedures that ensure high standards of humaneness, are developed and met.

2.2 With feral horse numbers now at very low levels, adopt a surveillance approach and frequency to enable the detection of any remaining feral horses or horses released into the Barmah National Park, and ensure that there is a rapid management response to remove those horses.

3. Reduce total grazing pressures and other impacts exerted by feral pigs and introduced large herbivores.

Eradication objectives for feral sheep and goats have been achieved. There are indications from formal monitoring and informal observations that ground disturbance and other impacts from feral pigs and deer are being reduced despite the recent improvement in conditions for feral pigs.

Recommendations: 3.1 Deliver targeted compliance actions aimed at reducing illegal hunting activities and vandalism, while increasing the success of feral pig and herbivore control implemented by Parks Victoria.

3.2 Increase the focus on control of Fallow and Sambar deer to reflect their general increase in abundance across the Parks Victoria estate.

4. Reduce the encroachment of invasive native flora species and control arrowhead invasion.

Adverse ground conditions and delays in approvals have limited progress in controlling the spread of Giant Rush and River Red Gum saplings. Monitoring is not scheduled until 2025-26 to determine management effectiveness.

There has been good progress in reducing existing Arrowhead infestations, and in the detection, control and prevention of new infestations, however the scale of reduction has not been measured.

Recommendations: 4.1 Explore with the Department of Environment Energy and Climate Action (DEECA) how burn plans could be prioritised to take advantage of seasonal conditions to control Giant Rush.

4.2 Investigate alternative techniques for monitoring Arrowhead, including remote sensing.

4.3 Explore with Goulburn-Murray Water (GMW) how to further reduce risk of Arrowhead invasion from irrigation drainage channels, and continue support for Arrowhead control being undertaken by other agencies (Goulburn Broken Catchment Management Authority, GMW).

5. Aid the re-establishment of Moira Grass in areas where it no longer occurs.

This strategy related to the implementation and evaluation of a trial for the propagation and transfer of Moira Grass, from the laboratory to the field. While the field trial was unsuccessful, the experiment showed that prevention of grazing is a much more efficient means of re-establishing Moira Grass at scale.

Recommendation: 5.1 The landscape-scale application of assisted propagation will not be pursued further. However, nursery-based propagation and re-planting in small patches may have some further application in wetlands where no viable propagules remain.

Conservation outcomes

Three ecological attributes were selected as priorities to track the health of the floodplain marshes of Barmah Forest on the basis that they would be responsive to the strategies for the management of water, large herbivores and invasive plants, and perform a critical function in enriching habitat for many other fauna and fish species occupying the floodplains, or that they are representative of other species that occupy the various levels of the floodplain profile. They are also key components of the *Ecological Character Description for Barmah Forest* (Hale & Butcher 2011).

Extent and cover of Moira Grass

There are strong signs of recovery in the extent and cover of Moira Grass. This signal is strongest in the six small-scale exclosures that were fenced between 2016 and 2020, to protect sensitive areas from the effects of grazing and trampling, and to measure the effects of natural and assisted propagation. Overall, monitoring has demonstrated higher cover of Moira Grass (and some other plant species) within the exclosures compared to outside the exclosures, and the resultant benefits attained by removing the grazing and trampling pressure of horses and other non-native grazing species.

The area of Moira Grass was mapped across the floodplain marshes of Barmah National Park following flooding in spring-summer 2020-21. While this resulted in an estimate of 245 hectares, an increase from the previous estimate, this mapping occurred before the full effects of the large herbivore control program that has been implemented over the last four years could be measured. It is anticipated that the next survey, planned for 2024-25, will reflect the current onground observations of increased Moira Grass cover in floodplain marshes where there have been sufficient stolons, rootstock and seed to allow reestablishment in the absence of grazing.

Presence of River Swamp Wallaby-grass

Over the period, the nationally threatened River Swamp Wallaby-grass (*Amphibromus fluitans*) has expanded its presence across the protected exclosure sites, increasing from one site to four. The recently surveyed abundance of River Swamp Wallaby-grass within the Harbours Lake exclosure fencing clearly demonstrates how this species can recover when feral grazing pressures are removed after just two years. This example, coupled with the measured recovery of both River Swamp Wallaby-grass and Moira Grass in Little Rushy Swamp since 2016, clearly indicates that these important native grass species have the potential to recover naturally where feral grazing pressure is removed.

Presence of Mueller Daisy

The nationally threatened Mueller Daisy (*Brachyscome muelleroides*) was not recorded in Victoria for over two decades until it was rediscovered at Barmah National Park in spring 2019. In spring 2020, Mueller Daisy was recorded at four separate sites within the Barmah National Park. Each site had several patches comprising hundreds or thousands of plants per patch. The survey in spring 2023 recorded Mueller Daisy at all the sites where it had previously been observed, albeit at lower densities due to higher rainfall and flooding.

Next steps

The implementation of the *Strategic Action Plan* has largely achieved its purpose to improve the health of the floodplain marshes of Barmah Forest, by addressing each of the threatening processes impacting them.

Recommendation: 6.0 While the recovery of the Moira Grass plains is at a beginning stage, the ongoing actions and the recommendations from this evaluation that are required to maintain this progress can now be managed through the implementation of the *Barmah Ramsar Site Management Plan* (as part of the *Goulburn Broken Waterway Management Strategy*), the *Barmah National Park Joint Management Plan*, and associated operational plans.

Yellow-billed Spoonbill nesting at Top Island. Moira Grass assists in the biological productivity of the wetland, and the resulting food resources available for nesting waterbirds.

1 Introduction

1.1 Background

This document reports on the evaluation of the implementation of the *Strategic Action Plan: Protection of Floodplain Marshes in Barmah National Park and Barmah Forest Ramsar Site, 2020-2023* (hereafter the *Strategic Action Plan*[1]), and provides recommendations for on-going management of floodplain marshes.

The *Strategic Action Plan* was developed in response to a decline in the wetland vegetation classification 'floodplain marshes' (as per DELWP 2016) in the Barmah Ramsar Site, where extensive swards of Moira Grass (*Pseudoraphis spinescens*) are found. This native wetland grass species used to dominate the extensive floodplain marshlands in the area but has declined dramatically since the regulation of the Murray River and the introduction of stock.

The *Strategic Action Plan* was released in February 2020 with the overarching objective to *improve the health of the floodplain marshes of Barmah Forest, increasing the extent and cover of Moira Grass and associated wetland vegetation*. Since this time, actions under each of the following strategies have been implemented to progress this objective:

- Continued environmental water management to restore key components of the flood regime and address unseasonal inundation and delivery constraints.
- Control of grazing and other impacts of the feral horse population.
- Continuation/expansion of current control programs for feral pigs and other introduced herbivores.
- Management of encroachment by exotic and native invasive plant species into the Moira Grass plains.
- Active regeneration of Moira Grass.

The *Strategic Action Plan* committed to a comprehensive review to occur in the final year of the plan in June 2023. Due to delays in implementation associated with social constraints imposed by the COVID-19 pandemic and wet seasonal conditions in late 2022 and throughout 2023, the *Strategic Action Plan* was subsequently extended to June 2024. This report describes the evaluation of the implementation of the *Strategic Action Plan*, from its commencement in February 2020, through to May 2024.

The outcomes and recommendations from this evaluation will be used to inform planning and delivery of the ongoing actions described in various relevant strategies and plans for the management of Barmah's floodplain marshes.

1.2 Ramsar site management obligations

To be listed as a Ramsar site, a site must meet at least one of the nine Ramsar criteria. At the time of listing in 1982, the Barmah Forest Ramsar Site met six of the criteria, and it continues to do so today. However, the continued decline of Moira Grass extent within floodplain marshes is of urgent concern. Detailed on-ground surveys in 2015 determined that only 12 per cent of this vegetation community remains, relative to that mapped when the site was Ramsar listed in 1982, and less than five per cent of its extent in the 1930s, prior to regulation of the Murray River. This decline exceeds the limit of acceptable change[2] for Moira Grass at the site and represents a potential change in the site's ecological character (Parks Victoria 2020).

The principal factors that are likely to have contributed to the decline in Moira Grass extent are:

- Changes to the natural flooding regime due to river regulation.
- Grazing and trampling pressure by introduced animals, particularly by feral horses (and previously, cattle).
- Encroachment by invasive plant species.

[1] Available on the Parks Victoria website

[2] The limit of acceptable change refers to the variation that is considered acceptable in a particular component or process of the ecological character of the wetland, without indicating change in ecological character that may lead to a reduction or loss of the criteria for which the site was Ramsar listed.

The development and implementation of the *Strategic Action Plan* is a direct and urgent response to these negative influences on Moira Grass, to protect this species and those dependent on healthy Moira Grass-dominated floodplain marshes, and to demonstrate commitment to the requirements of the Ramsar Convention[3].

Some of the conservation strategies within the *Strategic Action Plan* refer directly to those identified within other strategies and management plans developed and implemented by co-land managers and partner agencies that also have an interest in protecting the [multiple] values at Barmah Forest. Therefore, Parks Victoria, the Yorta Yorta Nation Aboriginal Corporation (YYNAC), Goulburn Broken Catchment Management Authority (GBCMA) and the Department of Energy, Environment and Climate Action (DEECA) all work collaboratively to deliver key responsibilities and goals. The *Strategic Action Plan* outlines the roles and responsibilities of partners in delivery. Parks Victoria acknowledges the contribution of sponsors and delivery partners in working towards common goals.

The *Strategic Action Plan* describes the following activities as most critical in protecting and restoring the floodplain marshes:

- Optimal watering regime.
- Program of actions required to reduce the grazing and trampling pressure applied by feral animals, particularly horses.
- Program to control the encroachment of invasive plants into Moira Grass plains, and to facilitate restoration of Moira Grass.

2 Evaluation objectives and scope

The overarching objective of this evaluation is to provide information in a suitable form to meet the needs of the agencies responsible for delivering the conservation strategies identified in the *Strategic Action* Plan and other relevant strategies and management programs.

Implementation of the *Strategic Action Plan* has relied on multiple investment programs outside Parks Victoria to fund the activities of the program. An evaluation of the effectiveness of the total program in achieving its goals will continue to provide confidence in further investment and on-going protection of the floodplain marshlands.

