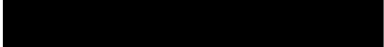


Date 28/04/2025
To 
From 
Copy to 
Subject MPE operational facility – Weed monitoring report February 2025

Introduction

Arcadis has been commissioned to conduct bi-monthly weed monitoring surveys within Moorebank Precinct East (MPE) operational facility at Moorebank Intermodal Precinct. The MPE operational facility includes the following:

- Import and Export Terminal (IMEX)
- Rail Access Land Package (RALP)
- Warehouses, distribution facilities and freight village
- Stormwater trunk drainage infrastructure and landscaping areas

Regular monitoring of the MPE operational facility will inform the land manager of weed cover and the presence of any weeds listed as 'priority' for the Greater Sydney Local Land Services region under the *Biosecurity Act 2015*.

Background

Arcadis has been monitoring the MPE operational facility for weed occurrence since April 2020. High levels of weed cover within the Rail Link have been observed across most of the monitoring period, except for during weed monitoring events immediately following remediation works. Routine weed remediation works have commenced as of December 2022 along the rail link corridor, with future remediation works planned continuously planned when relevant.

The RALP, which includes the MPE operational Rail Link, has seen significant change and works over the time Arcadis has conducted weed monitoring. The soft batters on either side of the Rail Link have had varying levels of exotic cover. Additionally, works conducted in the Moorebank Precinct West (MPW) in 2023/24 have changed the layout and vegetation spread in the RALP. Several weed remediation events have occurred since the inception of weed monitoring, detailed below in Table 1.

Table 1 Summary of weed events throughout monitoring history

Timing	Summary of events	Weed contractor
Spring 2020	• Weeds removed from batters and revegetated with native species, as per the Urban Design and Landscaping Plan (UDLP) for MPE • Cumberland Plain Seeds were procured to provide technical oversight of revegetation effort	Spray Grass Solutions
December 2021	• As per recommendations from Spray Grass Solutions and Cumberland Plain Seeds, the	

Timing	Summary of events	Weed contractor
	monitoring methodology was changed Changes included reporting on cover on 'priority' weeds species and key weeds specific to the project.	
December 2022 to June 2023	- Weed remediation works commenced - Priority weed species were targeted - Native species were identified throughout the RALP to avoid accidental removal.	P&E Services
December 2023 to present	- Weed remediation works continued - Regular maintenance of priority weed species via slashing, hand removal and herbicide spraying	Toolijooa Environmental Restoration

Methodology

Arcadis ecologist Kate Mauger attended the MPE operational facility on 26 March 2025 (this report will still be referred to as the 'February 2025' inspection). Monitoring involved traversing the MPE operational facility on foot, surveying landscaped areas, stormwater infrastructure and soft batters adjoining the Rail Link. The areas surveyed are presented in Figure 1.

The weather on the 26 March was sunny, with a maximum temperature of 27.5°C, and the weather recorded at Holsworthy Aerodrome (station 066161) (BOM 2024).

IMEX, warehouses and drainage infrastructure

In soft landscaped areas surrounding the IMEX, warehouses, freight village and within drainage infrastructure, the following activities were conducted:

- Identifying and mapping the occurrence of weeds listed as priority
- Mapping and estimating the per cent foliage cover of exotic species
- Mapping and estimating the per cent foliage cover of priority weeds
- Recording and mapping the extent of weed remediation works

The cover of exotic species and priority weeds were estimated based on the area of cover within a patch and categorised as per Table 2.

Table 2. Categories to describe percent cover of weeds

Categories	Percentage cover of weeds within a patch (%)
Low	5 – 25

Categories	Percentage cover of weeds within a patch (%)
Moderate	25 – 75
High	75 – 100

The location of weed infestations, priority weed species and observed weed remediation works were recorded on an Arc-GIS enabled iPad.

Rail Link

Following the meeting held in December 2021 regarding revegetating the Rail Link, the monitoring methodology for weeds within the Rail Link has been refined to focus on key and priority weed species rather than all exotic species.

Priority weed species are any exotic species listed under the *Biosecurity Act 2015* for the Greater Sydney Local Land Services Area, and key weed species have been identified as site-specific exotic plants with the potential to have detrimental outcomes for the recruitment of native seedlings or impacts on adjacent ecologically sensitive areas. A list of priority and key weed species known from the Rail Link is included in Table 3.

Table 3 Priority and key weed species subject to control within the Rail Link

Priority weed species	Key weed species
<i>Alternanthera philoxeroides</i> (Alligator weed)	<i>Chloris gayana</i> (Rhodes Grass)
<i>Asparagus asparagoides</i> (Bridal Creeper)	<i>Echium plantagineum</i> (Paterson's Curse)
<i>Lantana camara</i> (Lantana)	<i>Eragrostis curvula</i> (African Lovegrass)
<i>Ludwigia peruviana</i> (Ludwigia)	<i>Hyparrhenia hirta</i> (Coolatai Grass)
<i>Olea europaea</i> subsp. <i>cuspidata</i> (African Olive)	<i>Themeda quadrivalvis</i> (Grader Grass)
<i>Senecio madagascariensis</i> (Fireweed)	

Moorebank Precinct West (MPW)

One area on Bushmasters Drive, adjacent to the security office at MPW underwent weed removals as part of the works package at MPW, on the 30 October 2024. One Arcadis ecologist attend to supervise Toolijooa removing weeds adjacent to the BioBank site.

Additional monitoring was conducted along Bushmasters Drive in April 2024, to monitor the condition of the landscaped vegetation along the road.

Study Limitations

The data presented within this report is restricted to what was observed and recorded by the attending Arcadis ecologists during the site assessment on 26 March 2025.

Monitoring of weeds was restricted to the operational facility; weeds were not assessed within the bounds of the active construction areas surrounding new warehouses.

Surveys were not undertaken in areas extending beyond the junction between the QUBE Rail Link and the Southern Sydney Freight Line (SSFL).

Results

Observations made by the attending ecologists during the February 2025 weed monitoring survey are summarised below.

IMEX, warehouses and drainage infrastructure

Weed cover is generally low in soft landscaped areas surrounding the IMEX, besides few instances of *Conyza bonariensis* (Fleabane). A greater cover of weedy species are present along the batters of drainage infrastructure along the western boundary of the precinct and in the north-eastern corner around the basins. Further sapling and stands of *Acacia falcata* (Hickory Wattle) continue to grow unimpeded by weeds.

Although weeds are present around the warehouse areas, they are not causing infestations or inhibiting the growth of native species. Large areas of the native *Cynodon dactylon* (Couch Grass) is present across most of these areas and is generally outcompeting weed species..

Occurrences of weeds in the warehouse area and associated drainage infrastructure is restricted to scattered individuals of *Senecio madagascariensis* (Fireweed), *Plantago lanceolata* (Plantain), *Trifolium arvense* (Clover) and exotic grasses like *Sporobolus africanus* (Parramatta Grass), *Paspalum urvillei* (Giant Paspalum) and *Ehrharta erect* (Panic Veldtgrass).

The drainage lines and lower lying areas of the basins are showing strong resilience to weed infiltration. Native species dominate these areas and have a high cover and density. Some sections of the drainage channel and basins are dominated by *Bulboschoenus fluviatilis* (Marsh club-rush) whilst other are dominated by *Typha orientalis* (Bulrush). Where space is present between stands of theses native emergent species small clumps of *Persicaria decipiens* (Slender Knotweed), *Daviesia ulicifolia*, *Ficinia nodosa* (Knotted Club-rush), *Carex tereticaulis* and *Juncus usitatus* are present. Other native species such as *Imperata cylindrica* and *Lomandra longifolia* were observed in the drainage channels.

Photos for each area discussed above and illustrated in Table 4

Table 4 Photos for each monitoring area of MPE

Area of MPE	Photo
IMEX building and adjacent drainage infrastructure	 <i>Plate 1 IMEX building drainage infrastructure (Feb 2025)</i>

Area of MPE	Photo
Warehouse areas	 <i>Plate 2 Stabilized erosion areas with rainfall brining increased litter into drainage infrastructure (no change from August 2024)</i>
Eastern boundary drainage infrastructure	 <i>Plate 3 Erosion from persistent rain events evident in areas with limited vegetation cover (no change since October 2024)</i>

Rail Access Land Package (RALP)

During the February 2025 weed monitoring survey, bush regenerators from Toolijooa Environmental Restoration (Toolijooa) were conducting weed control works within the RALP.

There was little difference in the cover and density of exotic species between the recent summer surveys due to the ongoing management, and generally slow recruitment during the summer months.

Native species were observed to be growing well. Mature tussocks of native grass species, which have been avoided during slashing works, were observed with spent seed heads. With additional support from bush regenerators, it is anticipated that the fallen seed will germinate and establish and in turn the cover of native grasses will increase.

The status of weeds and weed remediation works observed during the Feb 2025 monitoring survey has been compared against a series of recommended actions developed during the baseline monitoring survey (Table 5). Overall, the status of weed management works by Toolijooa is performing well against these criteria.

Table 5 Weed remediation works tracking

Priority	Action	Action description	Current performance assessment
1	Eradicate 'priority' weeds	Target 'priority' weed species through manual removal and herbicide treatment. Herbicide application should consider timing (i.e., applying herbicide when weeds are actively growing) and best practice methodologies. Areas outlined by coloured polygons in Figure 3 - Figure 10 should be prioritised.	One priority weed species are present within the Rail Link: <i>Senecio madagascariensis</i> (Fireweed). These should be removed as a priority. Progress has been made through remediation works within the Rail link corridor. Continued management must be undertaken to work towards eradication.
2	Removal of key and aggressive weed species	Key weed species, including African Lovegrass, Rhodes Grass, Paterson's Curse, Coolatai Grass and Grader Grass, should be removed from revegetated areas of soft batter. Aggressive weed species, including Moth Vine and Castor Oil Plant, should be removed from all operational areas using a combination of manual and herbicide control. Areas outlined by coloured polygons in Figure 3 - Figure 10 should be prioritised.	Key weed species, including Rhodes Grass, African Lovegrass, Coolatai Grass, Paterson's Curse, and Grader Grass, are colonising soft batters in the Rail Link. These weeds should be removed. Progress has been made through remediation works within the Rail Link Corridor. Continued management must be undertaken to work towards eradication.
3	Suppress further colonisation of environmental weeds and encroachment into areas of bushland	Control of exotic species adjacent to the biobank site and ecologically sensitive areas. Manual removal should be adopted in areas adjacent to threatened flora locations. Areas outlined by coloured polygons in Figure 3 - Figure 10 should be prioritised.	Weed growth is stabilising through continued weed management on soft batters adjacent to the biobank site and ecologically sensitive areas. Manual removal, including routine slashing, is being used to prevent present weeds from reaching seeding maturity and further encroaching on adjacent high-value areas (biobank site and ecologically sensitive areas containing threatened plant

Priority	Action	Action description	Current performance assessment
			species). All works should be restricted to the operational area and not extend into the biobank site or identified ecologically sensitive areas. Slashing should only be conducted when weed species are not in flower to prevent further spread. Appropriate slashing time is during winter for most species.
4	Slashing of invasive grasses to prevent seeding.	Management of invasive grasses such as Rhodes Grass and African Love Grass through regular mowing or slashing. Areas outlined by coloured polygons in Figure 3 - Figure 10 should be prioritised.	Slashing has been adopted to manage the regrowth of invasive grasses (African Lovegrass, Grader Grass) within the Rail Link in ballast and gravel areas. Some areas beyond the Georges River bridge are yet to be managed. Slashing should be used to manage large expanses of exotic grassland to prevent seeding events. However, as native grasses become established, extreme care must be taken, and indiscriminate slashing must be avoided. A contractor with knowledge of native species should be employed to carry out this task, in failing that, an ecologist should be on site to monitor weed remediation.
5	Reduce cover of weeds within the Rail Link	Reduction of weed cover by applying control methods commensurate with the Operational Flora and Fauna Management Plan (Arcadis 2019).	Works should involve targeted slashing of mature plants and removing flowering and seed heads to minimise seeding. Targeted slashing has been previously employed to control weed colonisation on soft batters. However, it must be continued to limit the re-colonisation of weeds within the Rail Link. Future weed control actions will focus on removing and reducing the cover of priority and key weed species and suppressing the further colonisation of common weeds, which is consistent with the rehabilitation methodology proposed by Spray Grass Solutions and Cumberland Plain Seeds.

Priority	Action	Action description	Current performance assessment
6	Remove herbaceous and woody weeds within the operational area and trunk drainage infrastructure.	Reduction in herbaceous and woody weeds by applying control methods commensurate with the Operational Flora and Fauna Management Plan (Arcadis 2019)	Weed cover has generally remained low within trunk drainage infrastructure and at the north-eastern extent of the MIP East operational facility.

MPW weed works

Attending ecologist at the weed supervision on 30 October 2024 supervised the removal of minor occurrences of weed along the boundary of the MPW operational area and the BioBank site.

Weed monitoring conducted in April 2025 concluded that the landscaped areas along Bushmasters Avenue are in good condition, with minor weed incursions of *Sonchus oleraceus* (Common Sowthistle), *Chloris virgata* (Rhodes Grass), *Bidens pilosa*, *Conyza bonariensis* (Fleabane), *Cyclosporum leptophyllum* (Slender Celery), and *Tagetes minuta* (Stinking Roger). Whilst the current levels of these weeds are low, if continued maintenance of these landscaped areas is not frequent enough their coverage could increase. This is pertinent for areas where landscaped species have died back, and bare ground is more abundant (Plate 4).



Plate 4 Areas of bare ground along Bushmasters Avenue which could be colonised by weed species

Erosion

Geo-mesh fabric and boulders used to remediate erosion prone areas around the IMEX and drainage infrastructure were observed to be in good condition and serving their purpose of stabilisation during the Feb 2025 surveys.

Batter slumping is still present within drainage infrastructure in the warehouse area. Although some outlets have been stabilised with large boulders, the erosion is still present and will continue to erode during heavy rainfall events (Plate 3).

Previous areas of batter slumping within the RALP have accumulated more vegetation and the risk of further deterioration has been reduced. However the vegetation is mostly exotic species (Plate 5). Targeted stabilising of these areas with native vegetation is recommended once construction in the rail corridor is completed.



Plate 5 Batters adjacent to MPW that have been colonised by exotic species, such as Fleabane, in the absence of native vegetation

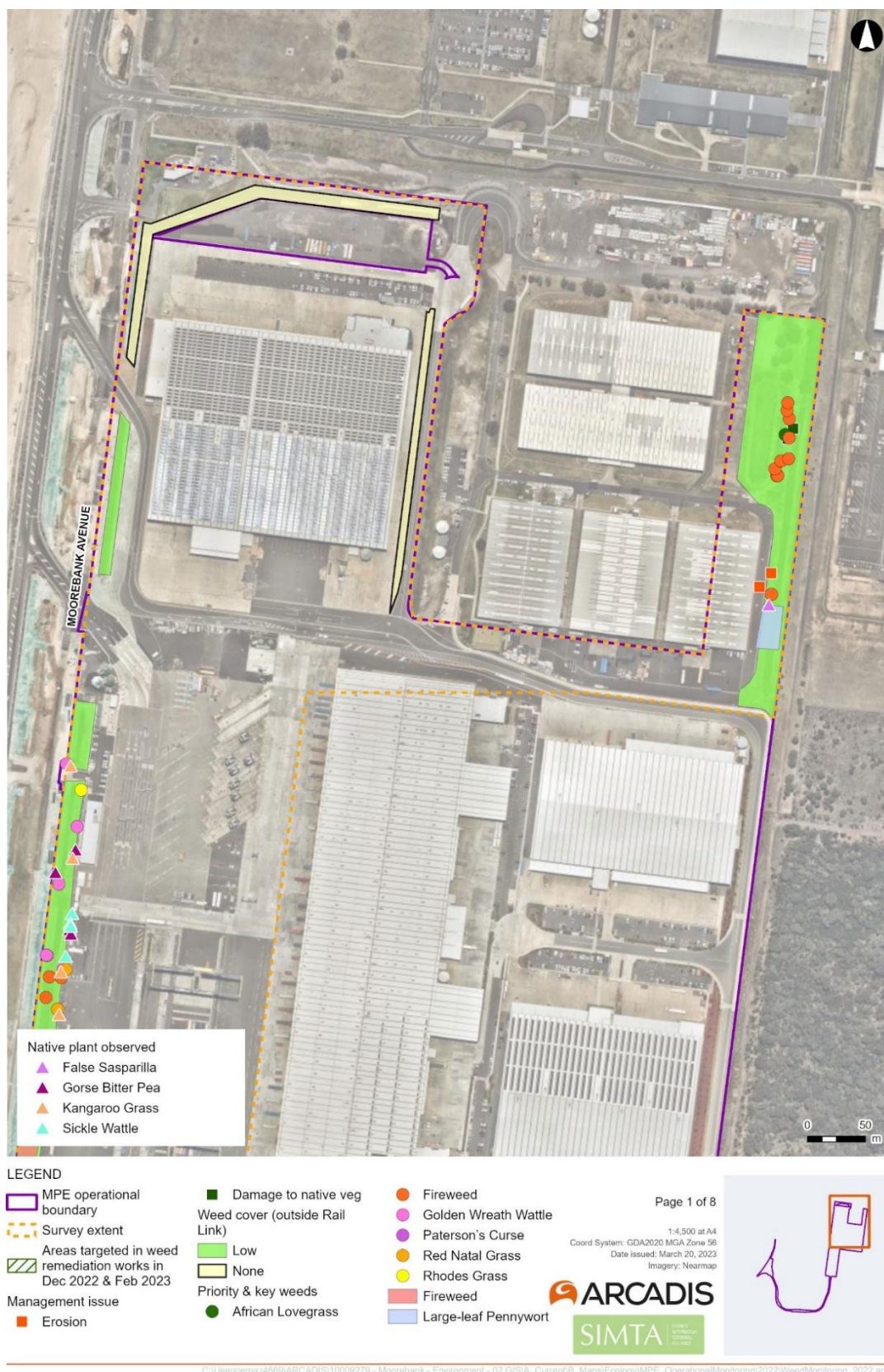


Figure 2 Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 1 of 8).