The design of the evaluation process has been guided by the Monitoring, Evaluation and Learning Manual for Parks Victoria's Conservation Action Plans. The primary purpose of the evaluation is to examine:

- the extent to which *Strategic Action Plan* Conservation Actions were implemented (*Strategic Action Plan*, Chapter 8)
- to what degree identified targets have been achieved (*Strategic Action Plan*, Table 13)
- how this has contributed to the overarching objective of the *Strategic Action Plan* (i.e. *Improve the health of the floodplain marshes of Barmah Forest, increasing the extent and cover of Moira Grass and associated wetland vegetation*)
- whether the structure and content of the *Strategic Action Plan* has met the needs of the delivery partners, and
- what changes are required (to actions, responsibilities, priorities) to improve the cost-effective achievement of desired outcomes.

The suitability of the indicators and targets, in terms of measurability, bias in data collection, and the relation between targets and the achievement of identified outcomes have also been examined. Gaps in measurement will also be identified.

2.1 Scope of this evaluation

There are multiple delivery partners with varying interests in Barmah, who derive funding from numerous sources to deliver on-ground outcomes, each with individual delivery and reporting requirements. There are also some components within the *Strategic Action Plan* that are primarily delivered and monitored by partner agencies, under pre-existing and strongly regulated governance frameworks that also already include auditing and evaluation processes. This is not unique

[3] https://www.water.vic.gov.au/waterways-and-catchments/our-waterways/wetlands/significant-wetlands

to Barmah – it is common across the natural resource management industry, and the challenge is therefore to minimise duplication. Key examples for Barmah are the:

- State-wide Victorian Environmental Watering Program and the Murray Darling Basin Authority Basin Plan and their associated reporting frameworks. This includes the establishment of Operational Advisory Groups for input by relevant stakeholders (including land managers) and includes an extensive (and funded) investigation, reporting, monitoring and adaptive management requirements.
- Goulburn-Broken Waterway Management Strategy. This strategy includes the Barmah Forest Ramsar Site Management Plan, which has an associated monitoring, evaluation, reporting and improvement plan.
- Joint Management Plan and Implementation Plan and the associated reporting framework. This includes a specific project progress status report and an annual project delivery report format required to be completed by Parks Victoria and submitted to the Yorta Yorta Traditional Owner Land Management Board (YYTOLMB), along with 5-year targets to be evaluated in detail at a 5-yearly outcomes review (due in 2025).

Accordingly, for each conservation strategy, the scope of this evaluation is limited to an assessment of the *Strategic Action Plan*'s actions (refer to Appendix 1) and performance measures (refer to Sections 3 and 4).

2.2 Information sources and consultation

The delivery partners described in section 1.2 have been consulted in the evaluation process.

Information for the evaluation has been drawn from interviews conducted with staff, data recorded for operational reports, and formal studies and reports.

Formal annual reviews foreshadowed in the *Strategic Action Plan* have not taken place due to the significant interruptions caused by unforeseen and uncontrollable factors, primarily the social constraints imposed by the COVID-19 pandemic and significant natural flooding. These factors and their impact on the ability to deliver the Conservation Actions described in the *Strategic Action Plan* will be further described in the evaluation report. However, human safety and animal welfare aspects of animal control were reviewed prior to each field operation and learnings integrated into operating instructions.

The Feral Horse Technical Reference Group has provided input to a draft version of this report.

Photo: Juvenile Common Long-necked Turtle, a culturally significant species for the Yorta Yorta people. Observed at Bunyip Waterhole.

Spotted Marsh frogs breeding after rain. Frogs are adapted to survive dry periods by burrowing underground, re-emerging en masse when floodwaters arrive. Moira Grass thatch creates useful insulation over the wetland soil surface after seasonal flood drawdown, and prevents compaction of the soil.

3 Threat objectives and actions

3.1 Overall progress

The *Strategic Action Plan* describes 43 actions under its five strategies. The majority of these have been completed, or have been implemented with ongoing action in progress (Figure 3.1). The progress status of each of the actions is provided in Appendix 1, together with the corresponding action from the *Joint Management Plan Implementation Plan*.

The result of these actions is that most targets or results specified in the *Strategic Action Plan* have been achieved. There were some external influences which delayed some actions, and required the extension of the *Strategic Action Plan* to June 2024.

Figure 3.1: Activity progress status

3.2 External influences on delivery

Progress on all the conservation strategies specified in the *Strategic Action Plan*, aside from "control of grazing by feral horses", was already underway when it was released. However, the following external influences had some degree of impact on delivery of project outcomes within the intended timeframe:

- Social constraints imposed by the COVID-19 pandemic (primarily in 2020-2021).
  - This required some actions to be paused, and subsequently modified to be COVID-safe, causing them to take much longer to implement.
- Wet seasonal conditions in late 2022 and throughout 2023, including extensive wetland and floodplain inundation.
  - This made access to the forest impossible for a number of months and prevented delivery of most on-ground actions until water levels had sufficiently subsided.

3.3 Evaluation of strategies

Key evaluation questions were developed for each action and threat objective relating to the general questions below:

- To what extent was the action implemented?
- What were the gaps in implementation?
- How have strategies influenced the conservation outcomes?
- How have the actions influenced the threat?
- What monitoring has been done to measure the change?
- Has monitoring been adequate?

The following sections summarise the responses to those questions for each strategy and identify key issues and recommendations for future action. A traffic light assessment of progress is provided with the following icons.

Progress status icons

	**Target or result largely achieved**		**Some progress on target or result, extent unmeasured**
	**Partial achievement of target or result**		**No progress**

Strategy 1:	Maintain and improve current water regimes
Threat Objective:	To maintain and, if possible, improve current water regimes of floodplain marshes, particularly Moira Grass plains

There are seven actions under this strategy: all have been implemented and are ongoing (Appendix 1).

The desired targets or results from this strategy are to:

- Provide an appropriate water regime (frequency, timing, duration, depth, variability and extent).
- Minimise the incidence and magnitude of undesirable summer and autumn flooding of floodplain marshes.
- Apply environmental or cultural flows (or both) to sustain ephemeral habitats and support culturally significant species.

Seasonal Watering Proposals for Barmah-Millewa Forest are developed annually by the Goulburn Broken CMA and NSW Department of NSW Department of Climate Change, Energy, the Environment and Water annually (in their capacity as environmental water managers) and they seek input from partner agencies during the drafting process via a formal review of the draft document. The MDBA-convened Murray River Operations Advisory Group meet frequently throughout the year during deliveries and natural flood events to contribute to real-time event planning to ensure watering regimes achieve the best outcomes for the floodplain marshes amongst requirements for river operations and private land flood minimisation.

Overall the management of the water regimes over the four years covered by the *Strategic Action Plan* has benefited the Moira Grass plains, as detailed below, acknowledging some late summer flood events extending the natural period of inundation of some of the floodplains. Although late summer flooding can be detrimental to Moira Grass plains by encouraging Giant Rush incursions, in this instance the late flooding extended the duration of beneficial flooding which commenced in the preceding spring.

Table 3.1: Summary of the progress towards the overall threat objective for the strategy, or the individual target/result over the duration of the *Strategic Action Plan*.

Target/result	Progress towards meeting threat objective / target
Provision of an appropriate water regime (frequency, timing, duration, depth, variability and extent) *and* Minimise the incidence and magnitude of undesirable summer and autumn flooding of floodplain marshes 	**2019-20** Consistent with the low rainfall seasonal conditions, the Barmah floodplains remained relatively dry in 2019-20. There was some low-level floodplain inundation as a result of rainfall in the upstream Ovens and Kiewa catchments in winter 2019, and inflows during September and October 2019 during the delivery of a Lake Hume-to-the-Sea environmental water event called the 'Southern Spring Flow'. These watering events were beneficial in transporting carbon from the floodplain to the river, and creating a connection for fish passage, but were of insufficient duration to stimulate colonial waterbird nesting or enable all plants to complete their lifecycle and set seed. **2020-21** Natural inflows supplemented by environmental water resulted in inundation of all key wetlands of Barmah Forest, including Little Rushy Swamp. This encouraged the establishment of an Ibis rookery in Boals Lagoon which supported the successful fledging of chicks. Low-level flooding in spring supported wetland plant growth and flowering for species (such as Moira Grass) that were unable to flower in 2019-20. In higher parts of the forest, understorey wildflowers flourished, including hundreds of hectares of Golden Everlasting and New Holland Daisy carpeting the forest. There was also a notable increase in the occurrence of the significant plant species – Mueller's Daisy and Winged Peppercress.

Target/result	Progress towards meeting threat objective / target
	2021-22 Four relatively small flood peaks during winter and spring 2021 were important for the health of the forest and inundated about 55 per cent of the Barmah Forest floodplain. Water for the environment was delivered to fill in gaps between natural events, to maintain flows throughout spring and to manage recession flows back to below channel capacity in summer. Two unseasonal natural flood events occurred in January and February resulting in the lower floodplain to have been inundated for seven months. Very good environmental outcomes resulted, including strong Moira Grass growth and flowering (especially where protected by feral horse exclusion areas in Barmah Forest), native fish breeding and some waterbird breeding where flooding occurred.
	2022-23 Environmental water was used between July and August 2022 to divert some water through Barmah Forest, until large scale natural flooding occurred in spring, resulting in 100 per cent of the floodplain becoming inundated. A rain-rejection event followed this in early February 2023, caused by a single day's record rainfall event in the Albury region, but was deemed to not have cause any concern as it was short-lived and re-inundated already wet/moist terrain, and may have improved water quality. Moira Grass responded well, with new growth and flowering and this was best demonstrated in the exclosure plots where it was protected from grazing pressure. Flooding also initiated colonial waterbird breeding, predominantly of Australian White Ibis, Straw-necked Ibis, Royal Spoonbills and cormorant species which bred and successfully fledged young. The flooding extended out to support river red gum and black box growth that cannot be reached with the delivery of environmental water alone. Unfortunately, large scale deaths of native fish and Murray crayfish occurred due to the hypoxic blackwater which also occurred across the forest and in the adjoining Murray River.
	2023-24 Floodplain marshes (Moira Grass plains) experienced widespread flooding between June to December, mostly driven from two major flood peaks in June-August and October. The release of e-water in September and November bridged the flood peaks and prevented premature draining from the forest. There were no rain-rejection events this year after regulators were fully closed on 12 December 2023. A diagram illustrating how flows in the Murray River are used to manage flooding in the Barmah Forest is provided at Figure 3.2.
Apply environmental or cultural flows (or both) to sustain ephemeral habitats and support culturally significant species 	Goulburn Broken CMA undertakes consultation on environmental water management through a structured process with key stakeholders including YYNAC. Goulburn Broken CMA has directly engaged with YYNAC to: – identify Aboriginal values and uses of the creeks – seek feedback on environmental water priorities Floodplain watering targets drought refuge for turtles that are an important totemic species for the Yorta Yorta people. In addition, floodplain marsh watering aims to improve: – the condition of vegetation that includes important food and medicinal plants for the Yorta Yorta community, such as Sneezeweed and Basket Sedge. – health of River Red Gums benefiting important aboriginal sites such as live significant trees and connection to country.