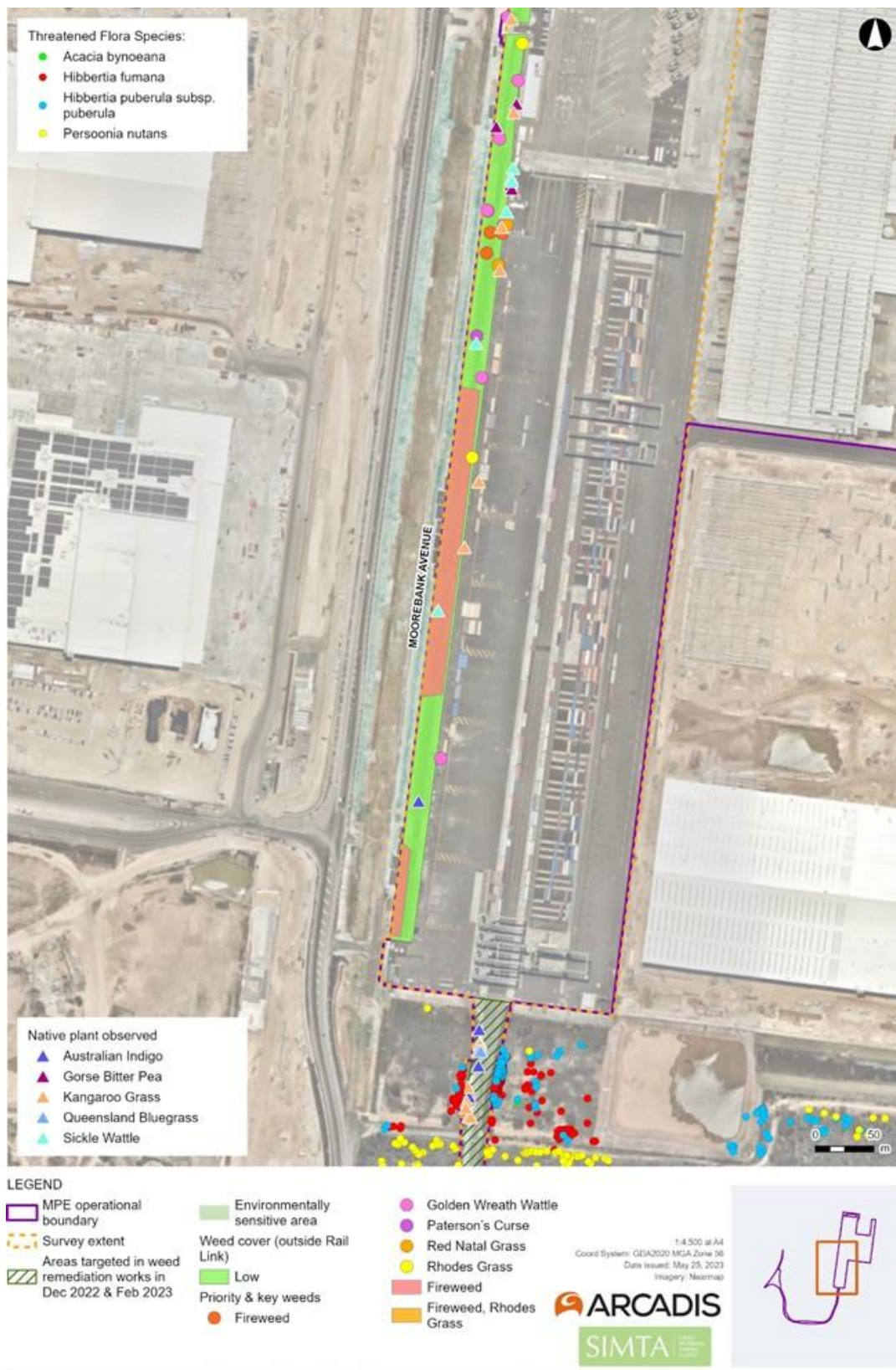


Figure 3 Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 2 of 8)

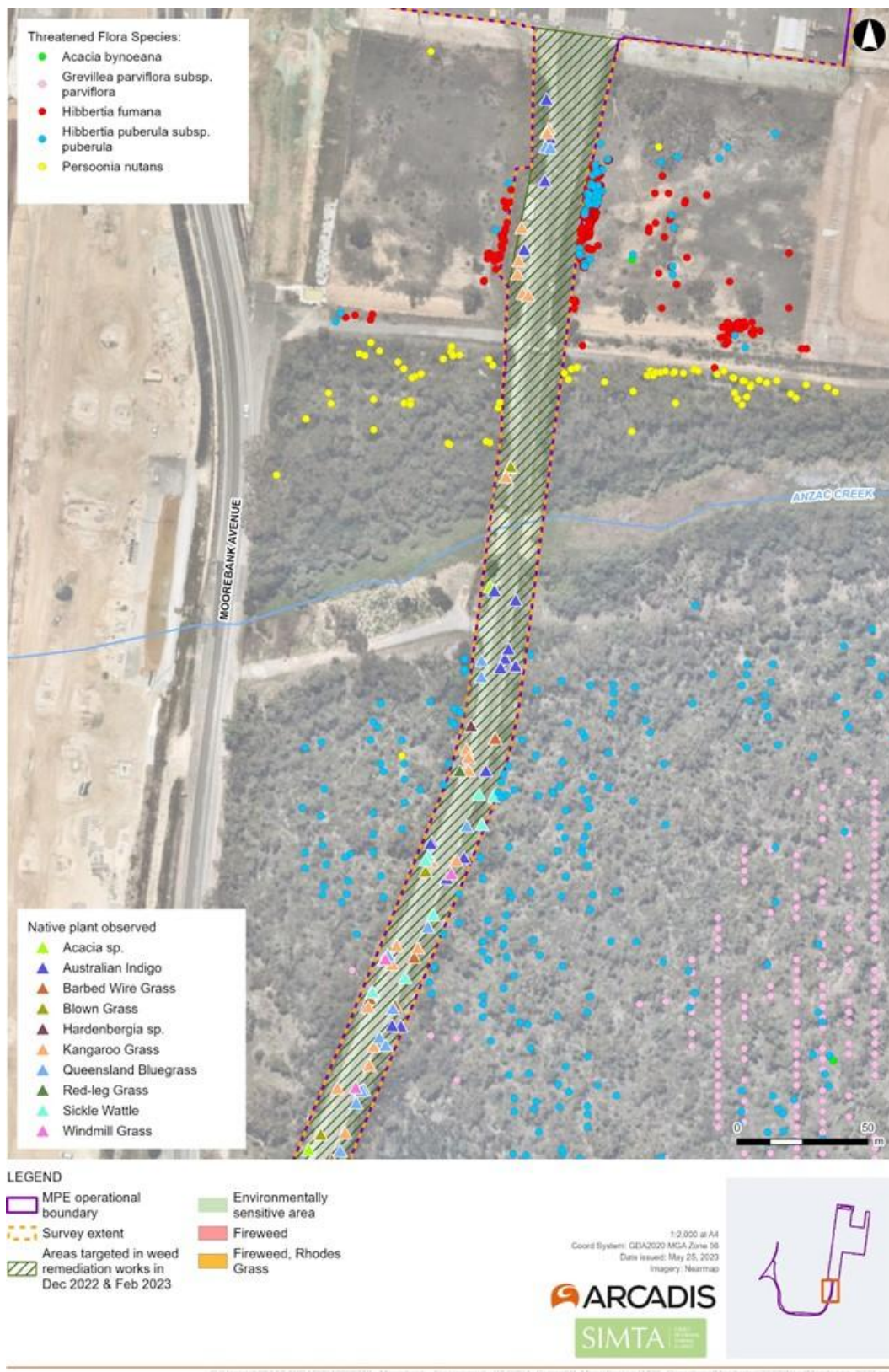


Figure 4 Native species, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 3 of 8)

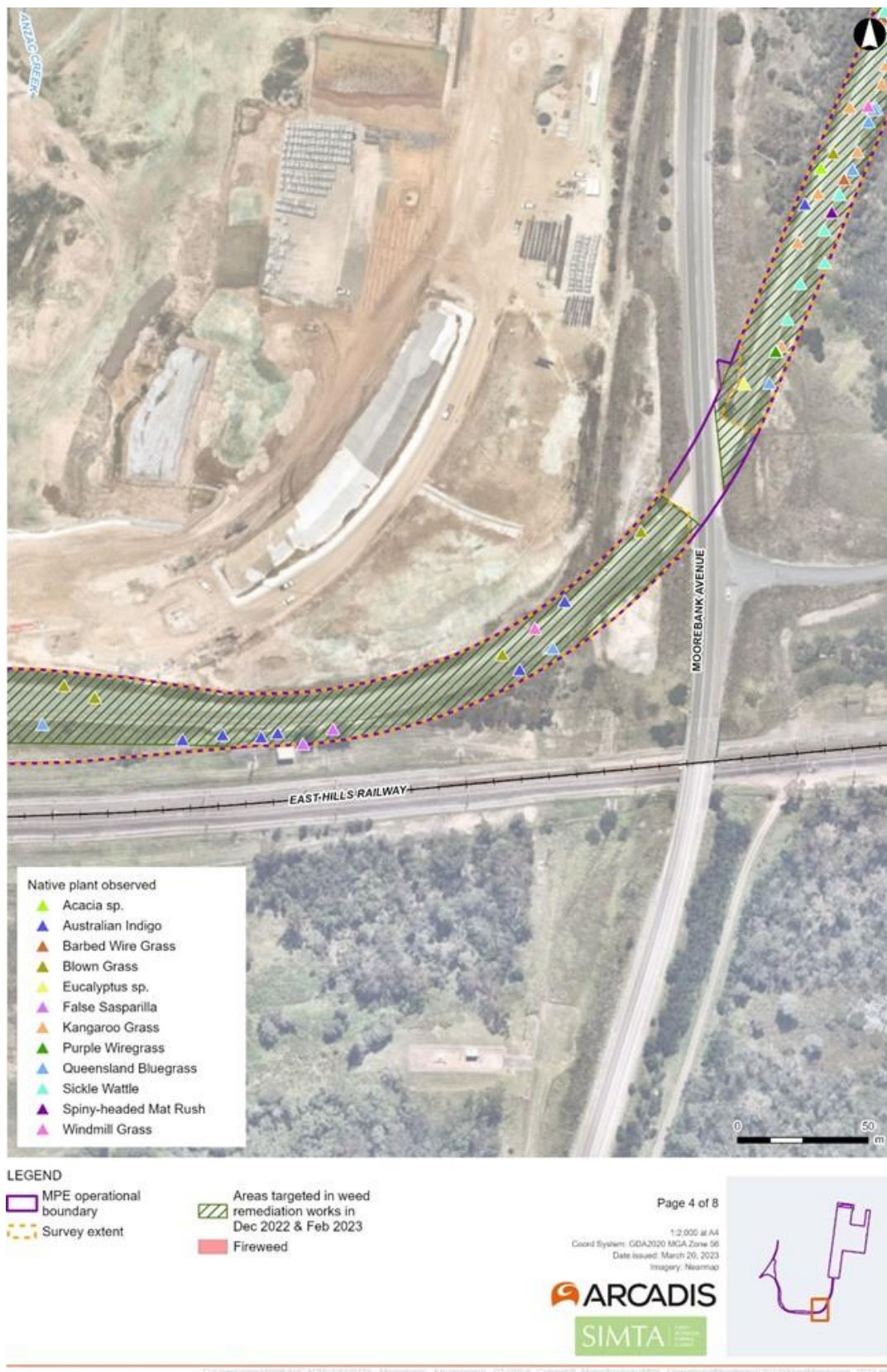




Figure 6. Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 5 of 8)

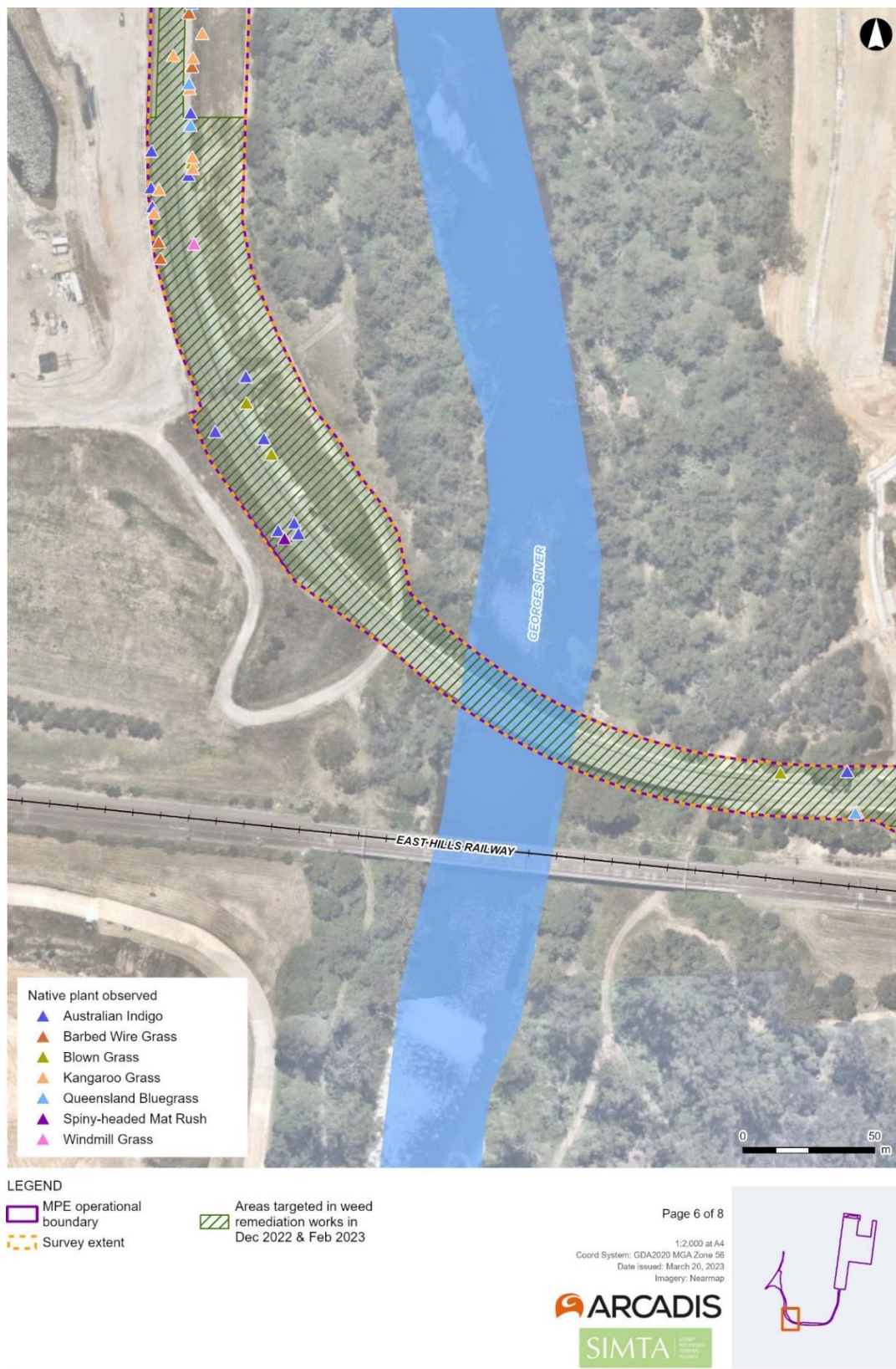


Figure 7. Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 6 of 8)

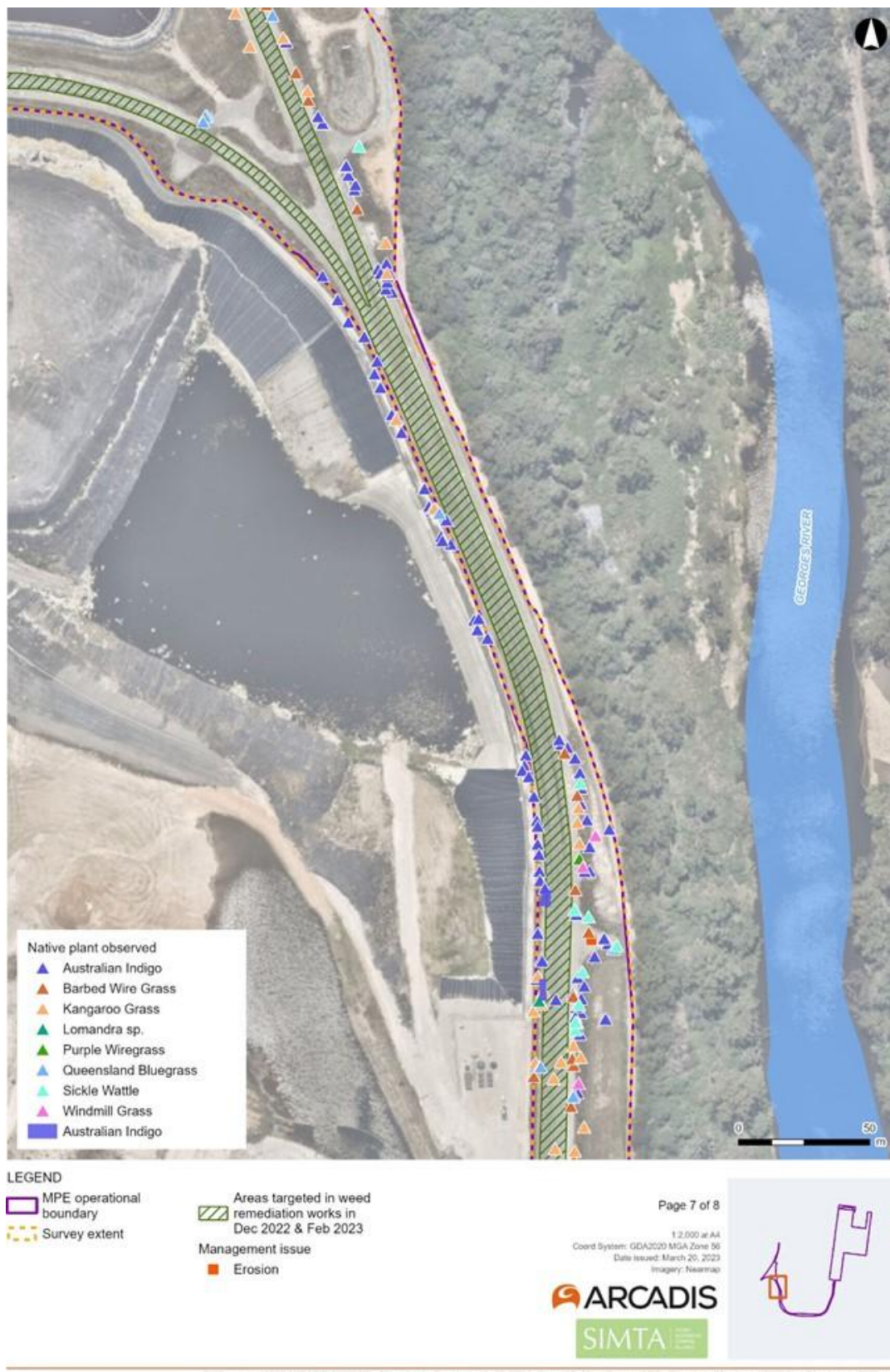


Figure 8. Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 7 of 8)

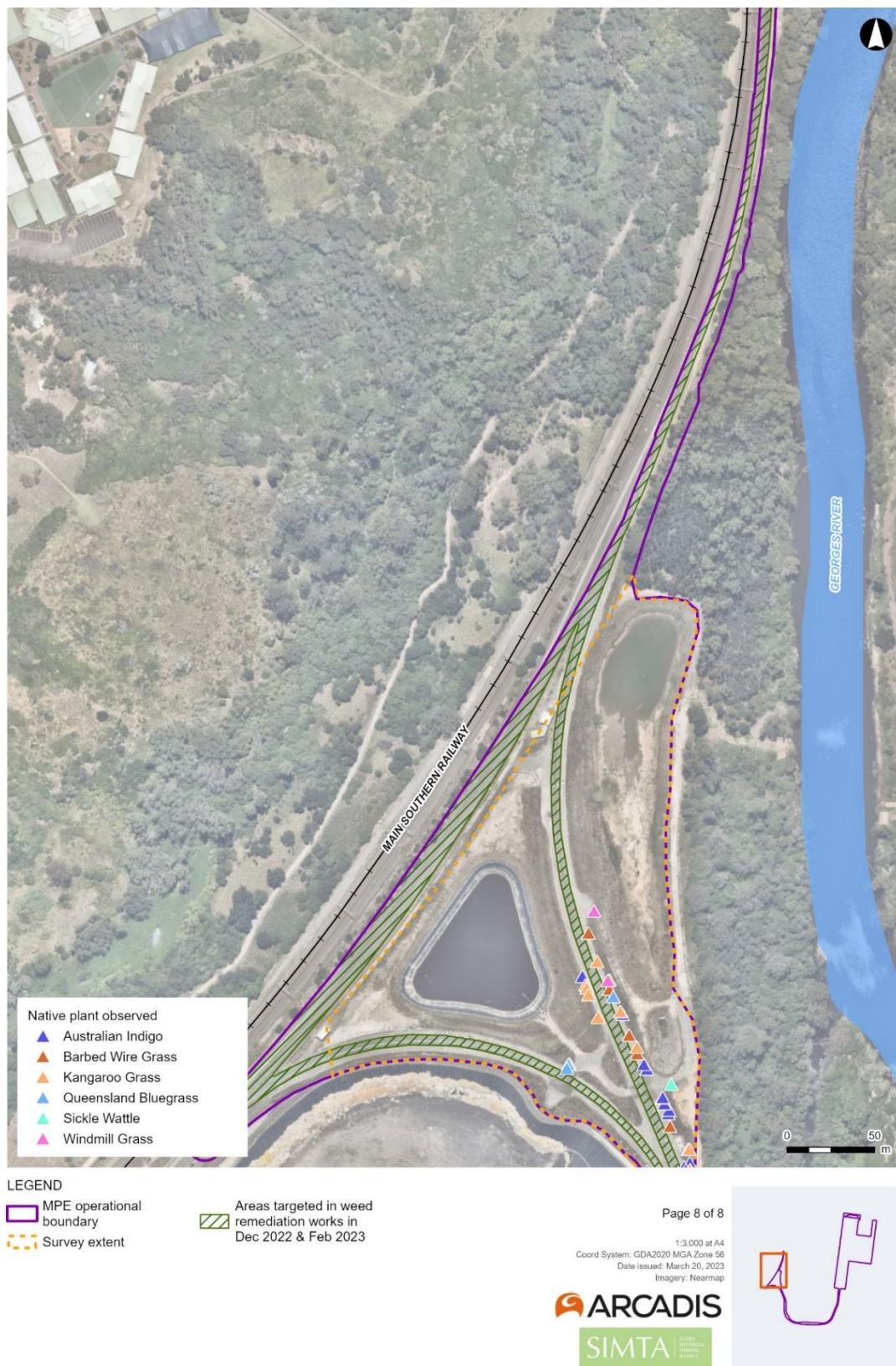


Figure 9. Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 8 of 8)

Recommendations

Recommended actions documented in previous weed monitoring reports are included in *Appendix A: Recommended Actions Catalogue*. The catalogue has been reviewed and updated to reflect works which have been completed and is considerate of the revegetation methodology proposed by Spray Grass Solutions and Cumberland Plain Seeds.

The majority of weed remediation and management action recommendations documented in the previous weed monitoring report are still applicable to the management of the site. These include:

- Targeted weed remediation to continue in 2025 and is to be conducted using the same methods and at the same locations as previously conducted.
- Targeted weed remediation works to continue along revegetated soft batters. Weed remediation works will focus on controlling priority and key weed species. Hand weeding should be conducted for individuals, whereas slashing and herbicide spraying should be adopted to target larger patches of weeds. However, extreme care must be taken when conducting any weed management along the rail corridor, as many native grasses have become established. A suggested process to target weeds along revegetated soft batters is presented in the methodology section of this report and Figure 11. Hand weeding is only feasible on annual species such as *Themeda quadrivalvis* (Grader Grass) and *Senecio madagascariensis* (Fireweed) due to their relatively small root system.
- Priority and aggressive weed species outside revegetated Rail Link areas should be removed. Weeds that should be targeted include *Senecio madagascariensis* (Fireweed).
- Large patches of *Eragrostis curvula* (African Lovegrass), *Chloris gayana* (Rhodes Grass) and *Themeda quadrivalvis* (Grader Grass) between the Rail Link and the East Hills train line should be slashed regularly to prevent seeding events (Figure 4 and Figure 9). This will reduce the colonisation of these grasses into revegetation areas. However, slashing should only occur when plants are not seeding to prevent further spread. Furthermore, as more native species become established in these areas, slashing may impact their growth; therefore, non-targeted slashing should be avoided.
- Continue to collect litter from within the Rail Link and in adjacent areas.
- Soft batters within the trunk drainage system and retention basin/swale at the north-eastern extent of the facility should be inspected for weed growth. Weed levels should be controlled through herbicide application, slashing and hand weeding. Weed remediation works should be conducted in accordance with the approved Weed Management Plan.

Application of herbicide within the Rail Link and in areas adjacent to the Moorebank biobank site should be conducted to prevent overspray (off-target poisoning). If herbicide application occurs, recommended herbicides for tussock grass, such as *Chloris gayana* (Rhodes Grass) and *Eragrostis curvula* (African Lovegrass), include glyphosate or flupropanate, while plants are actively growing during summer and spring. Native vegetation outside the Rail Link fence must not be impacted by herbicide during weed remediation works.

No herbicide spraying should be conducted outside the Rail Link corridor, specifically adjacent to ecologically sensitive areas south of the MPE Operational facility (Figure 3). Manual weed remediation works in ecologically sensitive areas should not extend beyond the construction envelope of the RALP project. If further clarification is necessary, the project ecologist should be consulted.

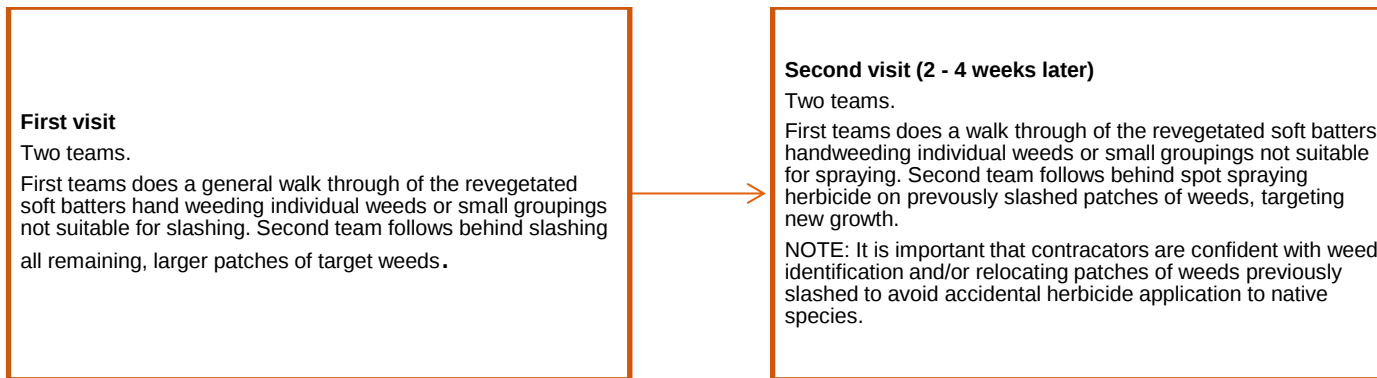


Figure 10. Suggested process to controlling target weeds on revegetated soft batters

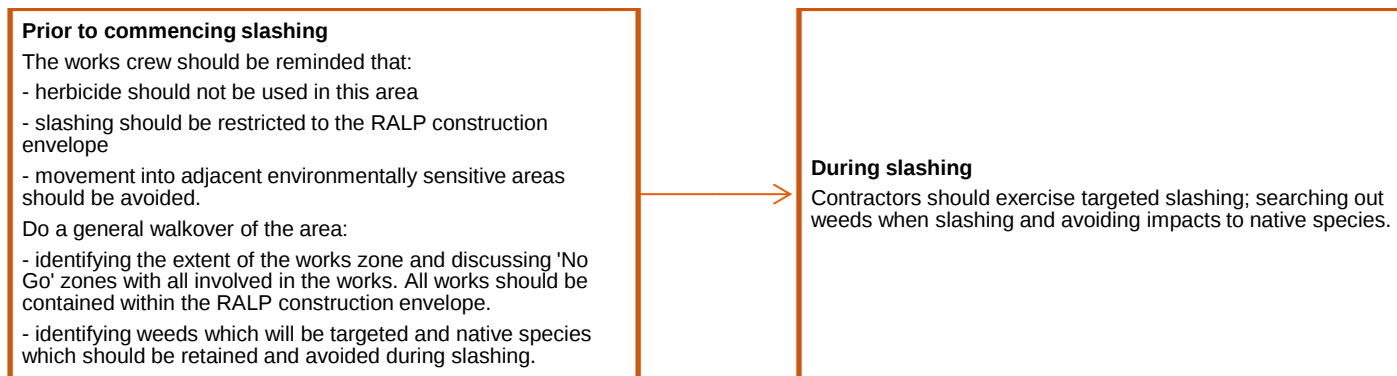


Figure 11. Slashing target weeds within the RALP construction envelope adjacent to ecologically sensitive areas

References

Arcadis (2019a) Urban Design and Landscape Plan. Moorebank Precinct East Stage 1

Arcadis (2019b) Operational Flora and Fauna Management Plan. Moorebank Logistics Park – East Precinct

Arcadis (2019c) Landscape Vegetation Management Sub Plan. Moorebank Precinct East Stage 2

Arcadis (2020) MPE Operational – Weed Monitoring Report December 2020

Arcadis (2020) Urban Design and Landscape Plan. Moorebank Precinct East Stage 2

Bureau of Meteorology (BOM) (2021) Climate Data Online. Weather and Climate: Holsworthy Aerodrome NSW (station 066161) <http://www.bom.gov.au/climate/dwo/IDCJDW2161.latest.shtml>

NSW Department of Primary Industries (DPI) (accessed 2021) NSW WeedWise. priority weeds for the Greater Sydney. <https://weeds.dpi.nsw.gov.au/WeedBiosecurities?AreaId=3>

APPENDIX A. RECOMMENDED ACTIONS CATALOGUE

Month of logging	Recommended action	Status (Not started, Commenced, Complete)	Comments
April 2020	Eradicate priority weeds species, including Bridal Creeper, Alligator Weed, Lantana, Fireweed and African Olive	Commenced	Lantana, African Olive, Fireweed and Bridal Creeper remain within the Rail Link. These weed species should be prioritised for removal.
April 2020	Remove key and aggressive weed species within Rail Link, including Golden Wreath Wattle, Moth Vine, Castor Oil Plant, Small-leafed Privet, Grader Grass and Balloon Vine	Commenced	Grader Grass has been observed colonising remediated areas within the Rail Link. This species should be removed to prevent further colonisation and infestations. Golden Wreath Wattle, Moth Vine and Castor Oil Plant on the southern side of the Rail Link in the area between the operational boundary and the East Hills line rail corridor. Consideration should be given to the management of these areas to reduce encroachment into recently remediated areas.
June 2020	Planning should commence to revegetate soft batters and un-developed areas within the MPE operational facility with native species in accordance with the approved Urban Design and Landscaping Plan (Arcadis 2019a, Arcadis 2020)	Commenced	Revegetation has commenced for remediated areas using a hydro-mulch containing a seed palette commensurate with the UDLP (Arcadis 2020). Additional striking of native seed was observed during the February 2022 monitoring inspection within the Rail Link. The following native species were observed growing Hickory Wattle, Indigofera, Windmill Grass, Queensland Bluegrass, Couch Grass, Kangaroo Grass, Kidney Weed, Barbed Wire Grass, Blown Grass, and Creeping Saltbush.

Month of logging	Recommended action	Status (Not started, Commenced, Complete)	Comments
December 2020	Exotic species, specifically <i>Medicago polymorpha</i> (Burr medic), should be removed from grassland on either side of the Rail Link at its eastern extent, closest to the operational area.	Commenced	Targeted manual removal, including slashing, has been conducted for exotic species outside the Rail Link corridor fencing. A qualified bush regeneration contractor should be used to avoid impacts on native species. Strictly no herbicide should be used in this area, and works should not extend beyond the RALP construction envelope. Where possible, contractors should not access/pass through adjacent areas.
December 2021	Collect litter scattered through the Rail Link corridor and in adjacent areas	Commenced	Litter remains in the Rail Link corridor and adjacent areas.
December 2021	Control aggressive weed species Coolatai Grass and Paterson's Curse within the Rail Link	Commenced	New instances of aggressive weed species Coolatai Grass and Paterson's Curse within the Rail Link should be removed as soon as practicable to avoid the spread of these species into ecologically sensitive areas adjacent to the Rail Link.
February 2022	Continued targeted slashing of woody and herbaceous weeds within the Rail Link.	Commenced	Continue regular slashing of large woody weeds to remove the fertile seed head and discourage further germination of these weeds within the Rail Link.
December 2022	Prioritise weed remediation works for priority and key weed species which have experienced accelerated growth in recent months.	Commenced	Areas of particularly high biomass of priority and key weed species should be prioritised for weed remediation works in coming months to avoid mass seeding events.
	Begin remediation of soft batters which have slipped following extreme rainfall events in recent weeks	Not started	Areas within the operational facility, including a number of areas within the Rail Link, require urgent batter remediation in areas of batter slipping.

Month of logging	Recommended action	Status (Not started, Commenced, Complete)	Comments
December 2022	Begin weed remediation of gravel and ballast areas along Rail link	Commenced	Removal of all vegetation in gravel and ballast areas due along Rail Link corridor using slashing and herbicide due to safety concerns of train operators and prevent spread of weeds.
December 2022	Continue weed remediation works along the soft batters within the Rail Link corridor.	Commenced	Future weed remediation works should include targeted slashing and spraying of priority and key weed species, whilst avoiding native species by hand weeding within a one metre buffer zone of native individuals.
February 2023	Continue weed remediation works along the soft batters within the Rail Link corridor beyond Georges River bridge.	Commenced	Future weed remediation works should include targeted slashing and spraying of priority and key weed species, whilst avoiding native species by hand weeding within a one metre buffer zone of native individuals.
April 2023	No weed remediation has occurred since February 2023. Expected to recommence in June 2023, in same areas that have previously been remediated.	Commenced	Future weed remediation works should include targeted slashing and spraying of priority and key weed species, whilst avoiding native species by hand weeding within a one metre buffer zone of native individuals.
June 2023	Continue weed remediation works along the soft batters within the Rail Link corridor	Commenced	Future weed remediation works should include targeted slashing and spraying of priority and key weed species, whilst avoiding native species by hand weeding within a one metre buffer zone of native individuals.
December 2023	Toolijooa Environmental Restoration inducted as primary weed control contractors. Weed remediation recommenced throughout the Rail Link corridor	Commenced	Future weed remediation works should include targeted slashing and spraying of priority and key weed species, whilst avoiding native species by hand weeding within a one metre buffer zone of native individuals.

APPENDIX B. REMEDIATION PROGRESS PHOTOGRAPHS



April 2021



December 2023



Feb 2025



April 2021



December 2023



Feb 2025



April 2021



December 2023



Feb 2025



April 2021



December 2023



Feb 2025



April 2021



December 2023



Feb 2025



April 2021



December 2023



N/A

Feb 2025



April 2021

Photo point not yet established



December 2023

Photo point not yet established



Feb 2025



Feb 2025 (no change)

APPENDIX C. PROFILES: PRIORITY WEEDS



Lantana



Fireweed



Alligator Weed



African Olive



Bridal Creeper



Peruvian Primrose

APPENDIX D. PROFILES: KEY WEEDS



Rhodes Grass



African Love Grass



Patterson's Curse



Coolatai Grass



Grader Grass



Red Natal Grass

APPENDIX E. PLANT SPECIES INVENTORY

Scientific name	Common name	Exotic	Priority/key weed
<i>Acacia falcata</i>	Hickory Wattle		
<i>Acacia parramattensis</i>	Parramatta Wattle		
<i>Acacia saligna</i>	Golden Wreath Wattle	*	
<i>Alternanthera philoxeroides</i>	Alligator weed	*	Priority
<i>Alternanthera pungens</i>	Khaki Weed	*	
<i>Araujia sericifera</i>	Moth Vine	*	
<i>Asparagus asparagoides</i>	Bridal Creeper	*	Priority
<i>Atriplex semibaccata</i>	Creeping Saltbush		
<i>Austrodanthonia spp.</i>	-		
<i>Avena spp.</i>	Oats	*	
<i>Bidens pilosa</i>	Cobbler's Pegs	*	
<i>Brassica rapa</i>	Field Mustard	*	
<i>Briza maxima</i>	Quaking Grass	*	
<i>Briza minor</i>	Shivery Grass	*	
<i>Cenchrus clandestinus</i>	Kikuyu Grass	*	
<i>Centaureum spp.</i>	-	*	
<i>Chloris gayana</i>	Rhodes Grass	*	Key
<i>Chloris truncata</i>	Windmill Grass		
<i>Cirsium vulgare</i>	Spear Thistle	*	
<i>Convolvulus erubescens</i>	Pink Bindweed		
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	*	
<i>Cyclospermum leptophyllum</i>	Slender Celery	*	
<i>Cynodon dactylon</i>	Common Couch		
<i>Cymbopogon refractus</i>	Barbed Wire Grass		
<i>Cyperus eragrostis</i>	Umbrella Sedge	*	
<i>Daviesia ulicifolia</i>	Gorse Bitter Pea		
<i>Dichanthium sericeum</i>	Queensland Bluegrass		
<i>Dichondra repens</i>	Kidney Weed		
<i>Echium plantagineum</i>	Paterson's Curse	*	Key
<i>Eragrostis brownii</i>	Brown's Lovegrass		
<i>Eragrostis curvula</i>	African Lovegrass	*	Key
<i>Euchiton spp.</i>	-		
<i>Ficinia nodosa</i>	Knobby Club-rush		
<i>Foeniculum vulgare</i>	Fennel	*	
<i>Glycine clandestina</i>	-		

Scientific name	Common name	Exotic	Priority/key weed
<i>Hardenbergia violacea</i>	False Sarsaparilla		
<i>Hypochoeris radicata</i>	Catsear	*	
<i>Indigofera australis</i>	Australian Indigo		
<i>Juncus usitatus</i>	-		
<i>Lantana camara</i>	Lantana	*	Priority
<i>Lachnagrostis filiformis</i>	Blown Grass		
<i>Lactuca serriola</i>	Prickly Lettuce	*	
<i>Linum trigynum</i>	French Flax	*	
<i>Lolium perenne</i>	Perennial Ryegrass	*	
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		
<i>Lysimachia arvensis</i>	Scarlet Pimpernel	*	
<i>Ludwigia peruviana</i>	Peruvian water primrose	*	Priority
<i>Medicago polymorpha</i>	Burr Medic	*	
<i>Melilotus alba</i>	Bokhara	*	
<i>Melinis repens</i>	Red Natal Grass	*	Key
<i>Modiola caroliniana</i>	Red-flowered Mallow	*	
<i>Olea europaea subsp. cuspidate</i>	African Olive	*	Priority
<i>Paspalum dilatatum</i>	Paspalum	*	
<i>Persicaria decipiens</i>	Slender Knotweed		
<i>Phytolacca octandra</i>	Inkweed	*	
<i>Plantago lanceolata</i>	Lamb's Tongues	*	
<i>Portulaca oleracea</i>	Common Purslane		
<i>Rumex crispus</i>	Curled Dock	*	
<i>Senecio madagascariensis</i>	Fireweed	*	Priority
<i>Setaria parviflora</i>	-	*	
<i>Sida rhombifolia</i>	Paddy's Lucerne	*	Key
<i>Solanum nigrum</i>	Black-berry Nightshade	*	
<i>Solanum sisymbriifolium</i>		*	
<i>Sonchus oleraceus</i>	Common Sowthistle	*	
<i>Tagetes minuta</i>	Stinking Roger	*	
<i>Themeda quadrivalvis</i>	Grader Grass	*	Key
<i>Themeda triandra</i>	-		
<i>Trifolium arvense</i>	Haresfoot Clover	*	
<i>Trifolium repens</i>	White Clover	*	
<i>Trifolium michelianum</i>	Bolansa Clover	*	
<i>Verbena bonariensis</i>	Purpletop	*	

Scientific name	Common name	Exotic	Priority/key weed
<i>Verbena rigida</i> var. <i>Rigida</i>	Veined Verbena	*	

Date 7/05/2025
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Subject MPE operational facility – Weed monitoring report May 2025

Introduction

Arcadis has been commissioned to conduct bi-monthly weed monitoring surveys within Moorebank Precinct East (MPE) operational facility at Moorebank Intermodal Precinct. The MPE operational facility includes the following:

- Import and Export Terminal (IMEX)
- Rail Access Land Package (RALP)
- Warehouses, distribution facilities and freight village
- Stormwater trunk drainage infrastructure and landscaping areas

Regular monitoring of the MPE operational facility will inform the land manager of weed cover and the presence of any weeds listed as 'priority' for the Greater Sydney Local Land Services region under the *Biosecurity Act 2015*.

Background

Arcadis has been monitoring the MPE operational facility for weed occurrence since April 2020. High levels of weed cover within the Rail Link have been observed across most of the monitoring period, except for during weed monitoring events immediately following remediation works. Routine weed remediation works have commenced as of December 2022 along the rail link corridor, with future remediation works planned continuously planned when relevant.

The RALP, which includes the MPE operational Rail Link, has seen significant change and works over the time Arcadis has conducted weed monitoring. The soft batters on either side of the Rail Link have had varying levels of exotic cover. Additionally, works conducted in the Moorebank Precinct West (MPW) in 2023/24 have changed the layout and vegetation spread in the RALP. Several weed remediation events have occurred since the inception of weed monitoring, detailed below in Table 1.

Table 1 Summary of weed events throughout monitoring history

Timing	Summary of events	Weed contractor
Spring 2020	• Weeds removed from batters and revegetated with native species, as per the Urban Design and Landscaping Plan (UDLP) for MPE • Cumberland Plain Seeds were procured to provide technical oversight of revegetation effort	Spray Grass Solutions
December 2021	• As per recommendations from Spray Grass Solutions and Cumberland Plain Seeds, the	

Timing	Summary of events	Weed contractor
	monitoring methodology was changed Changes included reporting on cover on 'priority' weeds species and key weeds specific to the project.	
December 2022 to June 2023	- Weed remediation works commenced - Priority weed species were targeted - Native species were identified throughout the RALP to avoid accidental removal.	P&E Services
December 2023 to present	- Weed remediation works continued - Regular maintenance of priority weed species via slashing, hand removal and herbicide spraying	Toolijooa Environmental Restoration

Methodology

Arcadis ecologist Kate Mauger attended the MPE operational facility on 7 May 2025. Monitoring involved traversing the MPE operational facility on foot, surveying landscaped areas, stormwater infrastructure and soft batters adjoining the Rail Link. The areas surveyed are presented in Figure 1.

The weather on the 7 May was sunny, with a maximum temperature of 27°C, and the weather recorded at Holsworthy Aerodrome (station 066161) (BOM 2024).