Condition and trend (2024) of ecological attributes affected by this strategy					
Extent and distribution of Moira Grass		Extent and distribution of River Swamp Wallaby-grass		Extent and distribution of Mueller Daisy	
Poor		Fair		Fair	

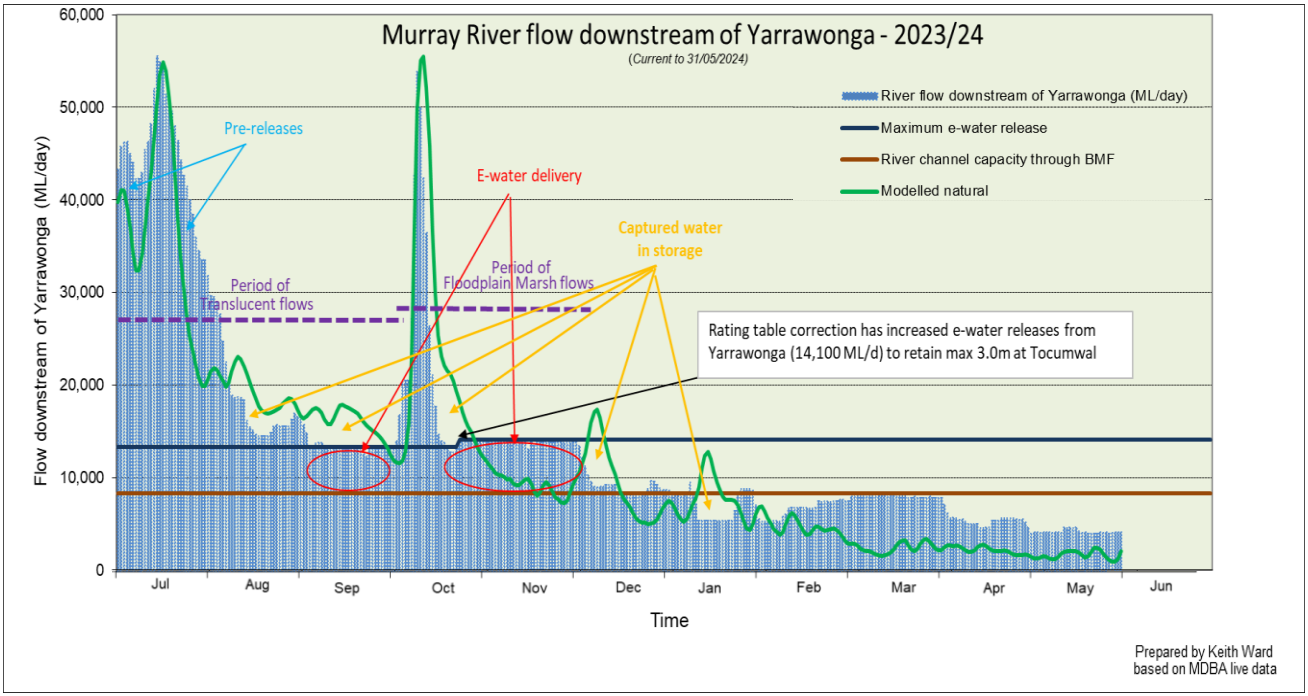


Figure 3.2: Murray River flows downstream of Yarrawonga (in blue), compared to modelled natural flows (in green), showing the difference that is captured in storage, the timing of environmental water releases (in red), and the period of translucent flows into Barmah Forest and the period of flooding in the floodplain marshes (in purple).

Key Issues

Although considered hugely beneficial to the ecology of the floodplain, extensive inundation did prevent physical access to much of the forest, hindering most management and monitoring activity.

Recommendations

1.1 Strengthen the adoption of water management that best reflects the natural flood regime of the Floodplain Marshlands through maximising flood depth in late-winter through to end of spring (withing recognised operating river release constraints), and promote floodplain drying regime in late-summer and autumn.

1.2 Encourage Murray Darling Basin Authority to reduce the current level of e-water delivery flow constraint (currently 3.0 metres at Tocumwal) so as to enhance the opportunity for increasing managed flood depth on the floodplain marshlands in Barmah Forest.

Flooding on Hut Lake in January 2023, showing the complete coverage of Moira Grass within the herbivore exclosure.

Strategy 2 -	**Control of grazing by feral horses**
Threat Objective:	Reduce the feral horse population to a maximum of 100 over four years, and in the long-term, to zero.

There are 16 actions under this strategy (Appendix 1):

- Three actions are complete, no further action.
- Nine actions have been implemented with ongoing action in progress.
- Three actions have been partially implemented, with further action at risk, related to trapping and rehoming.
- One action has been terminated, related to mustering.

The desired targets or results from this strategy are to:

- Reduce feral horse population density.
- Protect core areas.
- Optimise animal welfare outcomes.

The management of feral horses has achieved the overall feral horse population targets over the four years covered by the *Strategic Action Plan*, while meeting animal welfare and humaneness objectives.

Table 3.2: Summary of the progress towards the overall threat objective for the strategy, or the individual target/result over the duration of the *Strategic Action Plan*.

<table>
<tr><th>Target/result</th><th>Progress towards meeting threat objective / target</th></tr>
<tr><td>Reduce feral horse population
  </td><td>
Feral horse control has been implemented by Parks Victoria using the following methods:

Passive trapping and rehoming, following the establishment of a rehoming register.
Ground shooting of free-ranging horses using professional shooters.
Euthanasia of free-ranging horses and captive horses in poor condition.

Feral horse control programs are overseen by expert equine veterinarians and are conducted in accordance with national, State and Parks Victoria codes of practice and standard operating procedures relating to horse welfare; and operational safety for firearms use, field activities, and horse trapping and transport.
<table>
<tr><th>YEAR (Jan-Dec)</th><th>Euthanased (vet health checks)</th><th>Rehomed</th><th>Ground shooting</th><th>Total removed</th></tr>
<tr><td>2020</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2021</td><td>10</td><td></td><td>88</td><td>98</td></tr>
<tr><td>2022</td><td>38</td><td>43</td><td>147</td><td>228</td></tr>
<tr><td>2023</td><td></td><td></td><td>354</td><td>354</td></tr>
<tr><td>2024
(as at 21/05/2024)</td><td></td><td></td><td>20</td><td>20</td></tr>
<tr><td>Total</td><td>48</td><td>43</td><td>609</td><td>700</td></tr>
</table>
In addition, staff located 96 carcasses following the floods of October 2022, indicating that at least this number had died from unknown causes, such as exposure, starvation, injury, or drowning, during the emergency. The feral horse population is therefore known to have been reduced by a minimum of 796 horses.

Some additional horses were trapped on private land by the Barmah Brumby Preservation Group.

In 2022, 39 trapped horses were released back to the park, as the only safe and humane option under the circumstances. Many of these were refused by rehomers, deeming that colts, stallions and other trapped horses were unsuitable. The impact on animal welfare of unnecessarily trapping feral horses is covered under the next result - Optimise animal welfare outcomes.
</td></tr>
</table>

	In 2019, the feral horse population was estimated to be 621 horses (95% confidence range 477 to 765). In November 2021, the population was estimated to be 328 horses (95% confidence range 169 to 635) (Cairns, 2023). Further aerial observations were undertaken in June 2023, however there were insufficient numbers observed to allow an estimate of the population. There have been some claims that these population estimates have exaggerated the size of the population; however the scale of removals during this period support the accuracy of the estimates. Aerial transect surveys have now been discontinued since there are too few horses to reliably estimate the population using this technique. Reconnaissance flights over likely horse-occupied habitats in October 2023 observed 40 horses, which could be regarded as a minimum number at that time.
Optimise animal welfare outcomes - 100% compliance with relevant Codes of Practice and Standard Operating Procedures for horse capture, holding, transport and humane destruction 	**Ground-shooting** operations involve a high level of risk to human safety and animal welfare. Operational plans are developed incorporating compliance with Standard Operating Procedures (SOPs), and the planning and the review process for a ground shooting operation typically involves: – a Tactical Plan being developed by Parks Victoria, outlining a situational analysis, the proposed operations, how the proposed operations will be executed, the administration of the operation and its logistics, the command structure, communications arrangements, safety precautions and other relevant considerations – development of a Firearms Use Operations Plan, articulating the proposed timing of operations, planning roles and responsibilities, operational roles and responsibilities, requirements for ensuring humane outcomes, a description of and strict conditions for any use of detection dogs, performance measures and an authority to undertake the operation – risk management planning, so that risks related to safety, site access, security, confidentiality and interaction management, personnel and resourcing are addressed before Parks Victoria gives the contractor final approval to proceed. Before the contractor enters the national park full onsite inductions are carried out and a formal Job Safety Analysis is undertaken – final approval to enter the national park and commence operations being given to the contractor – attendance by the contractor's shooters in the national park in the company of Parks Victoria personnel – post-field attendance information being provided by the contractor to Parks Victoria, ordinarily consisting of imagery and geospatial information for each feral horse that has been shot – post-operation review to assess the effectiveness of the operations and learn of any incidents that occur during operations, and – random audits by an equine veterinarian, to help determine compliance with the Hunting Code and SOP HOR001 (Sharp 2016). All ground shooting operations were conducted in accordance with the above processes and procedures. 609 feral horses were subject to ground shooting (as at May 2024). Shooting was conducted with very high level of marksmanship. Post-shooting inspections located 99.8 per cent of horses after death and verified that they were humanely killed without unnecessary or prolonged pain or distress. An equine veterinarian has conducted two audits (2021 and 2022) of ground shooting operations and concluded that the animal welfare outcome is high, and the death is considered humane with no horses left wounded with non-fatal injuries. Annual reviews of operations were conducted, and recommended changes to operations mostly related to human health and safety.

	Trapping operations, which also intrinsically involve a high level of risk, have been undertaken with no horse welfare incidents. Trapping has been managed with a veterinarian present during operations to euthanase any horse captured in poor condition or injured. Operational plans are developed incorporating compliance with SOPs and are implemented with an end-of-operation review and checklist. Observation of trapping by the equine veterinarian was that trapping and transportation of feral horses has a worse short term animal welfare outcome relative to ground shooting. The fear and flight responses seen while trapping and loading horses create a higher risk of non-fatal injury and the behaviour demonstrated by the trapped horse/s shows higher and prolonged stress and anxiety when compared to ground shooting.
	Mustering was not trialled because of the high likelihood of injury and distress to feral horses.
Protect Country and sites of cultural significance while implementing grazing control 	Parks Victoria has worked with YYNAC to protect Country and sites of cultural significance while implementing grazing control management actions through maintaining fencing for cultural exclusion sites such as Garradha Molwa, developing cultural heritage plans for trap sites, and assessing the potential damage to cultural values from dragging when considering potential carcass removal. During the large-scale natural flooding of late 2022 groups of horses and other wildlife became stranded on high ground in Barmah Forest. During the declared flood emergency event, Barmah Forest and other flood affected areas came under the control of the multi-agency Incident Management Team. In response to the Animal Welfare Emergency occurring in Barmah Forest, an Animal Response Plan was implemented. This plan included undertaking supplementary feeding of hay. Higher locations across the park where animals congregated during the flood are very rich in Yorta Yorta Aboriginal Cultural Heritage and were impacted during the animal response operation. A rehabilitation plan to guide remediation works for affected sites was developed and is being implemented by Parks Victoria and Yorta Yorta Nation Aboriginal Corporation.
Protect core areas 	Small-scale fenced exclosures have been installed in sensitive areas where an immediate reduction of impacts is needed (e.g. prioritised remnant Moira Grass sites where active restoration is occurring), and fencing is feasible. These have a total area of 17 hectares and include: - Little Rushy Swamp (western section), area - 6.7 hectares (2016) - Little Rushy Swamp (eastern section), area - 2.3 hectares (2019) - Hut Lake 2019-2020, area - 2.0 hectares (2019-20) - Top Lake 2019-2020, area - 0.7 hectares (2019-20) - Harbours Lake 2019-2020, area - 2.1 hectares (2019-20) - Steamer Plain 2019-2020, area - 2.9 hectares (2019-20) Monitoring results from these exclosures are discussed in Section 3.

Condition and trend (2024) of ecological attributes affected by this strategy

Extent and distribution of Moira Grass		Extent and distribution of River Swamp Wallaby-grass		Extent and distribution of Mueller Daisy	
Poor	↗	Fair	↗	Fair	→

Key Issues

Overall the management of feral horse populations has achieved the population reduction targets set in the *Strategic Action Plan*. This is largely due to the success of the ground shooting program as detailed in Table 3.2 above. Trapping and rehoming have been less successful.

Trapping was conducted in 2021 and 2022 with limited results due to sabotage to traps and interference to trapping efforts by members of the public and activists, and inability to undertake operations safely due to weather and flooding. Of the total of 90 horses were trapped by Parks Victoria, 43 horses were rehomed during this period. A high proportion of the trapped horses were refused by rehomers deeming that colts, stallions and other trapped horses were unsuitable.

These horses were then released, as the only safe and humane option under the circumstances. No rehomed horses have been micro-chipped, as this cannot be done on a wild horse at capture, and managing the obligation on the rehomer was not achieved.

Feral horse surveys were flown in 2019 and in November 2021. Surveys planned for 2020 had to be deferred until late 2021 due to the operational constraints of COVID-safe settings. Aerial transect surveys have now been discontinued since there are now too few horses to reliably estimate the population. Ground or aerial observations are being made during patrols or other activities, to locate horses. Remaining horses are highly dispersed, difficult to detect and extremely cautious, and therefore unlikely to be trapped. No horses have been observed close to the boundary to horse-occupied paddocks on private land.

Recommendations

The objective of feral horse control is now to reduce the feral horse population to zero.

2.1 This will be achieved by removing feral horses from Barmah National Park primarily through targeted ground-shooting by appropriately accredited professionals under strict protocols and oversight. Feral horses will only be trapped and rehomed if it is feasible, safe and humane to do so, and if there is sufficient demand from organisations or individuals that can suitably care for the captured horses. Aerial shooting may be considered as an appropriate technique for removing small numbers of remaining horses, provided that specific standard operating procedures that ensure high standards of humaneness, are developed and met.

2.2 With feral horse numbers now at very low levels, adopt a surveillance approach and frequency to enable the detection of any remaining feral horses or horses released into the Barmah National Park, and ensure that there is a rapid management response to remove those horses.

Photos:
Top: Steamer Plain in March 2024, showing the recovery of the Moira Grass sward. Inset, feral horses at same location on Steamer Plain in December 2015, and below left, in January 2019, showing trampling and grazing impacts prior to reduction of the feral horse population.

Strategy 3:	Control of feral pigs and other introduced herbivores
Threat Objective:	Reduce total grazing, browsing and trampling pressure, and other impacts exerted by feral pigs and other large introduced herbivores on Moira Grass and other floodplain marsh communities.

There are 10 actions under this strategy (Appendix 1):

- Four actions are complete, no further action.
- Five actions have been implemented with ongoing action in progress.
- One action was partially implemented, further action at risk, related to establishing measurable targets for feral pigs and deer.

The desired targets or results from this strategy are:

- Reduced population density of feral pigs, feral goats, feral deer.
- Eradication of feral sheep.
- Disturbance monitoring.
- Compliance with relevant Standard Operating Procedures and Codes of Practice for large herbivore control.

Eradication objectives for feral sheep and goats have been achieved. There are indications from formal monitoring and informal observations that ground disturbance and other impacts from feral pigs and deer are being reduced despite the recent improvement in conditions for feral pigs.

Table 3.3: Summary of the progress towards the overall threat objective for the strategy, or the individual target/result over the duration of the *Strategic Action Plan*.

Target/result	Progress towards meeting threat objective / target
Reduced population density of feral pigs, feral goats, feral deer 	Feral pigs, deer and goats have been controlled primarily using control targeted ground shooting by professional shooters. Hoggone bait stations are also used for feral pigs.

YEAR	Feral pigs	Feral deer	Feral goats
2019-20	37	280	45
2020-21	36	111	6
2021-22	62	115	1
2022-23	58	119	NA
2023-24 (as at 13/05/2024)	93	203	NA
Total	**828**	**828**	**52**

The last 6 goats were removed in July 2020. In July 2021, another goat was removed that was believed to be an escaped or released goat in the east end of the park. There is no evidence from monitoring cameras which were installed in July 2020, or through observations on patrol or while conducting other operations, to suggest feral goats remain within the park. Feral goats are now considered extirpated from the park.

Control activities are informed by observations and signs of pest animal presence. While the control targets are zero for feral goats and sheep, the cryptic nature of pigs and deer makes their eradication difficult, along with the high risk of re-invasion.

Population estimation for pigs and deer is difficult, also because they are smaller and more cryptic than feral horses and have not been as easily discriminated through the helicopter-based thermal imaging surveys carried out to date. Due to the difficulty and expense of accurate quantitative monitoring pig and deer activity and impact, no targets have been determined for pigs and deer, other than to reduce their population levels to as low as possible.

Eradication of feral sheep 	Feral sheep are considered extirpated as none have been observed in the forest since 2020. However, due to poor fencing, incursions of wandering stock remain a problem to be managed.
Disturbance monitoring 	**Feral pigs** Transect-based monitoring is conducted to estimate the extent of ground disturbed by the rooting activity of pigs, and whether disturbance is increasing or decreasing over time. Monitoring is undertaken within eight established 20-hectare plots across five areas in the western section of Barmah Forest. In each plot a set of five 50-metre long permanent transects measures the cover of old disturbance, new disturbance and total disturbance. The survey conducted in Autumn 2023 indicated reduction in the observed disturbance compared to that detected in 2021, and significantly less than that observed in 2018. This is supported by anecdotal observations of very low levels of damage in Steamer and War Plains areas, in the context of high levels of control in 2023-24, and persisting good conditions for pigs since the 2021-22 floods. However there are high levels of variation in pig disturbance due to changes in soil moisture and food availability which varies both temporally and spatially, as well as recent impacts caused by other feral and native animals that may mask pig disturbance.
	Feral deer On the higher yellow box (sandy ridge) areas, informal observations indicate that impacts from deer trashing Yellow Box saplings and Pale-fruit Ballart have significantly decreased. The regeneration of these two species is significant. In 2024 there have been less rubs on eucalyptus saplings and rut pads on the ground during the April-May fallow deer rut.
Compliance with relevant Standard Operating Procedures and Codes of Practice for large herbivore control 	Shooting: as for feral horses, operational plans are developed which incorporate compliance with Standard Operating Procedures and Codes of Practice. End-of-operation reviews and checklists, as well as staff involvement in daily delivery ensure compliance with the plans. There was 100 per cent compliance with procedures.