IMEX, warehouses and drainage infrastructure

In soft landscaped areas surrounding the IMEX, warehouses, freight village and within drainage infrastructure, the following activities were conducted:

- Identifying and mapping the occurrence of weeds listed as priority
- Mapping and estimating the per cent foliage cover of exotic species
- Mapping and estimating the per cent foliage cover of priority weeds
- Recording and mapping the extent of weed remediation works

The cover of exotic species and priority weeds were estimated based on the area of cover within a patch and categorised as per Table 2.

Table 2. Categories to describe percent cover of weeds

Categories	Percentage cover of weeds within a patch (%)
Low	5 – 25

Categories	Percentage cover of weeds within a patch (%)
Moderate	25 – 75
High	75 – 100

The location of weed infestations, priority weed species and observed weed remediation works were recorded on an Arc-GIS enabled iPad.

Rail Link

Following the meeting held in December 2021 regarding revegetating the Rail Link, the monitoring methodology for weeds within the Rail Link has been refined to focus on key and priority weed species rather than all exotic species.

Priority weed species are any exotic species listed under the *Biosecurity Act 2015* for the Greater Sydney Local Land Services Area, and key weed species have been identified as site-specific exotic plants with the potential to have detrimental outcomes for the recruitment of native seedlings or impacts on adjacent ecologically sensitive areas. A list of priority and key weed species known from the Rail Link is included in Table 3.

Table 3 Priority and key weed species subject to control within the Rail Link

Priority weed species	Key weed species
<i>Alternanthera philoxeroides</i> (Alligator weed)	<i>Chloris gayana</i> (Rhodes Grass)
<i>Asparagus asparagoides</i> (Bridal Creeper)	<i>Echium plantagineum</i> (Paterson's Curse)
<i>Lantana camara</i> (Lantana)	<i>Eragrostis curvula</i> (African Lovegrass)
<i>Ludwigia peruviana</i> (Ludwigia)	<i>Hyparrhenia hirta</i> (Coolatai Grass)
<i>Olea europaea</i> subsp. <i>cuspidata</i> (African Olive)	<i>Themeda quadrivalvis</i> (Grader Grass)
<i>Senecio madagascariensis</i> (Fireweed)	

Moorebank Precinct West (MPW)

One area on Bushmasters Drive, adjacent to the security office at MPW underwent weed removals as part of the works package at MPW, on the 30 October 2024. One Arcadis ecologist attend to supervise Toolijooa removing weeds adjacent to the BioBank site.

Additional monitoring was conducted along Bushmasters Drive in April 2024, to monitor the condition of the landscaped vegetation along the road.

Study Limitations

The data presented within this report is restricted to what was observed and recorded by the attending Arcadis ecologists during the site assessment on 7 May 2025.

Monitoring of weeds was restricted to the operational facility; weeds were not assessed within the bounds of the active construction areas surrounding new warehouses.

Surveys were not undertaken in areas extending beyond the junction between the QUBE Rail Link and the Southern Sydney Freight Line (SSFL).

Results

Observations made by the attending ecologists during the May 2025 weed monitoring survey are summarised below.

IMEX, warehouses and drainage infrastructure

Weed cover is generally low in soft landscaped areas surrounding the IMEX. A greater cover of weedy species are present along the batters of drainage infrastructure along the western boundary of the precinct and in the north-eastern corner around the basins. Further sapling and stands of *Acacia falcata* (Hickory Wattle) continue to grow unimpeded by weeds.

Although some weeds are present around the warehouse areas, they are not causing infestations or inhibiting the growth of native species. Large areas of the native *Cynodon dactylon* (Couch Grass) is present across most of these areas and is generally outcompeting weed species.

Occurrences of weeds in the warehouse area and associated drainage infrastructure is restricted to scattered individuals of *Senecio madagascariensis* (Fireweed), *Plantago lanceolata* (Plantain), *Trifolium arvense* (Clover) and exotic grasses like *Chloris gayana* (Rhodes Grass), *Sporobolus africanus* (Parramatta Grass), *Paspalum urvillei* (Giant Paspalum) and *Ehrharta erect* (Panic Veldtgrass).

The drainage lines and lower lying areas of the basins are showing strong resilience to weed infiltration. Native species dominate these areas and have a high cover and density. Some sections of the drainage channel and basins are dominated by *Bulboschoenus fluviatilis* (Marsh club-rush) whilst other are dominated by *Typha orientalis* (Bulrush). Where space is present between stands of these native emergent species small clumps of *Persicaria decipiens* (Slender Knotweed), *Daviesia ulicifolia*, *Ficinia nodosa* (Knotted Club-rush), *Carex tereticaulis* and *Juncus usitatus* are present. Other native species such as *Imperata cylindrica* and *Lomandra longifolia* were observed in the drainage channels.

Photos for each area discussed above and illustrated in Table 4.

From the May 2025 inspection, some areas have been claimed for the Moorebank Avenue realignment project.

Table 4 Photos for each monitoring area of MPE

Area of MPE	Photo
IMEX building and adjacent drainage infrastructure	 <i>Plate 1 IMEX building drainage infrastructure (May 2025)</i>
Warehouse areas	 <i>Plate 2 Areas around the warehouses that have been claimed for the Moorebank Avenue realignment.</i>

Area of MPE	Photo
Eastern boundary drainage infrastructure	 Plate 3 Erosion from persistent rain events evident in areas with limited vegetation cover. Areas of erosion unable to be accessed.

Rail Access Land Package (RALP)

During the May 2025 weed monitoring survey, bush regenerators from Toolijooa Environmental Restoration (Toolijooa) were conducting weed control works within the RALP.

Some instances of *Themeda quadrivalvis* (Grader Grass) were removed during this inspection. Additionally, areas in the southern section of the Rail Link, in areas that have previously experienced significant batter erosion, are being colonised intensely by *Tagetes minuta* (Stinking Roger). This was also observed by Arcadis in areas below the rail bridge, in a separate monitoring scope.

Native species were observed to be growing well. Mature tussocks of native grass species, which have been avoided during slashing works, were observed with spent seed heads. With additional support from bush regenerators, it is anticipated that the fallen seed will germinate and establish and in turn the cover of native grasses will increase.

The status of weeds and weed remediation works observed during the May 2025 monitoring survey has been compared against a series of recommended actions developed during the baseline monitoring survey (Table 5). Overall, the status of weed management works by Toolijooa is performing well against these criteria.

Table 5 Weed remediation works tracking

Priority	Action	Action description	Current performance assessment
1	Eradicate 'priority' weeds	Target 'priority' weed species through manual removal and herbicide treatment. Herbicide application should consider timing (i.e., applying herbicide when weeds are actively growing) and best practice methodologies. Areas outlined by coloured polygons in Figure 3 - Figure 10 should be prioritised.	One priority weed species are present within the Rail Link: <i>Senecio madagascariensis</i> (Fireweed). These should be removed as a priority. Progress has been made through remediation works within the Rail link corridor. Continued management must be undertaken to work towards eradication.
2	Removal of key and aggressive weed species	Key weed species, including African Lovegrass, Rhodes Grass, Paterson's Curse, Coolatai Grass and Grader Grass, should be removed from revegetated areas of soft batter. Aggressive weed species, including Moth Vine and Castor Oil Plant, should be removed from all operational areas using a combination of manual and herbicide control. Areas outlined by coloured polygons in Figure 3 - Figure 10 should be prioritised.	Key weed species, including Rhodes Grass, African Lovegrass, Coolatai Grass, Paterson's Curse, and Grader Grass, are colonising soft batters in the Rail Link. These weeds should be removed. Progress has been made through remediation works within the Rail Link Corridor. Continued management must be undertaken to work towards eradication.
3	Suppress further colonisation of environmental weeds and encroachment into areas of bushland	Control of exotic species adjacent to the biobank site and ecologically sensitive areas. Manual removal should be adopted in areas adjacent to threatened flora locations. Areas outlined by coloured polygons in Figure 3 - Figure 10 should be prioritised.	Weed growth is stabilising through continued weed management on soft batters adjacent to the biobank site and ecologically sensitive areas. Manual removal, including routine slashing, is being used to prevent present weeds from reaching seeding maturity and further encroaching on adjacent high-value areas (biobank site and ecologically sensitive areas containing threatened plant species). All works should be restricted to the operational area and not extend into the biobank site or identified ecologically sensitive areas. Slashing should only be conducted when weed species are not in flower to prevent further spread. Appropriate slashing time is during winter for most species.

Priority	Action	Action description	Current performance assessment
4	Slashing of invasive grasses to prevent seeding.	Management of invasive grasses such as Rhodes Grass and African Love Grass through regular mowing or slashing. Areas outlined by coloured polygons in Figure 3 - Figure 10 should be prioritised.	Slashing has been adopted to manage the regrowth of invasive grasses (African Lovegrass, Grader Grass) within the Rail Link in ballast and gravel areas. Some areas beyond the Georges River bridge are yet to be managed. Slashing should be used to manage large expanses of exotic grassland to prevent seeding events. However, as native grasses become established, extreme care must be taken, and indiscriminate slashing must be avoided. A contractor with knowledge of native species should be employed to carry out this task, in failing that, an ecologist should be on site to monitor weed remediation.
5	Reduce cover of weeds within the Rail Link	Reduction of weed cover by applying control methods commensurate with the Operational Flora and Fauna Management Plan (Arcadis 2019).	Works should involve targeted slashing of mature plants and removing flowering and seed heads to minimise seeding. Targeted slashing has been previously employed to control weed colonisation on soft batters. However, it must be continued to limit the re-colonisation of weeds within the Rail Link. Future weed control actions will focus on removing and reducing the cover of priority and key weed species and suppressing the further colonisation of common weeds, which is consistent with the rehabilitation methodology proposed by Spray Grass Solutions and Cumberland Plain Seeds.
6	Remove herbaceous and woody weeds within the operational area and trunk drainage infrastructure.	Reduction in herbaceous and woody weeds by applying control methods commensurate with the Operational Flora and Fauna Management Plan (Arcadis 2019)	Weed cover has generally remained low within trunk drainage infrastructure and at the north-eastern extent of the MIP East operational facility.

MPW weed works

Attending ecologist at the weed supervision on 30 October 2024 supervised the removal of minor occurrences of weed along the boundary of the MPW operational area and the BioBank site.

Weed monitoring conducted in April 2025 concluded that the landscaped areas along Bushmasters Avenue are in good condition, with minor weed incursions of *Sonchus oleraceus* (Common Sowthistle), *Chloris virgata* (Rhodes Grass), *Bidens pilosa*, *Conyza bonariensis* (Fleabane), *Cyclospermum leptophyllum* (Slender Celery), and *Tagetes minuta* (Stinking Roger). Whilst the current levels of these weeds are low, if continued maintenance of these landscaped areas is not frequent enough their coverage could increase. This is pertinent for areas where landscaped species have died back, and bare ground is more abundant (Plate 4).



Plate 4 Areas of bare ground along Bushmasters Avenue which could be colonised by weed species

Erosion

Geo-mesh fabric and boulders used to remediate erosion prone areas around the IMEX and drainage infrastructure were observed to be in good condition and serving their purpose of stabilisation during the Feb 2025 surveys.

Batter slumping is still present within drainage infrastructure in the warehouse area. Although some outlets have been stabilised with large boulders, the erosion is still present and will continue to erode during heavy rainfall events (Plate 3).

Previous areas of batter slumping within the RALP have accumulated more vegetation and the risk of further deterioration has been reduced. However the vegetation is mostly exotic species (Plate 5). Targeted stabilising of these areas with native vegetation is recommended once construction in the rail corridor is completed.



Plate 5 Batters adjacent to MPW that have been colonised by exotic species, such as Fleabane, in the absence of native vegetation

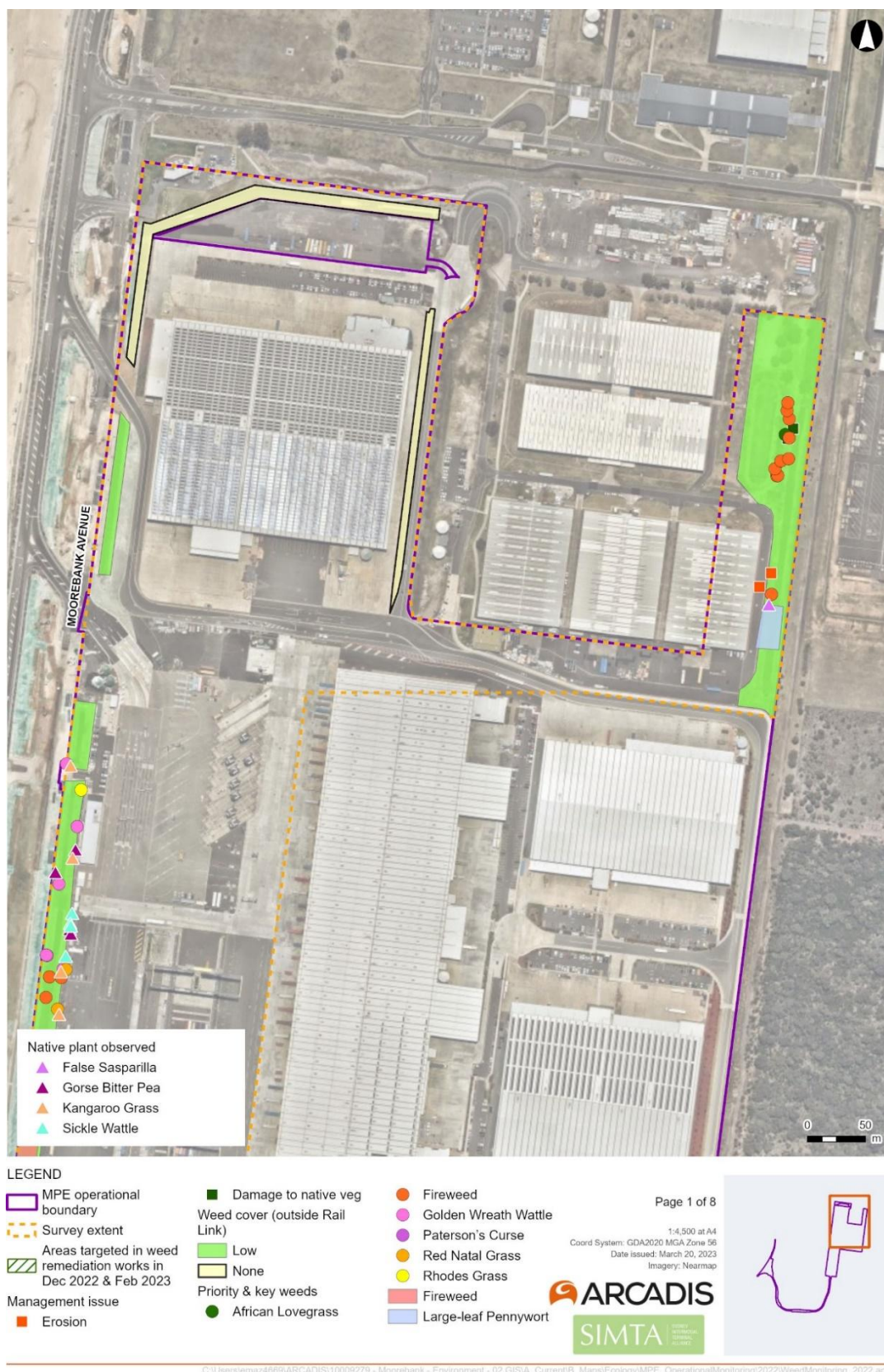


Figure 2 Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 1 of 8).

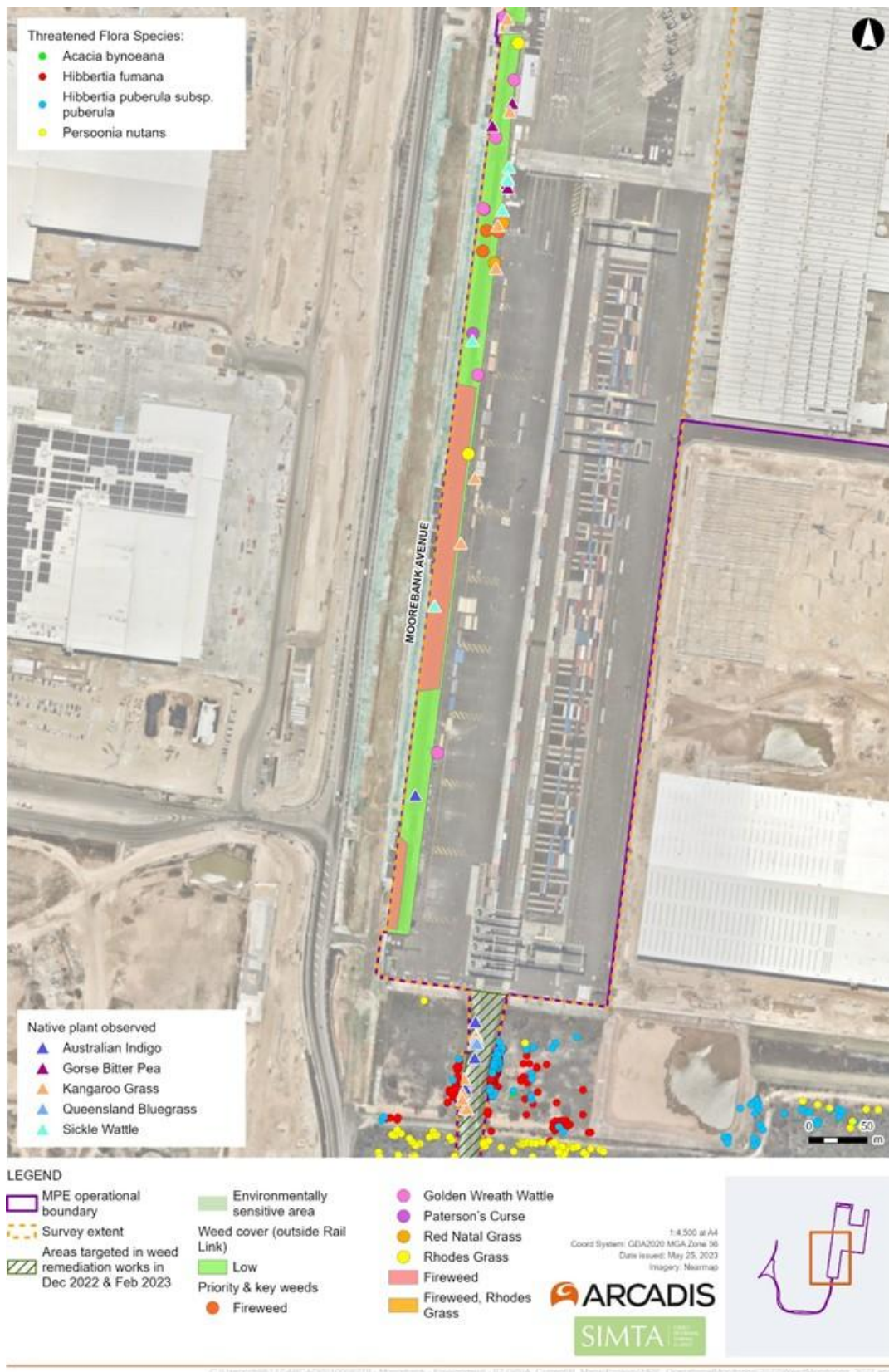


Figure 3 Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 2 of 8)