Condition and trend (2024) of ecological attributes affected by this strategy

Extent and distribution of Moira Grass		Extent and distribution of River Swamp Wallaby-grass		Extent and distribution of Mueller Daisy	
Poor		Fair		Fair	

Key Issues

Feral pig control efforts have been hampered by illegal pig hunting activities and vandalism, resulting in a smaller number of feral pigs being dispatched than expected for the effort delivered. Illegal hunting scares and sensitises the pigs, changing their movement patterns and making them more difficult to track as they move through the forest. Pig trapping was also impacted and ultimately discontinued due to repeated interference by poachers who vandalised and stole equipment.

There is a low level of confidence in pig monitoring procedures, and a need for improved experimental design for feral pig monitoring, although preliminary assessment indicates this will involve considerable resources and costs.

Recommendation

3.1 Deliver targeted compliance actions aimed at reducing illegal hunting activities and vandalism, while increasing the success of feral pig and herbivore control implemented by Parks Victoria.

3.2 Increase the focus on control of Fallow and Sambar deer to reflect their general increase in abundance across the Parks Victoria estate.

Photo: Trail camera image showing a feral pig raiding an Australian White Ibis nest.

Strategy 4:	Manage encroachment by invasive wetland plants
Threat Objective:	Control Arrowhead to acceptable levels, particularly where floodplain marshes are at risk, and eradicate new and emerging weeds.

There are eight actions under this strategy (Appendix 1):

- Five actions have been implemented with ongoing action in progress.
- Two actions have been partially implemented, further action at risk, related to the use of ecological burning and/or mechanical control of giant rush and river red gum, and targets for arrowhead control.
- One action has been cancelled, related to trials to restore the natural extent and distribution of giant rush and river red gum.

The desired targets or results from this strategy are to:

- Reduce extent of river red gum and giant rush incursion into Moira Grass plains.
- Reduce the extent and density of arrowhead.
- No new infestations of Arrowhead.

Adverse ground conditions and delays in approvals have limited progress in controlling the spread of Giant Rush and River Red Gum saplings. Monitoring is not scheduled until 2025-26 to determine management effectiveness.

There has been good progress in reducing existing Arrowhead infestations, and in the detection, control and prevention of new infestations, however the scale of reduction has not been measured.

Table 3.4: Summary of the progress towards the overall threat objective for the strategy, or the individual target/result over the duration of the *Strategic Action Plan*.

Target/result	Progress towards meeting threat objective / target
Reduce extent of River Red Gum and Giant Rush incursion into Moira Grass plains 	For most of the period of the *Strategic Action Plan,* Giant Rush control works were not conducted due to unsuitable flooding conditions, and the inability to have ecological burn plans approved and resourced. However in May 2024, approximately 45 hectares of a proposed burn area of 340 hectares of Giant Rush infestation was burnt. There is high confidence that burning and follow-up flooding is conducive to Giant Rush control, so these burns are being performed as management actions rather than trials. However treatment success is dependent on follow-up flooding in spring. YYNAC's Woka Wolla has been manually clearing River Red Gum saplings in key wetlands on an annual basis, but this work has been hindered by wet conditions in 2021-22 and 2022-23. In 2021, aerial photo interpretation was used to map changes in the extent and distribution of Giant Rush and River Red Gum at 35 wetland sites across Barmah Forest, between 2003 and 2017 (Brown & Tolsma 2021). The total area of wetland in the study area (comprising 35 sites) reduced by 102 hectares (7.3%) between 2003 and 2017 due to River Red Gum encroachment. Changes in Giant Rush were more variable, with a subset of 13 wetlands showing a 10 hectare (3.6%) decrease in the area of Giant Rush between 2007 and 2017, driven largely by Barmah Lake. Excluding Barmah Lake, there was a 13 hectare (6.8%) increase in the area of Giant Rush infestation across the remaining study site wetlands. This study can be used as a baseline, with another iteration of the mapping required to track changes since 2017, and make any inferences about the effect of management. Subject to funding, this may occur in 2025-26.
Reduce the extent and density of Arrowhead *and* No new infestations of Arrowhead	A target of 80 per cent reduction of Arrowhead was identified in the *Strategic Action Plan*, and was derived from the target of 80 per cent reduction in the extent and density of the six 'Priority 1' weed species (inclusive of Arrowhead) set for Barmah Forest to protect its ecological character. Arrowhead control has been done when funding has been available, and when flooding allowed access. Parks Victoria has engaged with the YYNAC's Woka Wolla team to target

and apply chemical control to previously mapped Arrowhead infestations in wetland areas.

Previous mapping of arrowhead was done in 2017, when the area of infestation detected was 6.8 hectares. No further mapping has been done, however the extent of Arrowhead in Barmah National Park is better known following extensive investigation and treatment this year in attempts to contain spread.

Weed search and treatment was applied over an area of 978 hectares during March-April 2024. The vast majority of this treatment was Arrowhead, but some was also for Blackberry.

New infestations are managed as they arise, with surveillance and observations occurring during routine patrols. Some satellite infestations discovered in creek lines upstream / east of that previously mapped in 2017 were found and treated. Drainage channels which discharge irrigation water runoff into the park where arrowhead infestations were found to be extensive were also treated. At this stage it appears that Arrowhead has not spread to the major floodplain marshes except for Top Island.

While new incursions have been prevented by treating incoming channels, risks could be further reduced through the partnership with Goulburn Murray Water.

Condition and trend (2024) of ecological attributes affected by strategy

Extent and distribution of Moira Grass		Extent and distribution of River Swamp Wallaby-grass		Extent and distribution of Mueller Daisy	
Poor	↗	Fair	↗	Fair	→

Key Issues

Aside from flooding, the main constraint to management of Giant Rush has been resourcing the actual burn, where in part this is reliant on DEECA, as the lead agency for fire, for approvals and operational staff to enable burns to proceed, after all planning has been completed.

There has been no resourcing available for regular, accurate monitoring of Arrowhead. An efficient monitoring method is required, which could inform a realistic target.

Recommendations

4.1 Explore with DEECA, how burn plans to control Giant Rush could be prioritised to take advantage of seasonal conditions.

4.2 Investigate alternative techniques for monitoring Arrowhead, including remote sensing.

4.3 Explore with Goulburn Murray Water how to further reduce risk of Arrowhead invasion from irrigation drainage channels.

Arrowhead at Top Island

Strategy 5:	Active revegetation of Moira Grass
Threat Objective:	Aid the re-establishment of Moira Grass back into areas where it has been lost, via an active re-establishment program.

There are two actions under this strategy (Appendix 1):

- Both actions are complete, no further action.

The desired targets or results from this strategy are:

- Re-establishment of Moira Grass in areas where it has been lost.

These actions related to the implementation and evaluation of a trial for the propagation and transfer of Moira Grass, from the laboratory to the field. While the field trial was unsuccessful, limited by adverse, but not unusual, weather conditions, the experiment showed that prevention of grazing is much more efficient means of re-establishing Moira Grass at scale.

Table 5.5: Summary of the progress towards the overall threat objective for the strategy, or the individual target/result over the duration of the *Strategic Action Plan*.

Target/result	Progress towards meeting threat objective / target
Re-establishment of Moira Grass in areas where it has been lost 	A trial for planting of Moira Grass thatch was implemented. This process involved establishing Moira Grass thatch in the laboratory and transferring these to the field, both within and outside exclosures in at four wetlands. While propagation was successful in controlled (greenhouse laboratory) conditions, propagation of Moira Grass into field conditions showed very poor success. The conditions for establishment of the propagation trial in May 2020 were favourable as the soil was moist and the winter seasonal timing nominally ideal, however, by January 2021 it was apparent that the field propagation trial failed due to the unfavourable hot and dry weather conditions that followed (Water Technology 2021). Although all the cuttings had failed both within and outside the grazing exclosures, Moira Grass from nearby natural plants extended into the propagation trial site in the absence of grazing within the exclosures. Also, during the trial period, the exclosure monitoring program showed an approximately 2.5 times greater increase in Moira Grass presence inside exclosures compared with outside where it was subject to grazing. These results indicate that prevention of grazing is much more efficient means of re-establishing Moira Grass at scale.
Condition and trend (2024) of ecological attributes affected by strategy	
Extent and distribution of Moira Grass	
Poor 	

Key Issues

While this trial showed that the method is a viable technique, the risk of adverse growing conditions makes this a cost-prohibitive exercise for large-scale revegetation actions.

Recommendation

5.1 With this information, the landscape-scale application of this Strategy will not be pursued further. However, nursery-based propagation and re-planting in small patches may have some further application in wetlands where no viable propagules remain.

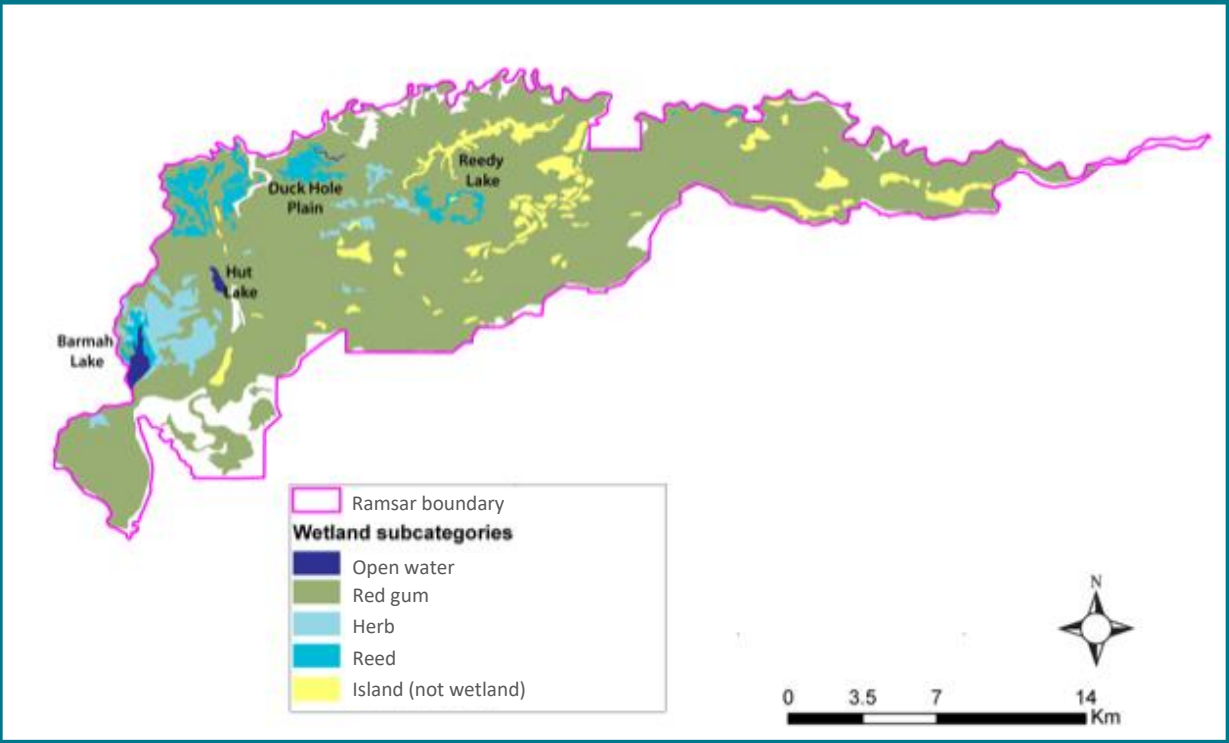


Figure 3.3: Floodplain marshes include several different vegetation communities that occur in low lying areas of the site that are subject to more frequent inundation, but with periods of drying. Using the standard Ramsar wetland classification types (Figure 3.3), floodplain marshes comprise the "seasonal/intermittent freshwater marshes/pools on inorganic soils" type which includes shallow freshwater marsh ('Herb') and deep freshwater marsh ('Reed') sub-categories, and "seasonal/intermittent freshwater lakes" (Open water'). In Barmah Forest, floodplain marshes include Moira Grass plains, Giant Rush (*Juncus ingens*) beds, Common Reed (*Phragmites australis*) beds, moist grasslands and aquatic herblands. These wetlands can be either semi-permanent or ephemeral, fluctuating in their extent and composition relative to water availability (flooding regime).

Photo: Shallow freshwater marsh at Little Rushy Swamp

4 Outcomes

The overarching objective of the *Strategic Action Plan* is to:

Improve the health of the floodplain marshes of Barmah Forest, increasing the extent and cover of Moira Grass plains and associated wetland vegetation.

Three attributes of condition addressed by the *Strategic Action Plan* were selected as priorities to track the health of the floodplain marshes of Barmah Forest ('ecological attributes'). They are a subset of the Limits of Acceptable Change (LAC) set out in the critical components, processes and services of the Barmah Forest Ramsar Site as identified in the *Ramsar Site Ecological Character Description* (Hale and Butcher 2011). They were selected on the basis that they would be responsive to the strategies for the management of water, large herbivores and weeds under the *Strategic Action Plan,* and are:

- Extent and cover of Moira Grass.
- River Swamp wallaby grass – distribution and extent (listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act).
- Mueller Daisy – distribution and extent (listed as vulnerable under the EPBC Act, and endangered under the *Flora and Fauna Guarantee Act 1988* (Vic) (FFG Act).

Moira Grass performs a critical function in assisting the floodplains accumulate nutrients and carbon during their inundation, receding and drying cycle, enriching habitat for many other fauna and fish species occupying the floodplains. River Swamp Wallaby-grass and Mueller Daisy are nationally threatened species, but their presence is also representative of the suitability of the habitat for more common species that occupy different levels of the floodplain profile.

Achieving recovery targets for the floodplain marshes is dependent on the delivery of each of the conservation strategies in parallel, as re-instatement of more suitable habitat conditions, regeneration, or reduced competition will occur as each progresses. Recovery is also affected by:

- The time it will take for existing rootstock and stolons, and viable seed, to re-establish, grow and re-spread across the floodplain, from a significantly reduced area, back into areas that have been grazed, browsed and trampled.
- The climatic conditions including local rainfall, frequency and penetration of large-scale natural flood events into areas (particularly beyond where environmental water can reach), ambient water and soil temperatures, and water depth and period of inundation that favours establishment of Moira Grass.
- The limited area that can be targeted with environmental water (due to delivery constraints), to provide the water requirements for key vegetation communities including Giant Rush and Moira Grass plains.
- The frequency of unseasonal (late summer and autumn) flooding.

Key evaluation questions were developed for each ecological attribute and associated objective relating to the general questions below:

- How has condition and trend of the conservation assets changed?
- To what extent have the desired conservation outcomes been achieved?
- What monitoring has been done to measure the change, and has the monitoring been adequate?

The following sections summarise the responses to those questions for each ecological attribute, and identify key issues and recommendations for future action.

Condition status icons

The assessment of current and desired future status and trend is represented by the following categories.

Condition		
Very Good	(optimal integrity)	The attribute is functioning at an ecologically desirable status, and requires little human intervention to maintain or improve health.
Good	(minimum integrity)	The attribute is functioning within its range of acceptable variation; it may require some human intervention.
Fair	(vulnerable)	The attribute is outside its range of acceptable variation and requires human intervention to recover or be restored. If unchecked, the target will be vulnerable to serious degradation.
Poor	(imminent loss)	Allowing the attribute to remain in this condition for an extended period of time will make restoration or preventing extinction practically impossible.

Trend	
	Improving
	Stable
	Declining
	Unknown

Table 4.1: Summary of the conservation outcomes for the floodplain marshes, including the ecological attributes, their condition status, measurable targets, and progress over the duration of the *Strategic Action Plan*.

Ecological Attribute:	Extent and cover of Moira Grass			
Conservation outcomes	**Target**	Extent and cover of Moira Grass to **increase** (from current) by **60 per cent by 2028**.		
	2020		**2024**	
	Condition	**Poor**	**Condition**	**Poor**
	Trend		**Trend**	
Monitoring and results	**Exclosures** The four small-scale fenced grazing exclosures installed in targeted wetlands during January and February 2020, along with pre-existing larger exclosure plots, demonstrate the benefits attained by removing the grazing and trampling pressure of horses and other non-native grazing species. Changes in flora species cover and abundance, and bare ground, were monitored in paired quadrats (1 m x 1 m), inside and outside exclosures at each site. Overall, in May 2023, the cover of Moira Grass increased markedly in the non-grazed (inside) quadrats. It decreased (or remained stable) in the grazed (outside) quadrats at all sites over the study period. The area of bare ground decreased considerably in the non-grazed (inside) quadrats from 2020 to 2023. In the grazed (outside) quadrats it decreased slightly or remained similar at some sites over the 40 months (Water Technology 2023). The 2024 exclosure monitoring results were not available at the time of the evaluation. **Mapping** From detailed on-ground surveys, Vivian et al. (2015) estimated that only **182 hectares** remained in Barmah Forest in 2015, with only 50 hectares of the monospecific swards that were a historically important part of the floodplain. This remaining area represented only 12 per cent of the extent at the site since its Ramsar-listing, and showed a continuing trend towards the extinction predicted by Colloff et al. (2014). A 60 per cent increase would equate to 290 hectares of Moira Grass. In 2021, Moira Grass was mapped across Barmah National Park, using a combination of multispectral data from the WorldView-2 and sentinel-2A satellite platforms and field inspections. Field data were collected following flooding in spring-summer 2020-21 to provide data to support modelled estimates of Moira Grass extent (White et al 2021).			

	The area of Moira Grass across the floodplain marshes of Barmah National Park was estimated as **245 hectares** (mean, 90% confidence within 191 and 299 hectares). While this estimate appears as a significant (35%) increase, this may be due to the difference in survey and estimation methods, relative timing of the surveys, and seasonal/yearly fluctuations in cover, as well as the early changes to cover within the exclosure fencing. This estimate would be best considered as a baseline for future estimates of cover. A repeat of the mapping project is planned to occur in 2024-25. This will provide a measure of the extent of change from the baseline. **Vegetation Condition** Wetland vegetation condition is monitored annually under The Living Murray Program. Data collected during 2023-24 showed a notable increase in the flowering of palatable plant species compared to that recorded for 2022-23. Autumn flowering of Moira Grass, for example, showed an increase from 1 per cent to 51 per cent. **Pre- and post-treatment photography** Images of the same locations recorded in the years up to 2020, and more recently, in 2024, provide less systematic but compelling evidence of the recovery of Moira Grass at those locations. Examples are provided on page 17.

Ecological Attribute:	River Swamp Wallaby-grass – distribution and extent			
Conservation outcomes	**Target**	River Swamp Wallaby-grass (*Amphibromus fluitans*) **present** in intermittent wetlands within the site.		
	2020		**2024**	
	Condition	**Poor**	**Condition**	**Fair**
	Trend		**Trend**	
Monitoring and results	In 2018, six wetlands were surveyed to identify and map patches of River Swamp Wallaby-grass and to estimate the percentage cover in any patches found. That survey located River Swamp Wallaby-grass inside and outside feral grazing exclosure fencing at Little Rushy Swamp. River Swamp Wallaby-grass was not located at any of the other wetlands. Since 2018, exclosure fencing areas have been installed at three of those originally surveyed wetlands. In 2022, those same six wetlands were resurveyed along with one additional wetland (Black Swamp). River Swamp Wallaby-grass was located at four of the seven surveyed wetlands in 2022. The abundance and density of River Swamp Wallaby-grass in Little Rushy Swamp has increased since 2018 in the absence of feral grazing. Two areas of River Swamp Wallaby-grass were also observed within the fenced exclosure at Harbours Lake, but this plant was not found on the grazed side of fencing. One small occurrence was located within the Steamer Plain wetland and a small area of individual plants was located at Black Swamp (Water Technology 2022). The surveyed abundance of River Swamp Wallaby-grass within the Harbours Lake exclosure fencing clearly demonstrates how this species can recover when feral grazing pressures are removed after just two years (the Harbours Lake exclosure fence was installed in January 2020). This example, coupled with the measured recovery of both River Swamp Wallaby-grass and Moira Grass in Little Rushy Swamp, clearly indicates that these important native grass species have the potential to recover naturally if feral grazing pressures are removed. The lack of River Swamp Wallaby-grass at the remaining three surveyed wetlands (Bucks Swamp, Top Lake and Hut Lake) is likely due to a lack of existing plants (parent material) and grazing pressures.			