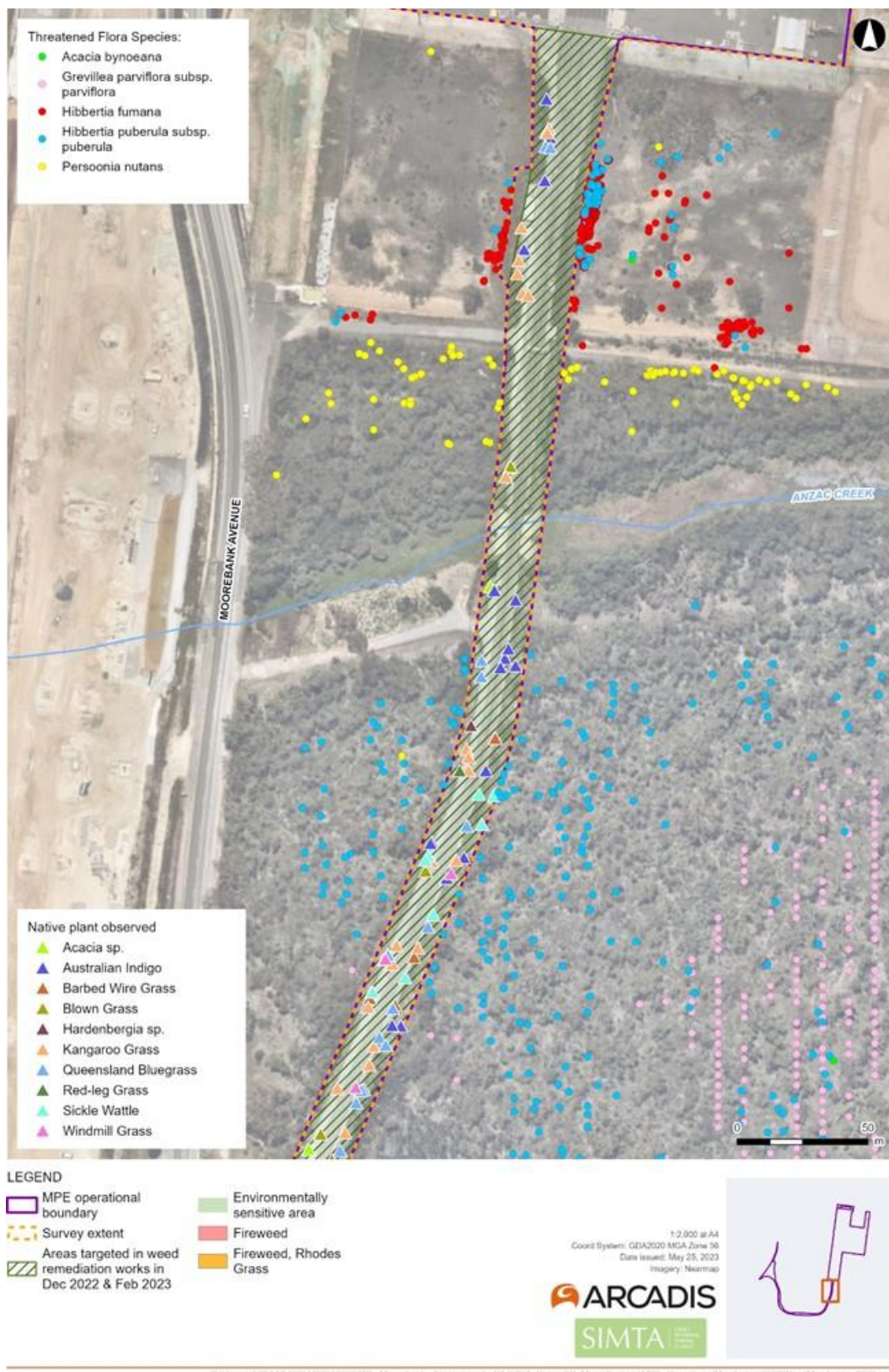


Figure 4 Native species, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 3 of 8)

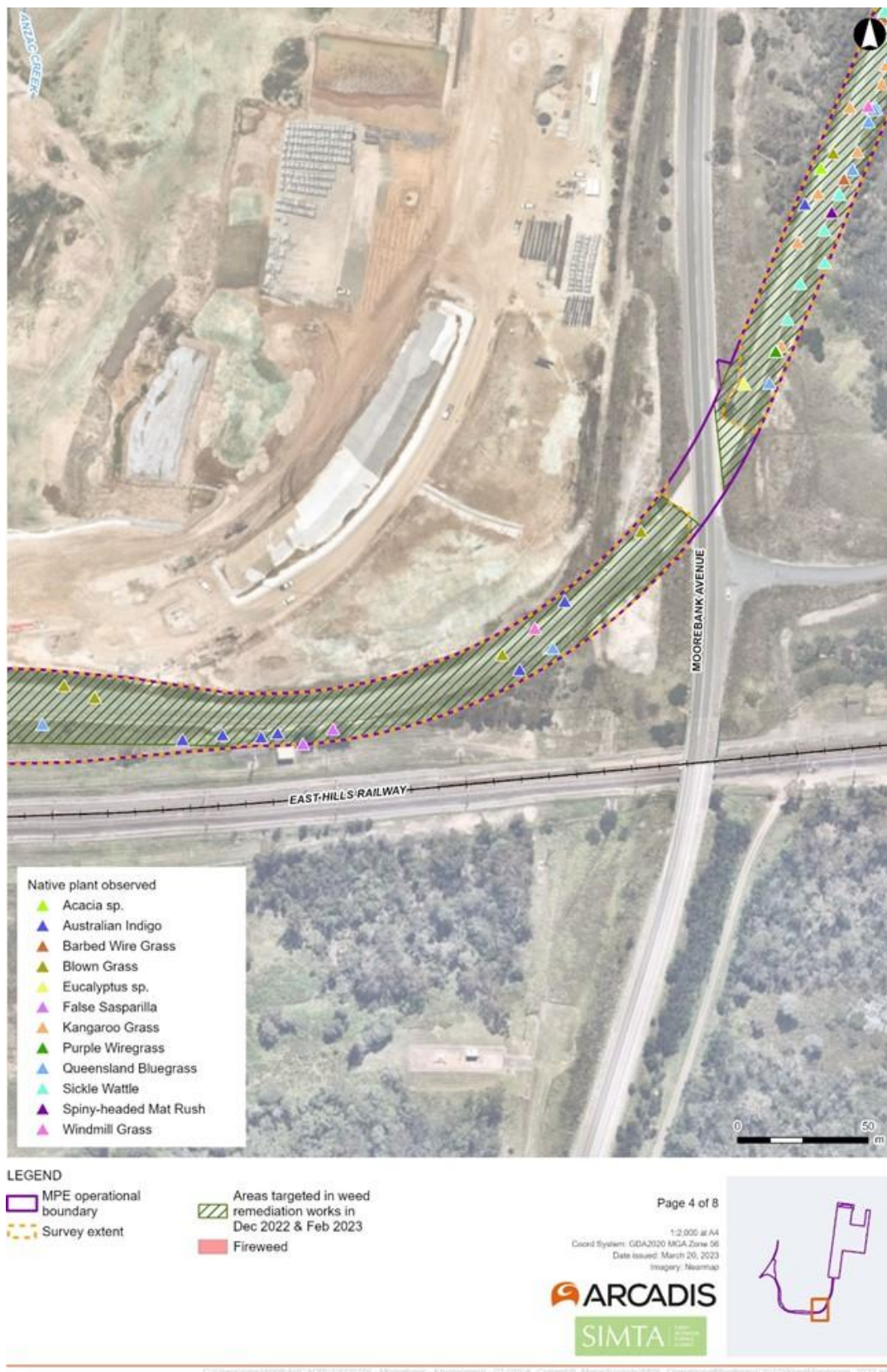




Figure 6. Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 5 of 8)

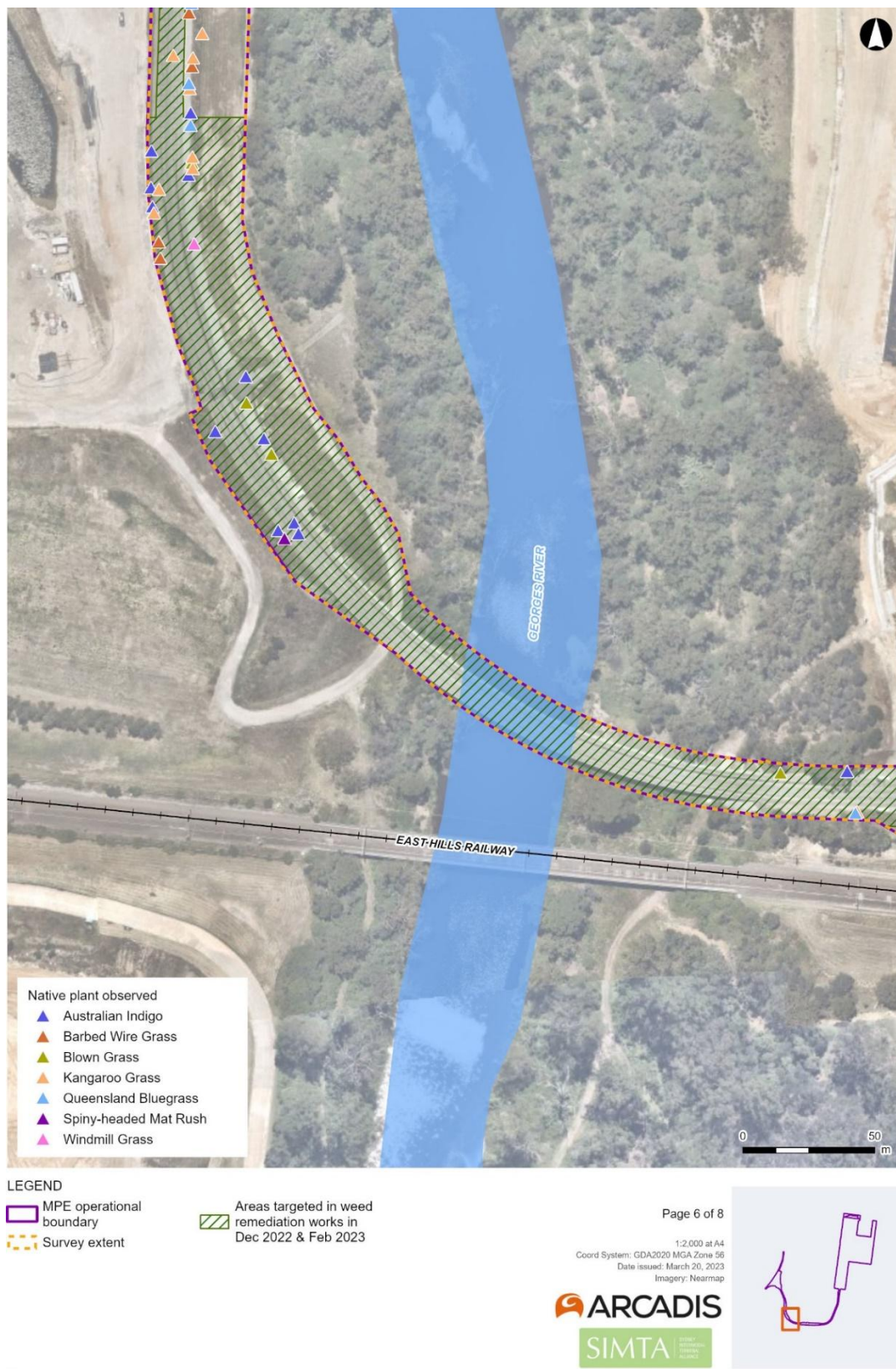


Figure 7. Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 6 of 8)

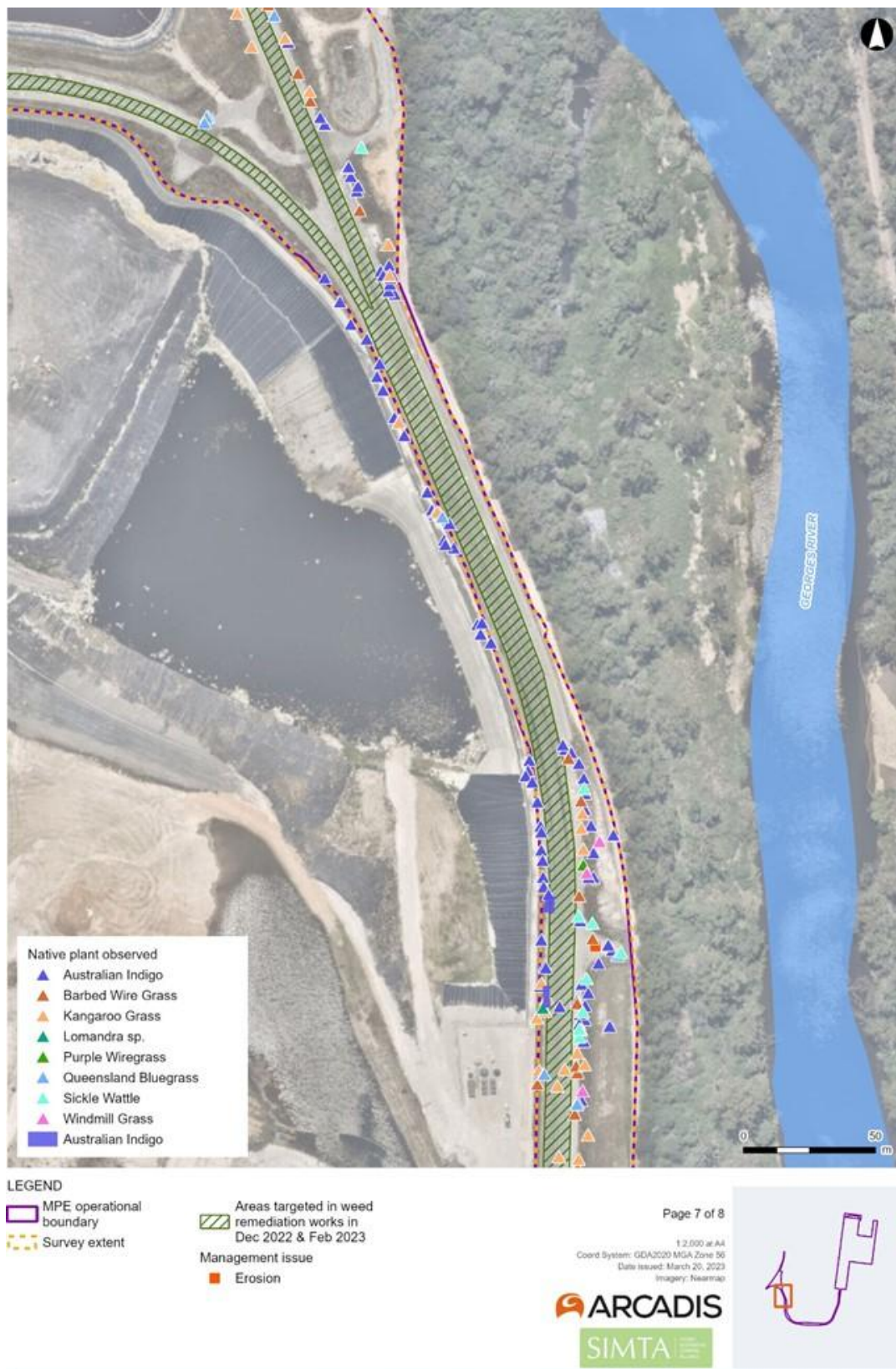


Figure 8. Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 7 of 8)

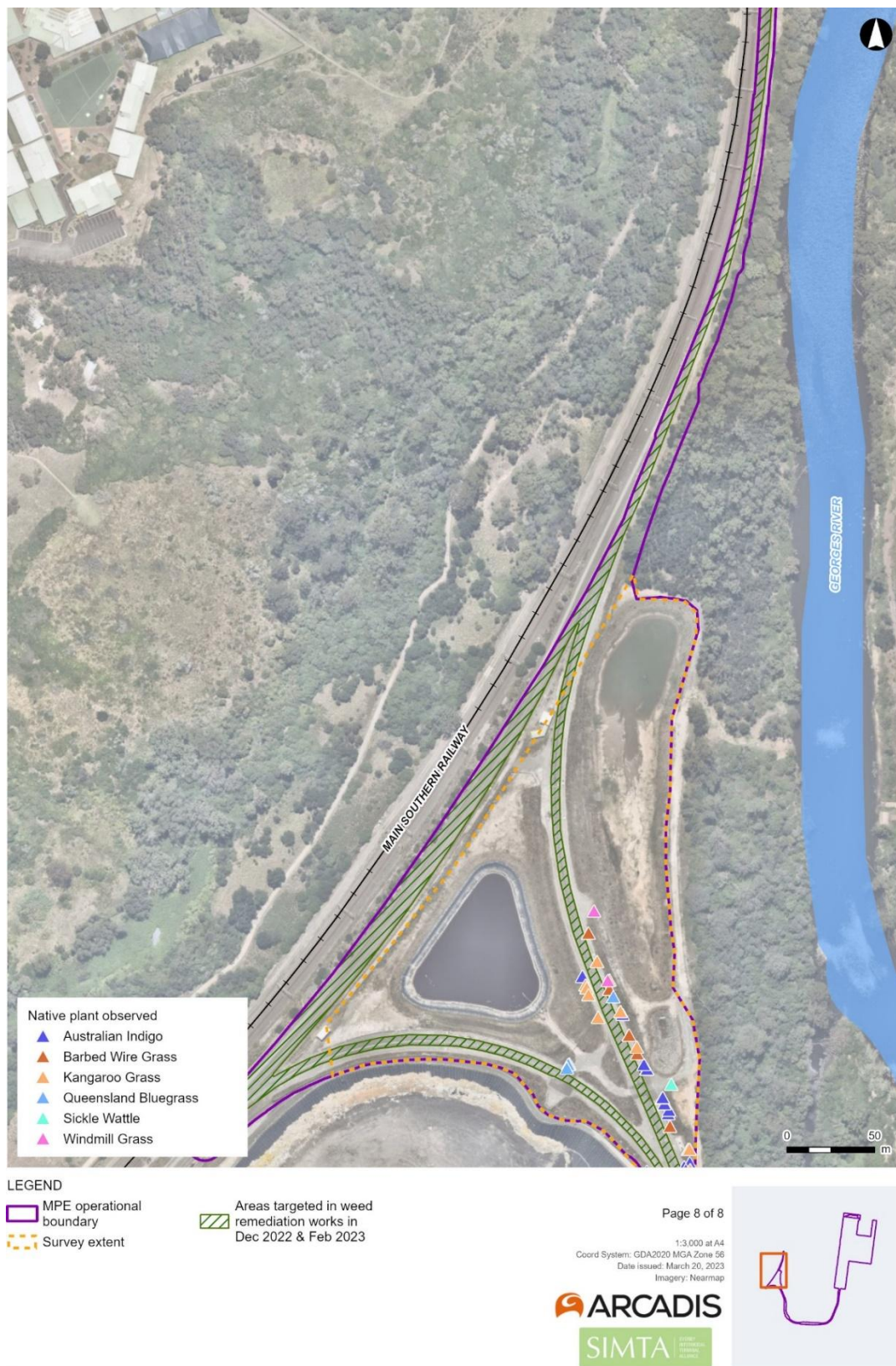


Figure 9. Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 8 of 8)

Recommendations

Recommended actions documented in previous weed monitoring reports are included in *Appendix A: Recommended Actions Catalogue*. The catalogue has been reviewed and updated to reflect works which have been completed and is considerate of the revegetation methodology proposed by Spray Grass Solutions and Cumberland Plain Seeds.

The majority of weed remediation and management action recommendations documented in the previous weed monitoring report are still applicable to the management of the site. These include:

- Targeted weed remediation to continue in 2025 and is to be conducted using the same methods and at the same locations as previously conducted.
- Targeted weed remediation works to continue along revegetated soft batters. Weed remediation works will focus on controlling priority and key weed species. Hand weeding should be conducted for individuals, whereas slashing and herbicide spraying should be adopted to target larger patches of weeds. However, extreme care must be taken when conducting any weed management along the rail corridor, as many native grasses have become established. A suggested process to target weeds along revegetated soft batters is presented in the methodology section of this report and Figure 11. Hand weeding is only feasible on annual species such as *Themeda quadrivalvis* (Grader Grass) and *Senecio madagascariensis* (Fireweed) due to their relatively small root system.
- Priority and aggressive weed species outside revegetated Rail Link areas should be removed. Weeds that should be targeted include *Senecio madagascariensis* (Fireweed).
- Large patches of *Eragrostis curvula* (African Lovegrass), *Chloris gayana* (Rhodes Grass) and *Themeda quadrivalvis* (Grader Grass) between the Rail Link and the East Hills train line should be slashed regularly to prevent seeding events (Figure 4 and Figure 9). This will reduce the colonisation of these grasses into revegetation areas. However, slashing should only occur when plants are not seeding to prevent further spread. Furthermore, as more native species become established in these areas, slashing may impact their growth; therefore, non-targeted slashing should be avoided.
- Continue to collect litter from within the Rail Link and in adjacent areas.
- Soft batters within the trunk drainage system and retention basin/swale at the north-eastern extent of the facility should be inspected for weed growth. Weed levels should be controlled through herbicide application, slashing and hand weeding. Weed remediation works should be conducted in accordance with the approved Weed Management Plan.

Application of herbicide within the Rail Link and in areas adjacent to the Moorebank biobank site should be conducted to prevent overspray (off-target poisoning). If herbicide application occurs, recommended herbicides for tussock grass, such as *Chloris gayana* (Rhodes Grass) and *Eragrostis curvula* (African Lovegrass), include glyphosate or flupropanate, while plants are actively growing during summer and spring. Native vegetation outside the Rail Link fence must not be impacted by herbicide during weed remediation works.

No herbicide spraying should be conducted outside the Rail Link corridor, specifically adjacent to ecologically sensitive areas south of the MPE Operational facility (Figure 3). Manual weed remediation works in ecologically sensitive areas should not extend beyond the construction envelope of the RALP project. If further clarification is necessary, the project ecologist should be consulted.