Ecological Attribute:	Mueller Daisy – distribution and extent			
Conservation outcomes	Target	Mueller Daisy (*Brachyscome muelleroides*) **present** in permanent and intermittent wetlands within the site		
	2020		2024	
	Condition	Fair	Condition	Fair
	Trend	?	Trend	→
Monitoring and results	Mueller Daisy was not recorded in Victoria for over two decades until it was rediscovered at Barmah National Park in spring 2019. In spring 2020, Mueller Daisy was recorded at three separate sites within the Ramsar site and one site at Ulupna Island. Each site had several patches comprising hundreds or thousands of plants per patch. For Mueller Daisy, the 2020 survey has provided a baseline against which future changes can be measured. The survey in spring 2023 recorded Mueller Daisy at all the sites where it had previously been observed, including three separate sites within the Ramsar site and one site at Ulupna Island. At all sites, there was a noticeable reduction in the number of plants compared to the previous assessment in 2020. This was attributed to the effects of flooding and higher rainfall, which had stimulated abundant growth of wetland forbs across the floodplain, while parts of the species habitat were inundated by shallow water. This is likely to be part of the natural fluctuation of an annual species (Just 2023).			

Photo: Carpet of Muellers Daisy at Grinters Ridge.

Key Issues

Mapping of Moira Grass

Technology is advancing the techniques available to map vegetation, and these are now being used in Barmah Forest to determine the extent of Moira Grass. The most recent example is the use of remotely sensed data from WorldView-2 satellite imagery in 2021 to assess, model and map Moira Grass, as distinct from other flora species across the floodplain to derive a figure of 245 hectare of Moira Grass (within the bound 191-299 ha) (Brown & Tolsma 2021).

This mapping technique is different to that used when the estimates of extent in previous years were derived (Table 4.2). The area occupied by Moira Grass is a dynamic value, as Moira Grass (along with other wetland species) are subject to the inherent variability in climate and hydrology as well as the impact of river regulation and introduced species. The estimates of extent represent the Moira Grass growth that the prevailing conditions had enabled at that point in time.

The certainty of the most recent estimate will be significantly enhanced with repetition in frequency of collection – and this will be possible as the current technique continues to be applied and improved.

Table 4.2: *Estimated area of Moira Grass in Barmah Forest over time*.

Year	Area (ha)	Technique	Reference
1930s	4000	Estimated extent	Chesterfield (1986)
1979	1650	Detailed on-ground surveys	Chesterfield (1986)
1982	1500	Estimated extent based on mapping	Chesterfield et al. (1984)
2007	947	Estimated extent based on vegetation maps	Colloff *et al.* (2014)
2015	182	Detailed on-ground surveys	Vivian *et al.* (2015)
2021	245	Satellite imagery analysis and modelling	White *et al.* (2021)

Photo: Spotted Marsh Frog eggmass at Steamer Plain.

5 Review of plan structure and content

The *Strategic Action Plan* set out a program of actions to supplement those in existing management plans that govern land and water management in the Barmah Forest. It identified the legislative and cultural context for land management and provided a detailed description of the principal factors, that in combination, have contributed to the decline in the health of the Barmah floodplains marshes and the extent of Moira Grass within them:

- Changes to the natural flooding regime due to river regulation.
- Grazing and trampling pressure by introduced animals, particularly by feral horses (and previously, cattle).
- Encroachment by invasive plant species.

In addressing these factors, the *Strategic Action Plan* provided the key function of expressing all of the required actions that needed to be implemented simultaneously in order to achieve its overarching objective, to improve the health of the floodplain marshes of Barmah Forest, increasing the extent and cover of Moira Grass plains and associated wetland vegetation.

The *Strategic Action Plan* articulated clear objectives for ecological values and threat mitigation, and identified measurable indicators for evaluating progress against its objectives. These objectives were aligned with those of other key planning instruments, notably the *Barmah-Millewa Forest Environmental Water Management Plan* (MDBA 2012), and the *Barmah Forest Ramsar Site Management Plan* within the *Goulburn Broken Waterway Strategy 2014-2022.* This alignment has enabled efficiency in implementation, monitoring and reporting amongst the delivery partners identified by the *Strategic Action Plan*.

The *Strategic Action* Plan identified ongoing as well as additional actions required to complement the effort currently being applied to control significant risks and to improve management effectiveness, and was successfully used to attract funding for those actions. This is reflected in the extent to which actions have been implemented (Appendix 1).

The *Strategic Action Plan* described the comprehensive consultation approach employed in its development, and further steps for engagement. The *Strategic Action Plan* also specified that a new plan would be developed and that the new plan would detail the next steps toward removal of the remaining horses in Barmah Forest.

Since the development of the *Strategic Action Plan,* the *Joint Management Plan for Barmah National Park* (YYTOLMB 2020) has been released. Many of the actions identified in the *Strategic Action Plan* have been adopted in the *Joint Management Plan* or its associated *Implementation Plan* (YYTOLMB 2022).

The *Joint Management Plan* was approved by the Minister for Environment following extensive community consultation that included capturing the range of community views in support of, and in opposition to, the control of feral horses. Since the *Joint Management Plan* specifies the removal of all feral horses, and because of the significant progress towards this goal, a renewed plan that specifically addresses this threat is no longer required.

The outcomes and recommendations from this evaluation can therefore be used to inform the planning and delivery of ongoing actions described in various relevant strategies and plans for Barmah's floodplain marshes, including the *Barmah Forest Ramsar Site Management Plan* (as part of the *Goulburn Broken Waterway Management Strategy*), the *Joint Management Plan,* and associated operational plans.

6 References and existing information

Brown, G. and Tolsma, A. (2021). *Mapping of River Red-gum and Giant Rush incursions into wetlands of the Barmah Forest Ramsar Site*. Unpublished Client Report for the Goulburn Broken Catchment Management Authority. Arthur Rylah Institute

Cairns S.C. (2023). *Analysis of the 2021 aerial survey of the feral horse population in the Barmah National Park, Victoria*. A report to Parks Victoria. Available at: https://www.parks.vic.gov.au/get-into-nature/conservation-and-science/conserving-our-parks/feral-animals/feral-horses/victorian-surveys-on-feral-horses

Chesterfield, E.A. (1986) Changes in the vegetation of the river red gum forest at Barmah, Victoria. *Australian Forestry*, 49:1, 4-15, DOI: 10.1080/00049158.1986.10674458

Chesterfield E.A., Loyn R.H. and MacFarlane M.A., (1984). *Flora and fauna of Barmah State Forest and their management*. Victorian Forests Commission Research Bulletin Report No. 240.

Colloff, M.J., Ward, K.A., and Roberts, J. (2014). Ecology and conservation of grassy wetlands dominated by spiny mud grass (*Pseudoraphis spinescens*) in the southern Murray-Darling Basin, Australia. *Aquatic Conservation: Marine and Freshwater Ecosystems* 24(2): 238–255.

DEECA (2023). *West Victoria Deer Control Plan 2023-2028*. Department of Energy, Environment and Climate Action, Melbourne. Available at: https://www.environment.vic.gov.au/__data/assets/pdf_file/0027/634167/West-Victoria-Deer-Control-Plan-2023-2028.pdf

DELWP (2016). *The Victorian wetland classification framework* (2014). Department of Environment, Land, Water and Planning, East Melbourne.

GBCMA (2014). *Goulburn Broken Waterway Management Strategy 2014-2022*, Goulburn Broken Catchment Management Authority, Shepparton.

Hale, J. and Butcher, R. (2011). *Ecological Character Description for the Barmah Forest Ramsar Site*. Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Just, K. (2023). *Barmah Forest Ramsar Site Threatened Species Surveys*. Unpublished report for Goulburn Broken Catchment Management Authority.

MDBA (2012). *Barmah–Millewa Forest Environmental Water Management Plan*. MDBA Publication No. 219/11. Murray–Darling Basin Authority, Canberra, ACT.

Parks Victoria (2020). *Strategic Action Plan: Protection of Floodplain Marshes in Barmah National Park and Barmah Forest Ramsar Site*. Parks Victoria: Melbourne, Australia.

Sharp, T. (2016). *Ground shooting of feral horses (HOR001). Standard Operating Procedure*. PestSmart. Available at: https://pestsmart.org.au/toolkit-resource/ground-shooting-of-feral-horses/

Vivian, L.M., Ward, K.A., Marshall, D.J., and Godfree, R.C. (2015). *Pseudoraphis spinescens (Poaceae)* grasslands at Barmah Forest, Victoria, Australia: current distribution and implications for floodplain conservation. *Australian Journal of Botany* 63(6): 526.

Water Technology (2021). *Barmah Moira Grass Propagation Trial – Spring 2019*. Unpublished report for Goulburn Broken Catchment Management Authority.

Water Technology (2022). *River Swamp Wallaby-grass survey at selected wetlands in the Barmah Forest Ramsar Site, March 2022*. Unpublished report for Goulburn Broken Catchment Management Authority.

Water Technology 2023. *Barmah Exclosure Monitoring* – May 2023. Unpublished report for Goulburn Broken Catchment Management Authority.

White, M., Brown, G., Mole. B. and Tolsma, A. (2021). *Mapping of Moira Grass* Pseudoraphis spinescens *in Barmah National Park*. Unpublished Client Report for the Goulburn Broken Catchment Management Authority. Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, Heidelberg, Victoria.

YYTOLMB (2020) *Joint Management Plan for Barmah National Park*. Prepared by Montane Planning for the Yorta Yorta Traditional Owner Land Management Board, Victoria. Available at: https://www.yytolmb.com.au/wp-content/uploads/2020/04/Minister-Approved-Final-Barmah-NP-JMP.pdf

YYTOLMB (2022) *Implementation Plan for the Barmah National Park Joint Management Plan 2022 – 2030.* Prepared by Montane Planning for the Yorta Yorta Traditional Owner Land Management Board, Victoria. Available at: https://www.yytolmb.com.au/wp-content/uploads/2022/03/Final-Joint-Management-Implementation-Plan-for-Barmah-National-Park-2022-2030.pdf

Appendix 1 – Summary of Conservations Actions in the *Strategic Action Plan* and the *Joint Management Plan*.