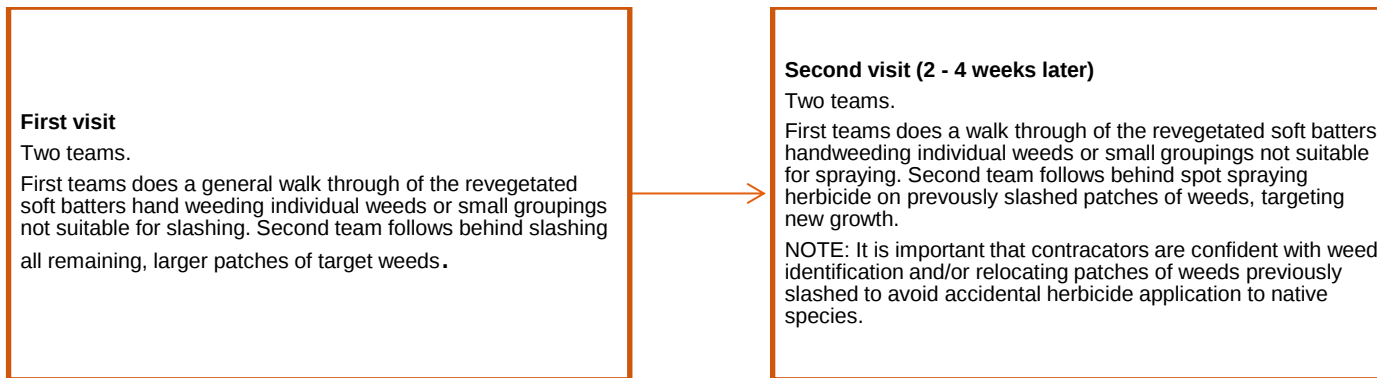


Figure 10. Suggested process to controlling target weeds on revegetated soft batters

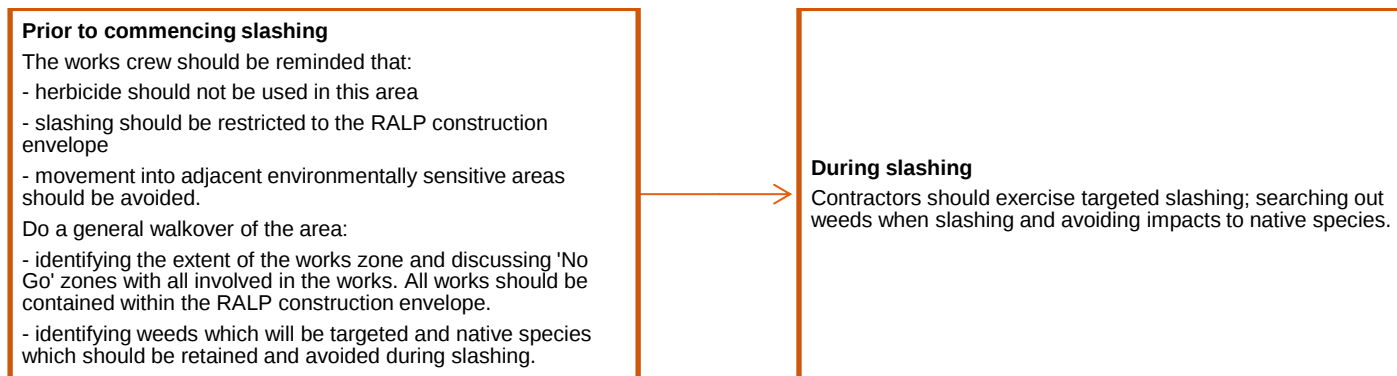


Figure 11. Slashing target weeds within the RALP construction envelope adjacent to ecologically sensitive areas

References

Arcadis (2019a) Urban Design and Landscape Plan. Moorebank Precinct East Stage 1

Arcadis (2019b) Operational Flora and Fauna Management Plan. Moorebank Logistics Park – East Precinct

Arcadis (2019c) Landscape Vegetation Management Sub Plan. Moorebank Precinct East Stage 2

Arcadis (2020) MPE Operational – Weed Monitoring Report December 2020

Arcadis (2020) Urban Design and Landscape Plan. Moorebank Precinct East Stage 2

Bureau of Meteorology (BOM) (2021) Climate Data Online. Weather and Climate: Holsworthy Aerodrome NSW (station 066161) <http://www.bom.gov.au/climate/dwo/IDCJDW2161.latest.shtml>

NSW Department of Primary Industries (DPI) (accessed 2021) NSW WeedWise. priority weeds for the Greater Sydney. <https://weeds.dpi.nsw.gov.au/WeedBiosecurities?AreaId=3>

APPENDIX A. RECOMMENDED ACTIONS CATALOGUE

Month of logging	Recommended action	Status (Not started, Commenced, Complete)	Comments
April 2020	Eradicate priority weeds species, including Bridal Creeper, Alligator Weed, Lantana, Fireweed and African Olive	Commenced	Lantana, African Olive, Fireweed and Bridal Creeper remain within the Rail Link. These weed species should be prioritised for removal.
April 2020	Remove key and aggressive weed species within Rail Link, including Golden Wreath Wattle, Moth Vine, Castor Oil Plant, Small-leafed Privet, Grader Grass and Balloon Vine	Commenced	Grader Grass has been observed colonising remediated areas within the Rail Link. This species should be removed to prevent further colonisation and infestations. Golden Wreath Wattle, Moth Vine and Castor Oil Plant on the southern side of the Rail Link in the area between the operational boundary and the East Hills line rail corridor. Consideration should be given to the management of these areas to reduce encroachment into recently remediated areas.
June 2020	Planning should commence to revegetate soft batters and un-developed areas within the MPE operational facility with native species in accordance with the approved Urban Design and Landscaping Plan (Arcadis 2019a, Arcadis 2020)	Commenced	Revegetation has commenced for remediated areas using a hydro-mulch containing a seed palette commensurate with the UDLP (Arcadis 2020). Additional striking of native seed was observed during the February 2022 monitoring inspection within the Rail Link. The following native species were observed growing Hickory Wattle, Indigofera, Windmill Grass, Queensland Bluegrass, Couch Grass, Kangaroo Grass, Kidney Weed, Barbed Wire Grass, Blown Grass, and Creeping Saltbush.

Month of logging	Recommended action	Status (Not started, Commenced, Complete)	Comments
December 2020	Exotic species, specifically <i>Medicago polymorpha</i> (Burr medic), should be removed from grassland on either side of the Rail Link at its eastern extent, closest to the operational area.	Commenced	Targeted manual removal, including slashing, has been conducted for exotic species outside the Rail Link corridor fencing. A qualified bush regeneration contractor should be used to avoid impacts on native species. Strictly no herbicide should be used in this area, and works should not extend beyond the RALP construction envelope. Where possible, contractors should not access/pass through adjacent areas.
December 2021	Collect litter scattered through the Rail Link corridor and in adjacent areas	Commenced	Litter remains in the Rail Link corridor and adjacent areas.
December 2021	Control aggressive weed species Coolatai Grass and Paterson's Curse within the Rail Link	Commenced	New instances of aggressive weed species Coolatai Grass and Paterson's Curse within the Rail Link should be removed as soon as practicable to avoid the spread of these species into ecologically sensitive areas adjacent to the Rail Link.
February 2022	Continued targeted slashing of woody and herbaceous weeds within the Rail Link.	Commenced	Continue regular slashing of large woody weeds to remove the fertile seed head and discourage further germination of these weeds within the Rail Link.
December 2022	Prioritise weed remediation works for priority and key weed species which have experienced accelerated growth in recent months.	Commenced	Areas of particularly high biomass of priority and key weed species should be prioritised for weed remediation works in coming months to avoid mass seeding events.
	Begin remediation of soft batters which have slipped following extreme rainfall events in recent weeks	Not started	Areas within the operational facility, including a number of areas within the Rail Link, require urgent batter remediation in areas of batter slipping.

Month of logging	Recommended action	Status (Not started, Commenced, Complete)	Comments
December 2022	Begin weed remediation of gravel and ballast areas along Rail link	Commenced	Removal of all vegetation in gravel and ballast areas due along Rail Link corridor using slashing and herbicide due to safety concerns of train operators and prevent spread of weeds.
December 2022	Continue weed remediation works along the soft batters within the Rail Link corridor.	Commenced	Future weed remediation works should include targeted slashing and spraying of priority and key weed species, whilst avoiding native species by hand weeding within a one metre buffer zone of native individuals.
February 2023	Continue weed remediation works along the soft batters within the Rail Link corridor beyond Georges River bridge.	Commenced	Future weed remediation works should include targeted slashing and spraying of priority and key weed species, whilst avoiding native species by hand weeding within a one metre buffer zone of native individuals.
April 2023	No weed remediation has occurred since February 2023. Expected to recommence in June 2023, in same areas that have previously been remediated.	Commenced	Future weed remediation works should include targeted slashing and spraying of priority and key weed species, whilst avoiding native species by hand weeding within a one metre buffer zone of native individuals.
June 2023	Continue weed remediation works along the soft batters within the Rail Link corridor	Commenced	Future weed remediation works should include targeted slashing and spraying of priority and key weed species, whilst avoiding native species by hand weeding within a one metre buffer zone of native individuals.
December 2023	Toolijooa Environmental Restoration inducted as primary weed control contractors. Weed remediation recommenced throughout the Rail Link corridor	Commenced	Future weed remediation works should include targeted slashing and spraying of priority and key weed species, whilst avoiding native species by hand weeding within a one metre buffer zone of native individuals.

APPENDIX B. REMEDIATION PROGRESS PHOTOGRAPHS



April 2021



December 2023



May 2025



April 2021



December 2023



May 2025



April 2021



December 2023



May 2025



April 2021



December 2023



May 2025



April 2021



December 2023



May 2025



April 2021



December 2023



N/A

May 2025



April 2021



December 2023



Feb 2025

Photo point not yet established

Photo point not yet established



May 2025

APPENDIX C. PROFILES: PRIORITY WEEDS



Lantana



Fireweed



Alligator Weed



African Olive



Bridal Creeper



Peruvian Primrose

APPENDIX D. PROFILES: KEY WEEDS



Rhodes Grass



African Love Grass



Patterson's Curse



Coolatai Grass



Grader Grass



Red Natal Grass

APPENDIX E. PLANT SPECIES INVENTORY

Scientific name	Common name	Exotic	Priority/key weed
<i>Acacia falcata</i>	Hickory Wattle		
<i>Acacia parramattensis</i>	Parramatta Wattle		
<i>Acacia saligna</i>	Golden Wreath Wattle	*	
<i>Alternanthera philoxeroides</i>	Alligator weed	*	Priority
<i>Alternanthera pungens</i>	Khaki Weed	*	
<i>Araujia sericifera</i>	Moth Vine	*	
<i>Asparagus asparagoides</i>	Bridal Creeper	*	Priority
<i>Atriplex semibaccata</i>	Creeping Saltbush		
<i>Austrodanthonia spp.</i>	-		
<i>Avena spp.</i>	Oats	*	
<i>Bidens pilosa</i>	Cobbler's Pegs	*	
<i>Brassica rapa</i>	Field Mustard	*	
<i>Briza maxima</i>	Quaking Grass	*	
<i>Briza minor</i>	Shivery Grass	*	
<i>Cenchrus clandestinus</i>	Kikuyu Grass	*	
<i>Centaureum spp.</i>	-	*	
<i>Chloris gayana</i>	Rhodes Grass	*	Key
<i>Chloris truncata</i>	Windmill Grass		
<i>Cirsium vulgare</i>	Spear Thistle	*	
<i>Convolvulus erubescens</i>	Pink Bindweed		
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	*	
<i>Cyclospermum leptophyllum</i>	Slender Celery	*	
<i>Cynodon dactylon</i>	Common Couch		
<i>Cymbopogon refractus</i>	Barbed Wire Grass		
<i>Cyperus eragrostis</i>	Umbrella Sedge	*	
<i>Daviesia ulicifolia</i>	Gorse Bitter Pea		
<i>Dichanthium sericeum</i>	Queensland Bluegrass		
<i>Dichondra repens</i>	Kidney Weed		
<i>Echium plantagineum</i>	Paterson's Curse	*	Key
<i>Eragrostis brownii</i>	Brown's Lovegrass		
<i>Eragrostis curvula</i>	African Lovegrass	*	Key
<i>Euchiton spp.</i>	-		
<i>Ficinia nodosa</i>	Knobby Club-rush		
<i>Foeniculum vulgare</i>	Fennel	*	
<i>Glycine clandestina</i>	-		

Scientific name	Common name	Exotic	Priority/key weed
<i>Hardenbergia violacea</i>	False Sarsaparilla		
<i>Hypochoeris radicata</i>	Catsear	*	
<i>Indigofera australis</i>	Australian Indigo		
<i>Juncus usitatus</i>	-		
<i>Lantana camara</i>	Lantana	*	Priority
<i>Lachnagrostis filiformis</i>	Blown Grass		
<i>Lactuca serriola</i>	Prickly Lettuce	*	
<i>Linum trigynum</i>	French Flax	*	
<i>Lolium perenne</i>	Perennial Ryegrass	*	
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		
<i>Lysimachia arvensis</i>	Scarlet Pimpernel	*	
<i>Ludwigia peruviana</i>	Peruvian water primrose	*	Priority
<i>Medicago polymorpha</i>	Burr Medic	*	
<i>Melilotus alba</i>	Bokhara	*	
<i>Melinis repens</i>	Red Natal Grass	*	Key
<i>Modiola caroliniana</i>	Red-flowered Mallow	*	
<i>Olea europaea subsp. cuspidate</i>	African Olive	*	Priority
<i>Paspalum dilatatum</i>	Paspalum	*	
<i>Persicaria decipiens</i>	Slender Knotweed		
<i>Phytolacca octandra</i>	Inkweed	*	
<i>Plantago lanceolata</i>	Lamb's Tongues	*	
<i>Portulaca oleracea</i>	Common Purslane		
<i>Rumex crispus</i>	Curled Dock	*	
<i>Senecio madagascariensis</i>	Fireweed	*	Priority
<i>Setaria parviflora</i>	-	*	
<i>Sida rhombifolia</i>	Paddy's Lucerne	*	Key
<i>Solanum nigrum</i>	Black-berry Nightshade	*	
<i>Solanum sisymbriifolium</i>		*	
<i>Sonchus oleraceus</i>	Common Sowthistle	*	
<i>Tagetes minuta</i>	Stinking Roger	*	
<i>Themeda quadrivalvis</i>	Grader Grass	*	Key
<i>Themeda triandra</i>	-		
<i>Trifolium arvense</i>	Haresfoot Clover	*	
<i>Trifolium repens</i>	White Clover	*	
<i>Trifolium michelianum</i>	Bolansa Clover	*	
<i>Verbena bonariensis</i>	Purpletop	*	

Scientific name	Common name	Exotic	Priority/key weed
<i>Verbena rigida</i> var. <i>Rigida</i>	Veined Verbena	*	

APPENDIX B. REMOTE CAMERA: FAUNA SPECIES INVENTORY

Species	Pest monitoring - Wattle Grove					Connectivity - Wattle Grove			
	C1-14	C1-20	3525	5318	5028	C1-11	C1-12	C1-13	C1-17
Site ID	E01	E02	E03	E04	E05	E06	E07	E08	E09
Australasian Swamphen (<i>Porphyrio melanotus</i>)					x				
Australian Magpie (<i>Gymnorhina tibicen</i>)		x		x					
Australian Raven (<i>Corvus coronoides</i>)		x		x	x				
Black Rat* (<i>Rattus rattus</i>)							x		
Common Brushtail Possum (<i>Trichosurus vulpecula</i>)			x						
Common Ringtail Possum (<i>Pseudocheirus peregrinus</i>)						x			
Common Wallaroo (<i>Macropus robustus</i>)					x				
Deer (<i>Rusa spp.</i>)									
Domestic Cat* (<i>Felis catus</i>)		x							
Eastern Grey Kangaroo (<i>Macropus giganteus</i>)	x	x		x					
European Rabbit (<i>Oryctolagus cuniculus</i>)				x					
Grey Strikethrush (<i>Colluricincla harmonica</i>)					x				
Koala (<i>Phascolarctos cinereus</i>)		x	x				x		
Red Fox* (<i>Vulpes vulpes</i>)	x	x		x	x	x	x	x	x

MIP Operational Facility AMR 2024/2025

Species	Pest monitoring - Wattle Grove					Connectivity - Wattle Grove			
	C1-14	C1-20	3525	5318	5028	C1-11	C1-12	C1-13	C1-17
Swamp Wallaby (<i>Wallabia bicolor</i>)	x					x	x		
Unknown Rat (<i>Rattus spp.</i>)						x	x		x

Species	Pest monitoring- Georges River			Connectivity - Georges River							
	5332	C1-4	5028(MA)	C2	C10	C1-11	C1-12	5332(MA)	C1-13	5028	5318
Site ID	W01	W02	W03	W04	W05	W06	W07	W08	W09	W10	W11
Australasian Swamphen (<i>Porphyrio melanotus</i>)											
Australian Magpie (<i>Gymnorhina tibicen</i>)											
Australian Raven (<i>Corvus coronoides</i>)		x									
Black Rat* (<i>Rattus rattus</i>)											
Common Brushtail Possum (<i>Trichosurus vulpecula</i>)											
Common Ringtail Possum (<i>Pseudocheirus peregrinus</i>)											
Common Wallaroo (<i>Macropus robustus</i>)											
Deer (<i>Rusa spp.</i>)	x				x	x	x	x		x	
Domestic Cat* (<i>Felis catus</i>)		x	x	x			x				
Eastern Grey Kangaroo (<i>Macropus giganteus</i>)											x

MIP Operational Facility AMR 2024/2025

Species	Pest monitoring- Georges River			Connectivity - Georges River							
	5332	C1-4	5028(MA)	C2	C10	C1-11	C1-12	5332(MA)	C1-13	5028	5318
European Rabbit (<i>Oryctolagus cuniculus</i>)											
Brown Hare (<i>Lepus europaeus</i>)		x	x	x							
Grey Shrikethrush (<i>Colluricincla harmonica</i>)											
Common Myna (<i>Acridotheres tristis</i>)							x				
Koala (<i>Phascolarctos cinereus</i>)			x								
Laughing Kookaburra (<i>Dacelo novaeguineae</i>)						x					
Red Fox* (<i>Vulpes vulpes</i>)	x	x	x		x	x	x		x		x
Swamp Wallaby (<i>Wallabia bicolor</i>)	x		x	x	x	x	x	x			
Unknown Rat (<i>Rattus spp.</i>)											

APPENDIX C. EPBC OFFSET SITES - ANNUAL MONITORING REPORT

MOOREBANK PRECINCT EAST - EPBC OFFSET SITE

EPBC Threatened Flora Monitoring Report

16/04/2025



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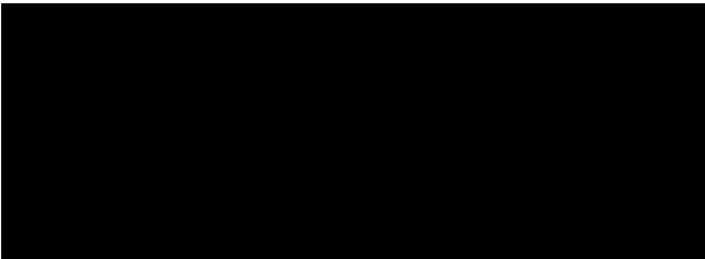
MOOREBANK LOGISTICS PARK - PRECINCT EAST

EPBC Threatened Flora Monitoring Report

Author Author Name

Checker Checker Name

Approver Approver Name



Report No 1.0

Date 16/04/2025

Revision Text A

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REVISIONS

Revision	Date	Description	Prepared by	Approved by
A	16/04/2025	First draft	AJ	JW, EE

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1 INTRODUCTION

Arcadis was commissioned by LOGOS Property to undertake annual monitoring and reporting requirements in accordance with federal approval conditions for the Moorebank Logistics Precinct East operational facility Project (**EPBC 2011/6229**) (herein referred to as the MPE Project).

1.1 Project background

The MPE Project was approved as a Controlled Action with conditions under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 6 March 2014. Construction of the MPE project commenced in mid-2016, with operations being launched in a staged manner from Q2-2020. The MPE Project includes an intermodal terminal and warehouse/distribution facility, offering container storage and warehousing solutions with direct rail access to Port Botany.

The MPE Project was approved to directly impact populations of two threatened flora species listed under the EPBC Act:

- Removal of 17 *Persoonia nutans* (Nodding Geebung) listed as Endangered under the EPBC Act and *Biodiversity Conservation Act 2016* (BC Act); and,
- Removal of 20 *Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea) listed as Vulnerable under the EPBC Act and BC Act.

Impacts to EPBC Act-listed threatened flora species occurred at two locations within the MPE Project footprint:

- A portion of Stage 1, Package 1: the Rail Link; and,
- The MPE Stage 2 Modification 2 project area – onsite stormwater detention basin (OSD) 2 (which includes a section of the MPL East Stage 2 project footprint).

A total of 11 *Persoonia nutans* and 20 *Grevillea parviflora* subsp. *parviflora* were removed to make way for the MPE Rail Link construction. An additional six *Persoonia nutans* were removed during the construction of the OSD basin at the southern extent of the MPE Stage 2 project site.

1.2 Conditions of approval (EPBC 2011/6229)

The referral decision lists a series of conditions of approval (CoA) to which the proponent is required to comply with to lawfully undertake the action. This Threatened Flora Monitoring report is required as part of CoA 6 of EPBC 2011/6229, which stipulates the requirement for a Threatened Flora Offset Management Plan (TFOMP). The TFOMP details the monitoring procedures as required in CoA 6(e) provided in Table 1 below.

Table 1. CoA (EPBC 2011/6229): Condition 6

CoA	Requirement
6	For the better protection of <i>Persoonia nutans</i>, <i>Grevillea parviflora</i> subsp. <i>parviflora</i> (and potentially, <i>Hibbertia</i> sp. Bankstown and Bynoe's Wattle pending the outcome of conditions 3 and 4), the person taking the action must engage a suitably qualified expert to prepare a Threatened Flora Offset Management Plan (TFOMP) (or plans) for the approval of the Minister. The TFOMP must include (but need not be limited to): (a) Details of a direct offset that satisfies the requirement of the Department's offset policy, in accordance with the offset user guide (including timeframes for the delivery or acquisition of the direct offset); (b) Maps (s) and shapefile that identify the location and boundaries of the direct offset; (c) Details of the management action and performance objectives which will maintain and enhance the <i>Persoonia nutans</i> and <i>Grevillea parviflora</i> subsp. <i>parviflora</i> habitat and/or population covered by the TFOMP (including duration, intensity, and timing of management actions); (d) An assessment of the baseline population and distribution for <i>Persoonia nutans</i> and <i>Grevillea parviflora</i> subsp. <i>parviflora</i> within the direct offset, including: • The number of plants protected and their location; and • Plant and habitat protection (e) Measures for regular monitoring of the status of individuals of <i>Persoonia nutans</i> and <i>Grevillea parviflora</i> subsp. <i>parviflora</i> and their habitat as measured against the baseline population and distribution, including: • Fluctuations in population size and distribution; and • Response to disturbance and/or management actions (f) Provisions to revise the approved TFOMP in response to monitoring associated with condition 6 (e) • Native vegetation clearance must not occur until the TFOMP has been approved. The TFOMP must be implemented once approved. • Should the action result in, or be likely to result in, residual impacts to <i>Hibbertia</i> sp. Bankstown or Bynoe's Wattle (as determined by the Minister), the TFOMP must also demonstrate how it meets the standards described in (a) and (f), for these two species.

1.3 Project objectives

Objectives of monitoring, survey methodologies, timings and guidelines are detailed in the TFOMP prepared by Arcadis in 2017 and updated in 2020. Monitoring commenced for the MPE Project in spring 2019 and is undertaken annually for a 20-year period.

This monitoring report addresses the conditional requirements to monitor *Grevillea parviflora* subsp. *parviflora* and *Persoonia nutans* and presents the results of the fifth-year monitoring survey (2024-2025) within the designated EPBC offset sites (Figure 1).



Figure 1. EPBC offset sites within Wattle Grove offset area; adjacent to the MPE site

1.4 Project documents

The following project documents were reviewed prior to establishing offset sites and referenced during the inaugural monitoring surveys to ensure adherence to the EPBC offsetting requirements and to maximise the chance of success in achieving the monitoring objectives:

- BioBanking Agreement (BA341) for Moorebank Intermodal Terminal Biobank Site (OEH 2017);
- Biodiversity Assessment Report: Biobanking Agreement – Wattle Grove Offset Area, Casula Offset Area and Moorebank Conservation Area (WSP & Parsons Brinckerhoff 2017);
- Biodiversity Management Implementation Plan (Arcadis 2019);
- Conditions attached to the approval: SIMTA Moorebank Intermodal Terminal Facility, Sydney, NSW (EPBC 2011/6229) (DoE 2014); and,
- Threatened Flora Offset Management Plan (Arcadis 2020a).

1.5 Establishment of offset sites

Five designated offset sites were established to satisfy offset obligations for impacts to EPBC-listed threatened flora generated by the MPE Project. The offset sites are situated within the Wattle Grove offset area, which forms part of the BA341 Moorebank biobank site. A formal Biobanking agreement between the Commonwealth Government and the NSW Government was established as the legal instrument to implement management, monitoring and auditing of the site and to protect the offset land in perpetuity.

In accordance with the revised TFOMP (Arcadis 2020a), four offset sites are designated for conserving *Persoonia nutans*, and one for *Grevillea parviflora* subsp. *parviflora*. It is anticipated that the conservation and management of EPBC offset sites will maintain the initial number of plants/stems of these species and will result in a population increase over a 20-year management period. To satisfy offset obligations generated by the action the following must be achieved across the designated offset sites:

- 171 *Persoonia nutans* individuals to achieve 100% of the offset obligation (as per Table 3-3 of TFOMP, Arcadis 2020a); and,
- 159 *Grevillea parviflora* subsp. *parviflora* individuals to achieve 104% of the offset obligation (Table 3-4 of TFOMP, Arcadis 2020a).

Offset calculations were prepared for *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* based on guidance provided in the EPBC Offset Assessments Guide (DOEE 2012). Offset calculations and associated species information (temporal scale, risk scales, future habitat quality, result confidence) have been included within the approved TFOMP (Arcadis 2020a). These calculations assessed and supported the suitability of the proposed offset sites to achieve at least 100 percent of the required EPBC offset for the MPE project over a period of 20 years.

A total of 155 *Persoonia nutans* and 142 *Grevillea parviflora* subsp. *parviflora* form the start value across the five designated offset sites. Over the 20-year time horizon and active management of the offset sites, the start populations of *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* are to increase by 16 and 17 individuals, respectively, to meet at least 100% of the offset obligation. The details of the offset site populations is provided in Table 2 and Table 3 below.

Table 2. Details of EPBC offset sites: *Persoonia nutans*

EPBC Offset Site	Area	Number of individual plants to be conserved within the offset site per the EPBC Act offset requirement	Offset requirement objective
P1	0.25 ha	31 plants of <i>Persoonia nutans</i>	Increase <i>Persoonia nutans</i> population within EPBC Offset Sites by 16 plants over 20 years
P2	0.2 ha	46 plants of <i>Persoonia nutans</i>	
P3	0.26 ha	35 plants of <i>Persoonia nutans</i>	
P4	2.17 ha	43 plants of <i>Persoonia nutans</i>	
Total	2.88 ha	155 plants of <i>Persoonia nutans</i>	

Table 3. Details of EPBC offset sites: *Grevillea parviflora* subsp. *parviflora*

EPBC Offset Site	Area	Number of stems to be conserved within the offset site per the EPBC Act offset requirement	Offset requirement objective
G1	0.24 ha	142 stems of <i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Increase <i>Grevillea parviflora</i> subsp. <i>parviflora</i> population within EPBC Offset Sites by 17 plants over 20 years

1.6 Monitoring history

The inaugural monitoring survey occurred in spring 2019 when four EPBC offset sites were established in accordance with the TFOMP (Arcadis 2017). The four offset sites were established to directly offset impacts to 11 *Persoonia nutans* and 20 *Grevillea parviflora* subsp. *parviflora* associated with the MPE Project.

In 2020, an additional six *Persoonia nutans* plants were impacted by the MPE Stage 2 development and subsequently required offsetting in accordance with the EPBC Offsetting Guide. The TFOMP was updated (Arcadis 2020a) to include the additional impacts and document how the additional offset would be achieved. During the second year of monitoring, an additional *Persoonia nutans* offset site (P4) was established at the northern extent of the Wattle Grove offset area. The P4 offset site was monitored along with the existing *Persoonia nutans* offset sites (P1, P2, P3 and P4), and *Grevillea parviflora* subsp. *parviflora* offset site (G1) during 2021, 2022, 2023 and within the current 2024 assessment.

Offset sites P1, P2, P3 and G1 were subject to wildfire 18 months prior to commencement of the monitoring program. The fire burnt through the southern portion of the Wattle Grove offset area which destroyed most start populations of *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* previously recorded. Offset site P4 was unaffected.

A summary of the species census results since inception of the respective EPBC offset sites (P1-P4, G1) is provided in Table 4. A summary of the previous 2023 monitoring is included in Section 1.6.1.

Table 4 Population census results of previous monitoring years (2019-2023)

Census Year	P1	P2	P3	P4	G1
2019	9	3	100	-	143
2020	13	0	77	43	60
2021	12	0	39	41	50
2022	7	1	28	32	112
2023	7	1	28	32	146

1.6.1 Summary of year 4 (2023-2024) monitoring results

In spring 2023, monitoring was conducted for the four *Persoonia nutans* (P1, P2, P3 and P4) offset sites and the *Grevillea parviflora* subsp. *parviflora* offset site (G1). The population census recorded **68** individuals of *Persoonia nutans* and **146** individuals of *Grevillea parviflora* subsp. *parviflora*.

Of the 68 *Persoonia nutans* individuals identified, seven were identified across offset sites P1, one at P2, 28 at P3 and 32 individuals at offset site P4. A thorough search was conducted throughout offset sites P1, P2, P3 and P4 to re-locate *Persoonia nutans* individuals previously tagged during the previous monitoring surveys (2019, 2020, 2021, and 2022) and to record any new plants which may have recruited. Searches re-located 55 tagged *Persoonia nutans* individuals and identified 13 new plants. A total of 13 individuals located during the previous year's survey (2022 monitoring event) were not re-located in P3 and P4 and are presumed to have died between the 2022 and current surveys.

1.6.1.1 Offset site condition: *Persoonia nutans* (P1-P4)

Generally, *Persoonia nutans* within offset sites were observed to be in good condition. No evidence of impacts from mammals (trampling or grazing) was observed. However, there was some evidence of damage from insects on juvenile plants in offset site P1 and P4. A diversity of native plant species was recorded across all offset sites, and exotic species occurrence was restricted to the edges of bushland, specifically on the interface between access tracks and bushland. *Eragrostis curvula* (African Lovegrass) was the most encountered weed species.

1.6.1.2 Offset site condition: *Grevillea parviflora* subsp. *parviflora* (G1)

Based on spatial distribution in the *Grevillea parviflora* subsp. *parviflora* offset area, the population continues to increase in density and distribution, *Grevillea parviflora* subsp. *parviflora* stems were more prevalent towards the north-east and south-west of the offset site (G1). Individuals were generally sparsely scattered. However, close groupings of up to five plants were occasionally observed, generally in areas where leaf litter and ground cover species were absent.

The condition of vegetation across the G1 offset site was observed to be in good condition. Tagging individual *Grevillea parviflora* subsp. *parviflora* is not required as part of the annual monitoring.

2 METHODS

In addition to the annual monitoring undertaken across the entire Wattle Grove Offset Area, specific monitoring is to be undertaken within the EPBC offset sites (G1, P1-P4).

This section identifies how the specified monitoring activities for offset sites G1 and P1 – P4 are to be undertaken in accordance with Table 6-1 of the TFOMP (Arcadis 2020a). The required monitoring activities and timing is presented in Table 5 below and detailed within the respective sections.

Table 5 Specified monitoring activities for the EPBC offset sites (Arcadis 2020a)

Monitoring activity	Frequency	Report section
Population census	Annually in spring	Section 2.1
Habitat assessment		Section 2.2
Photo point monitoring		Section 2.3

2.1 Population census

Targeted searches for *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* were conducted within the respective offset sites. The following procedure and data were collected:

- Systematic transects at five-metre spacing were walked covering the entirety of each site;
- The location of individual plants was recorded using an Arc-GIS-enabled iPad to an accuracy of ± 5 -10 metres;
- Total counts were made for *Grevillea parviflora* subsp. *parviflora* and *Persoonia nutans* within the designated offset sites;
- For *Persoonia nutans* the following was recorded for each individual observed:
 - Size (height and spread)
 - General health (i.e. insect damage, stress etc)
 - Reproductive status (i.e. evidence of flowering and fruiting)
 - Individuals marked with numbered metal tags for tracking across monitoring periods
- Classification of individuals into growth stages:
 - Juveniles: smaller individuals lacking reproductive material (flowers and seeds); and,
 - Adults: larger individuals displaying reproductive material (flowers and seeds).

2.2 Habitat assessment

Offset sites were evaluated for habitat suitability for *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora*. An assessment of the habitat value of each offset site was determined by quantitatively measuring the condition of native vegetation, noting significant changes to site characteristics (i.e. vegetation growth, weed occurrence, erosion) and identifying potential impacts.

The condition of native vegetation within each offset site was measured using vegetation quadrats in accordance with Section 5.3 of the Biodiversity Assessment Method (BAM) (DPIE, 2020). Results of BAM quadrats were used to inform upon the following vegetation attributes:

- Percent foliage cover of canopy species

- Percent foliage cover of shrub species
- Percent foliage cover of ground cover species
- Percent foliage cover of exotic species

A Vegetation Integrity (VI) score was calculated using the results of vegetation quadrats conducted at each offset site. VI scores will be compared between monitoring periods to measure changes to vegetation conditions. It is anticipated that the VI score continually improves and the contributing attributes (composition, function etc.) move towards the benchmark scores for the present Plant Community Type (PCT), being PCT 883 *Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion*.

Notes were made for observations of native vegetation dieback within or surrounding the EPBC offset sites.

2.3 Photo points

Four photo points were established on the perimeter of each EPBC offset site, and a single photo point was established centrally within each offset site. Photo points on the boundary were captured in a single cardinal direction. In the middle of the plot, four photographs were captured from the central photo point in the four cardinal directions.

Photo points are located at metal boundary stakes and a stake in the middle of the offset site. The metal stakes were demarcated with a numbered metal tag identifying the relevant photo point. The locations of photo points and the orientation of photographs are presented in Appendix D.

2.4 Assessment qualifications and limitations

Arcadis ecologists undertook annual monitoring of EPBC offset sites over three days between 27 September 2024 and 25 October 2024.

Generally, the weather on the survey dates was overcast, and the temperature was mild to warm. Weather records from the nearest weather station, Holsworthy Aerodrome AWS (station 066161), for the surveyed dates, are presented in **Error! Reference source not found.**

Threatened flora searches were undertaken during the recommended survey season for *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* (DPIE 2019a, 2019b) to maximise the chance of detection.

Table 6. Surveying ecologists and climatic conditions during EPBC offset site monitoring

Date	Surveying ecologists	Temperature		Rain (mm)
		Min (°C)	Max (°C)	
27/09/2024	Acacia Jennings, Emma Teusner	10.2	17.2	12.2
09/10/2024	Acacia Jennings, Kate Mauger, Briony Mowbray	11.9	16.8	0
25/10/2024	Acacia Jennings, Briony Mowbray	9.5	21.5	8.4

2.4.1 Limitations

In offset sites burned by the bushfire (P1, P2, P3 and G1), *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* transects were difficult to conduct due to common post-bushfire recruitment species such as *Acacia spp.*, *Melaleuca nodosa* (Prickly-leaved Paperbark), and *Petrophile sessilis* (Conesticks) creating dense thickets and hindering access. Transects were recorded on GPS devices to keep track of approximate lines. In some small areas where walking in straight lines was not possible, ecologists sought to prioritise areas of high-quality habitat.

Due to the density of bushland in some offset sites and the inconspicuous nature of seedling *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora*, transects may have failed to locate/re-locate all the plants present.

Additionally, while some individual *Grevillea parviflora* subsp. *parviflora* were observed flowering the majority of individuals observed were not flowering as a result of being either juvenile or surveys being conducted early in the flowering window.

3 RESULTS

The results of the 2024 monitoring events for *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* are detailed within the following sections.

3.1 Population census for EPBC threatened flora

3.1.1 *Persoonia nutans*

Table 7 Summary of changes to *Persoonia nutans* populations across Offset Sites P1, P2, P3 and P4.

Census Year	P1	P2	P3	P4
2019	9	3	100	-
2020	13	0	77	43
2021	12	0	39	41
2022	7	1	28	32
2023	7	1	28	32
2024 (current)	7	1	38	34
Total 2024				80

A thorough search was conducted throughout offset sites P1, P2, P3 and P4 to re-locate *Persoonia nutans* individuals previously tagged between the 2019 and 2023 surveys, and any new plants which may have recruited. Searches re-located 60 tagged *Persoonia nutans* individuals and identified 20 new plants. A total of 8 individuals located during the previous year's survey (2023 monitoring event) were not re-located in P1, P3 and P4 and are presumed to have died between the 2023 and current surveys.

Offset sites P1 and P3 predominantly consisted of juvenile *Persoonia nutans*. In contrast, offset site P4, which was not impacted by the 2018 wildfire, has a *Persoonia nutans* population represented by adult plants greater than one metre in height and width, and bearing fruit (Plate 1). The population dynamics of *Persoonia nutans* within each offset site are discussed below. In offset sites P1 and P3 juvenile *Persoonia nutans* were mostly observed within seven meters of a road or access track.

Across all sites the number of *Persoonia nutans* observed increased by 12 individuals since 2023, 10 of which are located in P3 and 2 in P4 (Figure 2).

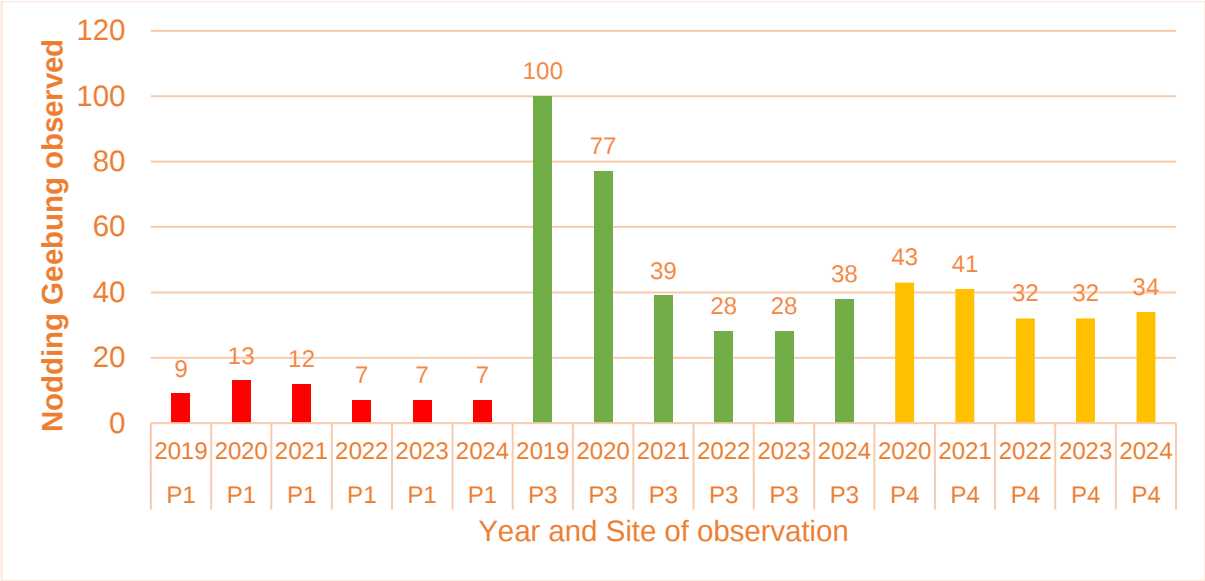


Figure 2: *Persoonia nutans* counts at each offset site since monitoring commenced. Site P2 has been omitted due to a small number (<3 individuals) of *Persoonia nutans* observed since 2019.

Generally, *Persoonia nutans* within offset sites were observed to be in healthy condition, with approximately 89 percent of all individuals observed to be in healthy condition. No evidence of impacts from mammals (trampling or grazing) was observed. However, there was some evidence of damage from insects predominantly in offset site P4.