Action Status icons

✓	Implemented, ongoing action in progress	✓	Complete, no further action
⚠	Partially implemented, further action at risk	⊘	Action cancelled

Strategic Action Plan **(PV 2020)**	**Action** (explanation for the designation as 'Partially implemented, further actions at risk' are in footnotes below)	**Action Status**	***Joint Mgt Plan Implementation Plan*** **(YYTOLMB 2022)**
Strategy 1 – Maintain and improve current water regimes			
Work with partner agencies to ensure that managed water regimes maintain and enhance the ecological character of the Ramsar Site, particularly floodplain marsh vegetation on open plains.	Liaise on the development of watering proposals and their delivery. Priority watering actions to include:	✓	Project ID: 22E23
	• Provision of an appropriate water regime (frequency, timing, duration, depth, variability and extent) to increase the extent and diversity of floodplain and wetland vegetation, with particular emphasis on re-invigorating floodplain marsh species such as Moira Grass.	✓	
	• Undertake measures to ensure preservation of vegetative fragments of Moira Grass and deter further expansion of giant rush and river red gums (or invasion of introduced plant species) into Moira Grass plains.	✓	
	• Continuing to minimise the incidence and magnitude of undesirable summer and autumn flooding of floodplain marshes (e.g. Steamer Plain, Hut Lake, Little Rushy Swamp and War Plain) due to unexpected large rainfall events leading to irrigation rejections, by instead diverting unseasonal floodwater to giant rush dominated wetlands such as Boals Deadwoods and Top Island or connecting creeks leading to higher terrain usually containing water-stressed red gums.	✓	
Help to sustain the health of Country for Traditional Owners through use of environmental or cultural flows.	Ensure Aboriginal water values and uses are identified and supported, for example through the Aboriginal Waterways Assessment tool enabling Traditional Owners to assess the cultural health of their Country and inform priorities for environmental water delivery.	✓	Project ID: 22E10
	Use environmental or cultural flows (or both) to sustain ephemeral habitats and support culturally significant species, such as the Common Long-necked Turtle.	✓	
Monitor and evaluate the effectiveness of environmental water planning (including water deliveries and planned dry periods) in achieving the desired water regime.	Monitor the flooding regime at Barmah Forest (including frequency, timing, duration, depth, variability and extent of flooding) to assist with annual planning and determine whether the appropriate water regime is being achieved according to the environmental water management plan (MDBA 2012).	✓	–

Strategic Action Plan **(PV 2020)**	**Action** (explanation for the designation as 'Partially implemented, further actions at risk' are in footnotes below)	**Action Status**	***Joint Mgt Plan Implementation Plan*** **(YYTOLMB 2022)**
Strategy 2 – Control of grazing by feral horses.			
Reduce population density of horses by effective and integrated control programs	Removal targets – Year 1: remove 100-120 horses* Year 2: remove 150-250 horses* Year 3: remove 50-150 horses* Year 4: remove any further horses, as needed, until the remaining population number is approximately 100 * Numbers to be informed by total population counts through annual aerial surveys.		Project ID: 22E3.1
	Establish a trapping network to capture (where possible) feral horses where rehoming interest has been determined through the annual Expression of Interest process.[1]		Project ID: 22E3.2
	Surrender captured horses to rehoming groups or individuals.[2]		Project ID: 22E3.2
	Develop seasonal operational plans for professional shooter deployment for lethal control of free-ranging horses.		–
	For each horse removed collect the following data: • gender, age and body condition score • removal method • surrender outcome.		–
	Mustering may be trialled as a feral horse control technique during the term of this plan.		–
Protect smaller areas where core natural and cultural values occur	Install targeted small-scale fenced exclosures in sensitive areas where an immediate reduction of impacts is needed (e.g. prioritised remnant Moira Grass sites where active restoration is occurring), and fencing is feasible. These will be constructed using a design that will exclude feral horses, pigs and other large introduced herbivores including deer.		–
Help to sustain the health of Country for Traditional Owners.	Work closely with Yorta Yorta to protect Country and sites of cultural significance while implementing grazing control management actions.		–
Increase community support for rehoming captured horses and horse management	Establish an expression of interest (EOI) process and rehoming register to identify rehoming opportunity in advance of trapping horses.		Project ID: 22E3.3
	Build partnerships that contribute to the success of feral horse management at Barmah Forest.		
	Keep the community and stakeholders informed of actions and progress.		

[1] A trapping network is longer practical, since remaining horses are highly dispersed, difficult to detect, and extremely cautious, and therefore unlikely to be trapped (Strategy 2-Key Issues).

[2] Given the feasibility of capture is low, the likelihood of rehoming is also low (Strategy 2-Key Issues).

Strategic Action Plan **(PV 2020)**	**Action** (explanation for the designation as 'Partially implemented, further actions at risk' are in footnotes below)	**Action Status**	***Joint Mgt Plan Implementation Plan*** **(YYTOLMB 2022)**
	Actively develop partnerships and programs to maximise rehoming capacity.[3]		
	In the final year of this plan, consult the local community and other stakeholders on further steps in management of the feral horse population.[4]		
Reduce suffering of free-ranging horses	Euthanasia of free-ranging horses may be required when horses are injured, ill, or are in very poor body condition.		–
Monitor effectiveness of horse control in reducing population abundance	Undertake annual feral horse surveys using helicopter-based thermal imaging in late Autumn.[5]		–
	Increased surveillance to reduce the incidence of re-introduction of feral horses.		
Strategy 3 – Control of feral pigs and other introduced herbivores			
Reduce population densities of **feral pigs** by effective and collaborative control programs	Reduce feral pig population density across the planning area to reduce ground disturbance and predation.		Project ID: 22E3.6
	Implement an on-going multi-technique control program (baiting, trapping and shooting using professional shooters and accredited volunteers) targeting the protection of key assets (e.g. colonial waterbird rookeries; Moira Grass).		
	Install targeted small-scale fenced exclosures in sensitive areas where an immediate reduction of impacts is needed (e.g. prioritised remnant Moira Grass sites where active restoration is occurring), and fencing is feasible.		
	Exclosures will be constructed using a design that will exclude feral horses as well as pigs and other large introduced herbivores (refer to section 8.2 – Fenced exclusion in sensitive areas).		
Reduce population densities of **feral deer** by effective and collaborative control programs	Reduce population density of all deer species present and maintain the density at low levels that minimise impacts on wetland values.		Project ID: 22E3.6
	Implement an on-going multi-technique control program targeting the protection of key assets (e.g. Moira Grass) using professional shooters and accredited volunteers.		
Reduce population densities of **feral goats** by effective and collaborative control programs	Reduce goat population densities to levels that allow regeneration of perennial shrub and ground layers. If eradication is achieved, maintain goat-free status.		Project ID: 22E3.6
	Implement an on-going multi-technique control program targeting the protection of key assets (e.g. Moira Grass) using professional shooters and accredited volunteers.		

[3] Given the feasibility of capture is low, the likelihood of rehoming is also low (Strategy 2-Key issues).

[4] Delivery partners have been consulted on the evaluation. Further community engagement will take the approach of informing the community of the results of the review/evaluation (Section 5).

[5] While COVID-safe settings limited the annual surveys during the period, this action is complete as this technique will not be used for further surveys (Strategy 2-Key issues).

Strategic Action Plan **(PV 2020)**	**Action** (explanation for the designation as 'Partially implemented, further actions at risk' are in footnotes below)	**Action Status**	***Joint Mgt Plan Implementation Plan*** **(YYTOLMB 2022)**
Eradicate herbivore populations that have not yet established	Eradicate **feral sheep** by 2019 and maintain feral sheep-free status using professional shooters and accredited volunteers.		–
Monitor effectiveness of animal control programs and adapt.	Establish measurable targets and monitoring programs for feral pigs, deer, goats and sheep.[6]		–
Strategy 4 – Manage encroachment by invasive wetland plants			
Reduce extent of encroaching native species (giant rush and river red gum) to restore the boundary between forest and grasslands (open plains)	Minimise the incidence and magnitude of undesirable summer-autumn flooding of floodplain marshes (e.g. Steamer Plain, Hut Lake, Little Rushy Swamp and War Plain) (refer to conservation action 8.1).		Project ID: 22E23
Control arrowhead to acceptable levels, particularly where floodplain marsh communities are at risk.	Continue to control arrowhead in surrounding waterways and delivery channels to reduce the source of seed and other propagules that could reach floodplain marshes.		Project ID: 22E4.3
	Eradicate arrowhead where localised and small populations exist.		
	Respond rapidly to identify and eradicate new infestations of arrowhead within Barmah Forest.		
	Aim for an 80 per cent reduction in the extent and density of existing infestations of arrowhead within Barmah Forest.[7]		
Monitor effectiveness of control programs and adapt control as needed.	Monitor the distribution and extent of arrowhead and encroaching native species in the floodplain marshes.		Project ID: 22E3.7
	Trial the use of ecological burning and/or mechanical control (e.g. slashing or thinning), followed by managed flooding to limit giant rush and river red gum regrowth or germination from the soil seed bank on Moira Grass plains.[8]		
	Based on research results and Traditional Owner knowledge, implement further on-ground trials to restore the natural extent and distribution of giant rush and river red gum, in targeted locations, particularly where new thickets are emerging.		
Strategy 5 – Active revegetation of Moira Grass			
Re-instate Moira Grass thatch in areas of floodplain marshland	Implement trials of laboratory thatch growth, followed by translocation into floodplain marshes, within grazing exclosures.		Project ID: E3.4
Monitor effectiveness of the re-establishment program & adapt.	Evaluate survival of translocated thatch within grazing exclosures.		Project ID: E3.4

[6] Establishing a robust system of indicators, targets and monitoring methods for feral pigs and deer are resource dependent (Strategy 3-Key issues).

[7] Alternative techniques for monitoring Arrowhead, and a specific target is required to be developed, and is resource dependent (Strategy 4-Key issues).

[8] Some progress has been made on this, but there is a residual risk to the action related to ecological burn approvals (Strategy 4-Key issues).

page intentionally blank