Plate 1. Adult *Persoonia nutans* bearing fruit observed during the population census

Offset site P1

A total of seven *Persoonia nutans* were found in offset site P1 during the 2024 survey. All seven individuals were adult plants, however, were not showing signs of seeding or flowering. Five of the seven plants identified had been previously recorded and were marked with numbered metal tags. Two

individuals observed were unmarked, indicating that they could be new recruits. One tag was found unattached on the ground which could account for one of the individual identified during the 2023 which was not reidentified. The two individuals that were not reobserved could have perished or their tags could have fallen off. A summary of changes to the *Persoonia nutans* population within offset site P1 has been presented in Table 8.

Table 8. Summary of changes to *Persoonia nutans* population in offset site P1

Offset site P1	Count
Count of individuals from 2023 survey	7
Existing individuals	5
New individuals	2
Total	7
Individuals not re-located (presumed dead)	2

Persoonia nutans within offset site P1 were located towards the northern boundary of the offset site in disturbed areas near an access track (



Figure 3). *Persoonia nutans* were observed growing as individuals and in small groupings on a sandy

soil profile interspersed amongst tussocks of African Lovegrass and beneath burnt Conesticks. *Persoonia nutans* were more prevalent in exposed areas with reduced leaf litter and vegetation cover.

All *Persoonia nutans* were found to be in a healthy condition. The six of the seven *Persoonia nutans* found in healthy condition did not exhibit insect damage with one individual showing low signs of damage.

Offset site P2

During the 2024 monitoring event, one *Persoonia nutans* was identified within offset site P2. This *Persoonia nutans* was observed for the first time in the 2022 survey and no new individuals have been recorded since. The *Persoonia nutans* was found in healthy condition with no insect damage.

Table 9. Summary of changes to *Persoonia nutans* population in offset site P2

Offset site P2	Count
Count of individuals from 2023 survey	1
Existing individuals	1
New individuals	0
Total	1
Individuals not re-located (presumed dead)	0

Offset site P3

A total of 38 *Persoonia nutans* were identified in offset site P3 during the 2024 survey, consisting of 27 adult plants and 11 juvenile plants. Of the 38 individuals identified, 23 had been recorded and marked with numbered metal tags during previous surveys. The additional 15 plants are considered to have germinated since the 2023 surveys. A total of 5 *Persoonia nutans* recorded during the previous 2023 surveys were not able to be re-located and are presumed to have died. A summary of changes to the *Persoonia nutans* population within offset site P3 has been presented in Table 10.

Table 10. Summary of changes to *Persoonia nutans* population in offset site P3

Offset site P3	Count
Count of individuals from 2023 survey	28
Existing individuals	23
New individuals	15
Total	38
Individuals not re-located (presumed dead)	5

The majority of individuals were observed growing in dense groupings along the northern boundary of the offset site interspersed amongst tussocks of African Lovegrass beneath stands of *Kunzea ambigua* (Tickbush). Individuals were observed to prefer the bushland's disturbed edge adjacent to an access track (

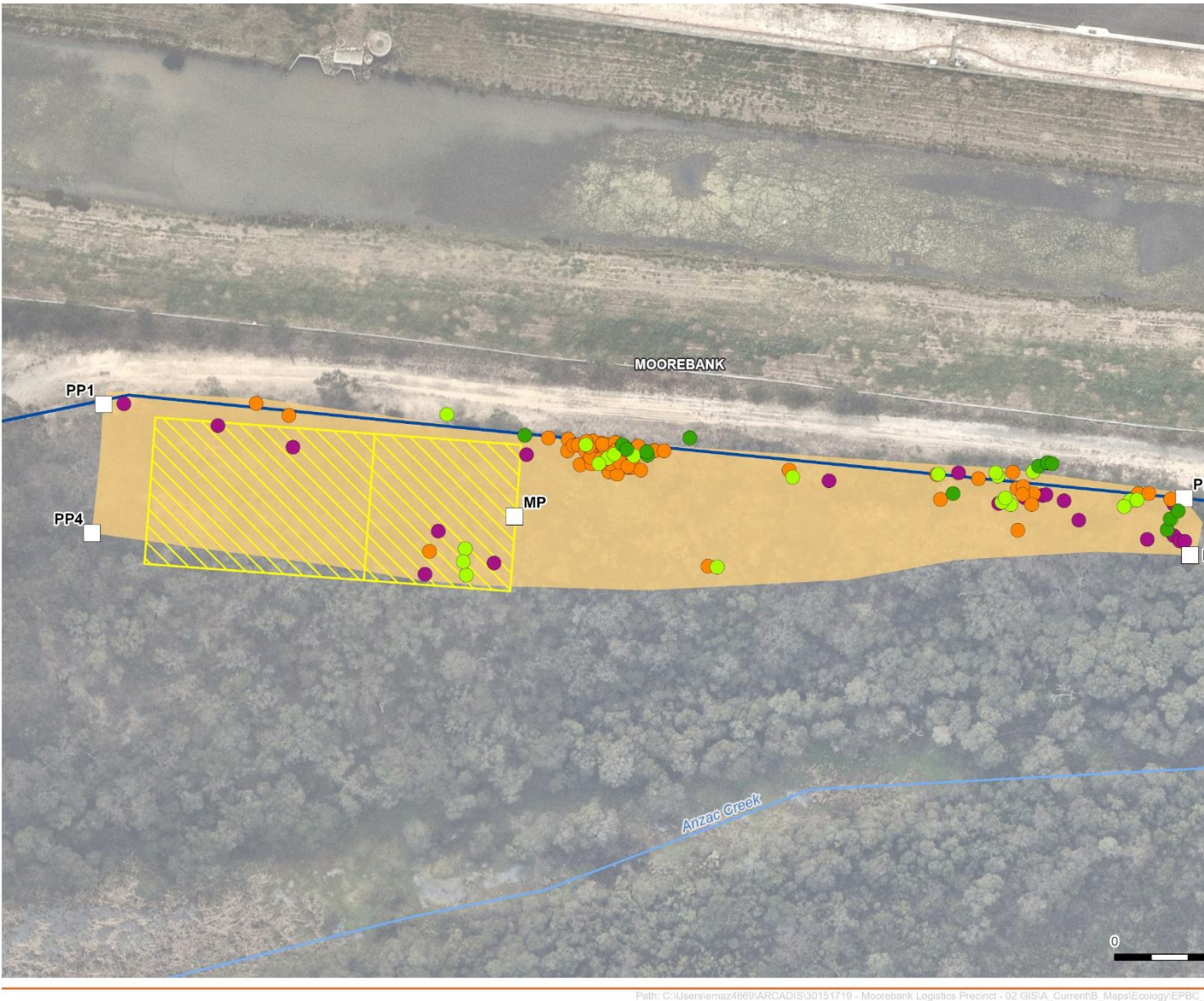


Figure 5).

Offset Site P4

A total of 34 *Persoonia nutans* were identified in offset site P4 during the 2024 survey. Of the 34 individuals identified, 31 had been previously recorded and marked with numbered metal tags during previous monitoring surveys. Three additional plants not previously recorded were found and one *Persoonia nutans* was found to have died since the 2023 survey. A summary of changes to the *Persoonia nutans* population within offset site P4 has been presented in Table 11.

Table 11. Summary of changes to *Persoonia nutans* population in offset site P4

Offset site P4	Count
Count of individuals from 2023 survey	32
Existing individuals	31
New individuals	3
Total	34
Individuals not re-located (presumed dead)	1

Persoonia nutans within offset site P4 were distributed throughout Hard-leaved Scribbly Gum Woodland. Individuals were identified in areas of open woodland with a sparse shrub layer as well as areas densely vegetated with mid-storey species and shrubs.

Of the *Persoonia nutans* found, 30 individuals were in healthy condition, one in moderate condition, and three were in poor condition. This Offset site had the highest rate of insect damage with one individual exhibiting high effects of insect damage and a further 6 individuals demonstrated moderate (n=3) and low (n=3) levels of damage.

Annual EPBC Offset Site Monitoring (2024-25)



Figure 3. Offset site P1: *Persoonia nutans* records 2024

Annual EPBC Offset Site Monitoring (2024-25)

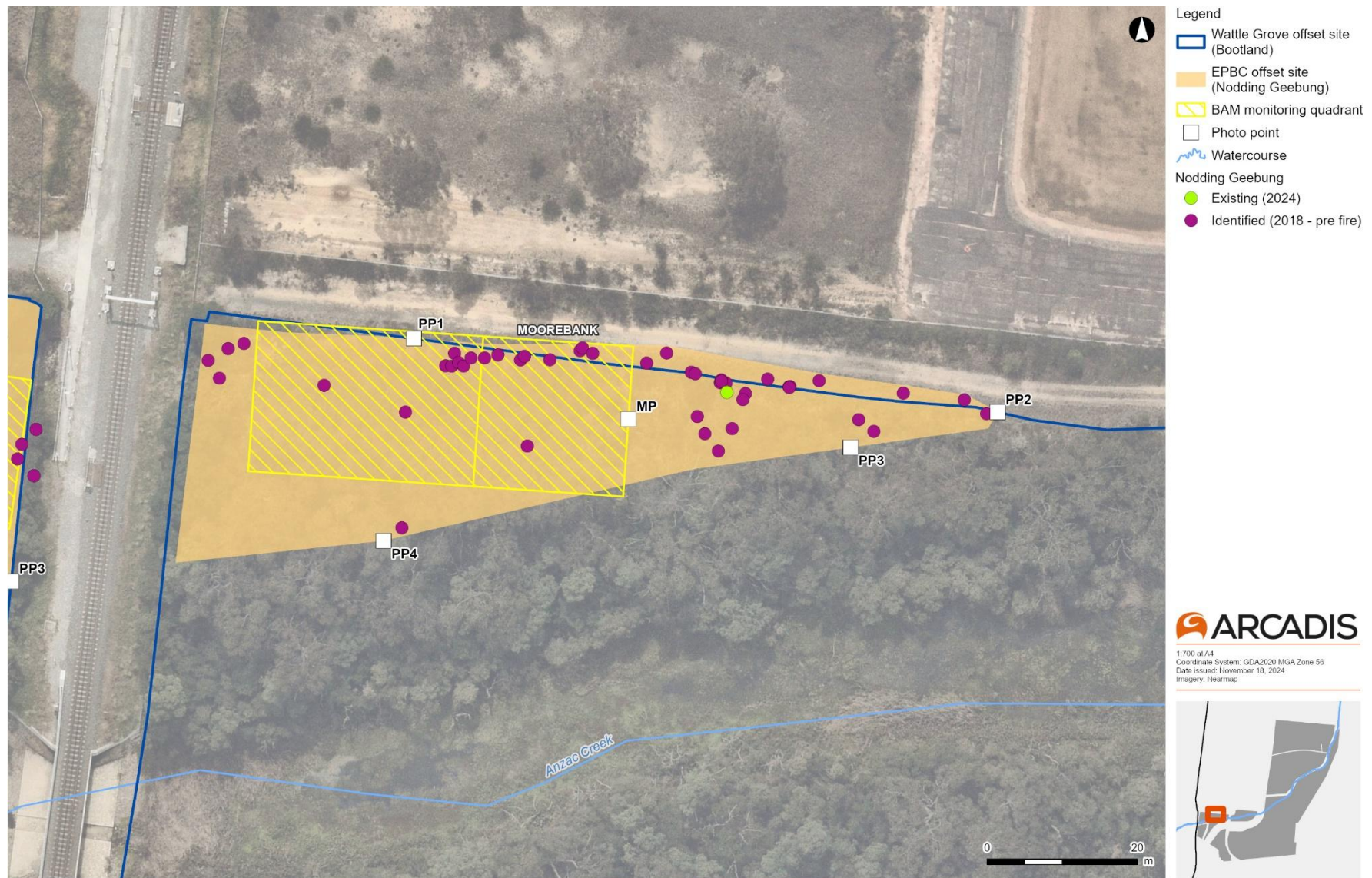


Figure 4. Offset site P2: *Persoonia nutans* records 2024

Annual EPBC Offset Site Monitoring (2024-25)

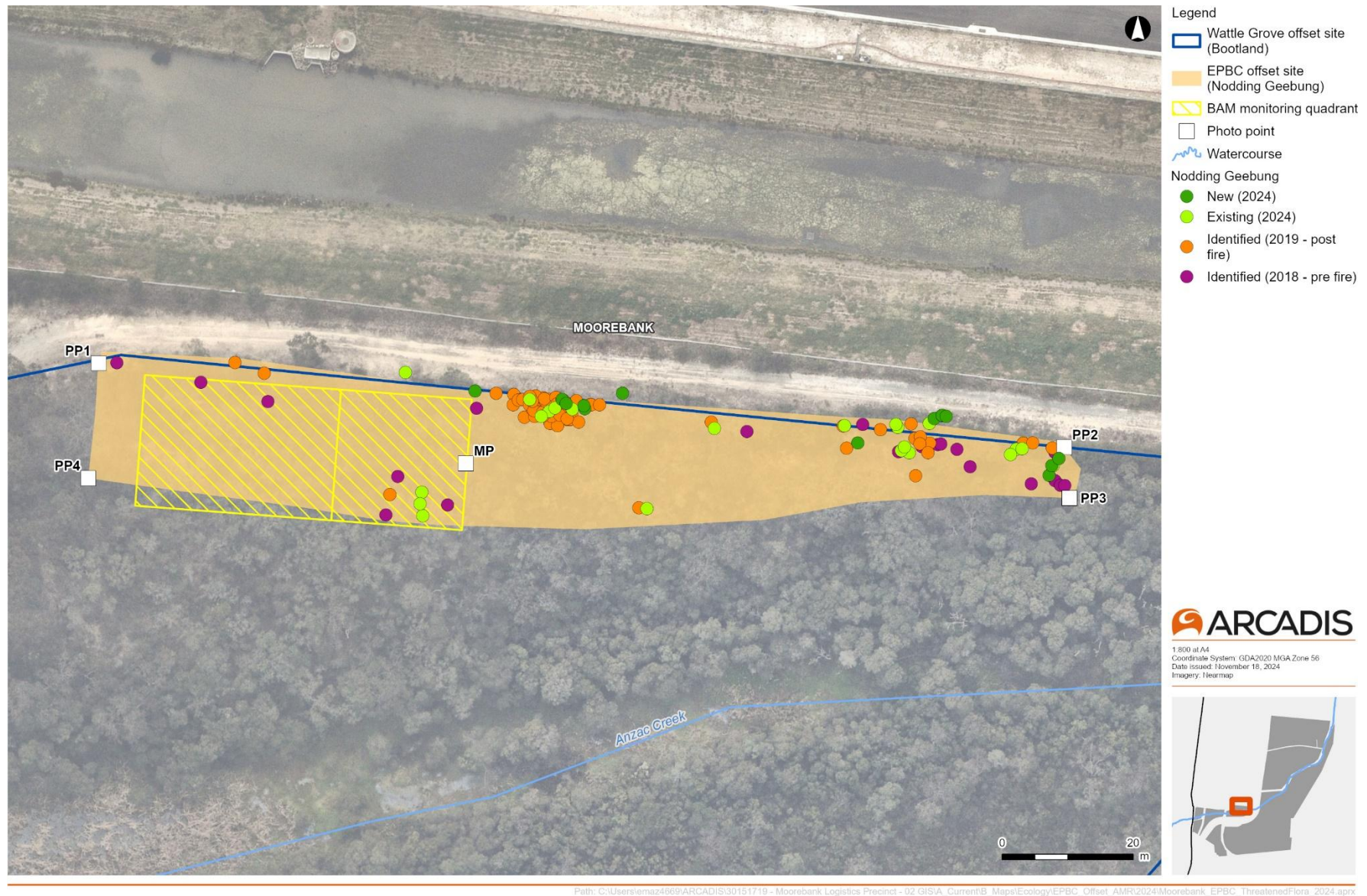


Figure 5. Offset site P3: *Persoonia nutans* records 2024

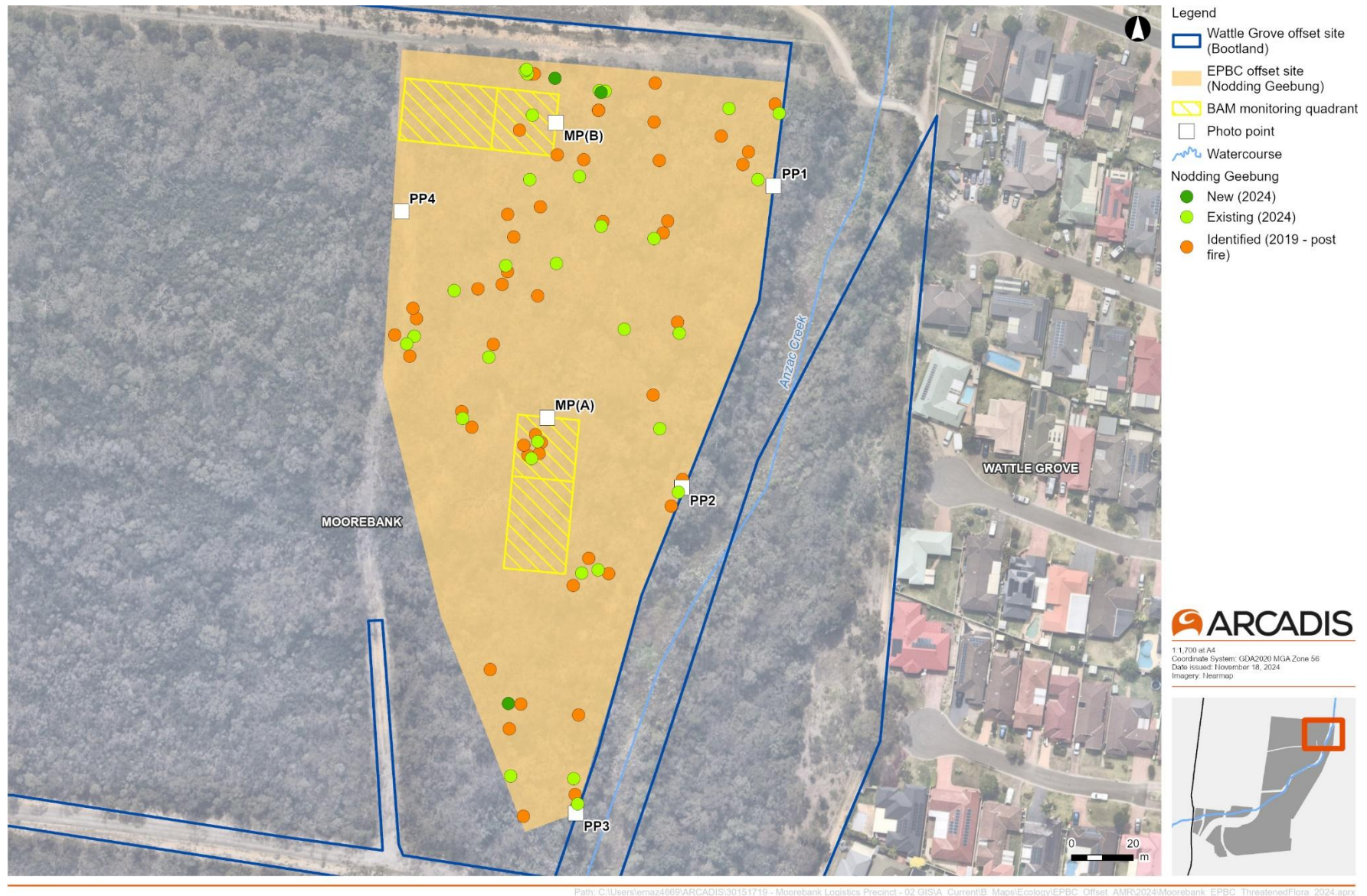


Figure 6. Offset site P4: *Persoonia nutans* records 2024

3.1.2 *Grevillea parviflora* subsp. *parviflora*

Offset site G1

A total of 75 *Grevillea parviflora* subsp. *parviflora* stems were identified within offset site G1 during the 2024 survey. Unlike *Persoonia nutans*, the TFOMP (Arcadis 2020) did not include a requirement to mark *Grevillea parviflora* subsp. *parviflora* individuals during the 2019 survey, therefore, recruitment and death rates within the population cannot be accurately determined. Furthermore, as the plants are capable of suckering from a rootstock and most populations demonstrate a degree of vegetative spread, counts of individual genets in a population is very difficult as new shoots can be mistaken for distinct plants. This year, contrary to previous survey years a point was dropped and the number of individuals within an approx. 3m diameter vicinity were counted. The 2024 survey has seen a decrease in *Grevillea parviflora* subsp. *parviflora* compared to the 2022-2023 surveys, with a decrease of 71 *Grevillea parviflora* subsp. *parviflora* individuals since 2023. The number of individuals recorded is more closely aligned with the numbers observed in 2020 and 2021. The population was observed to have a similar distribution to previous surveys (

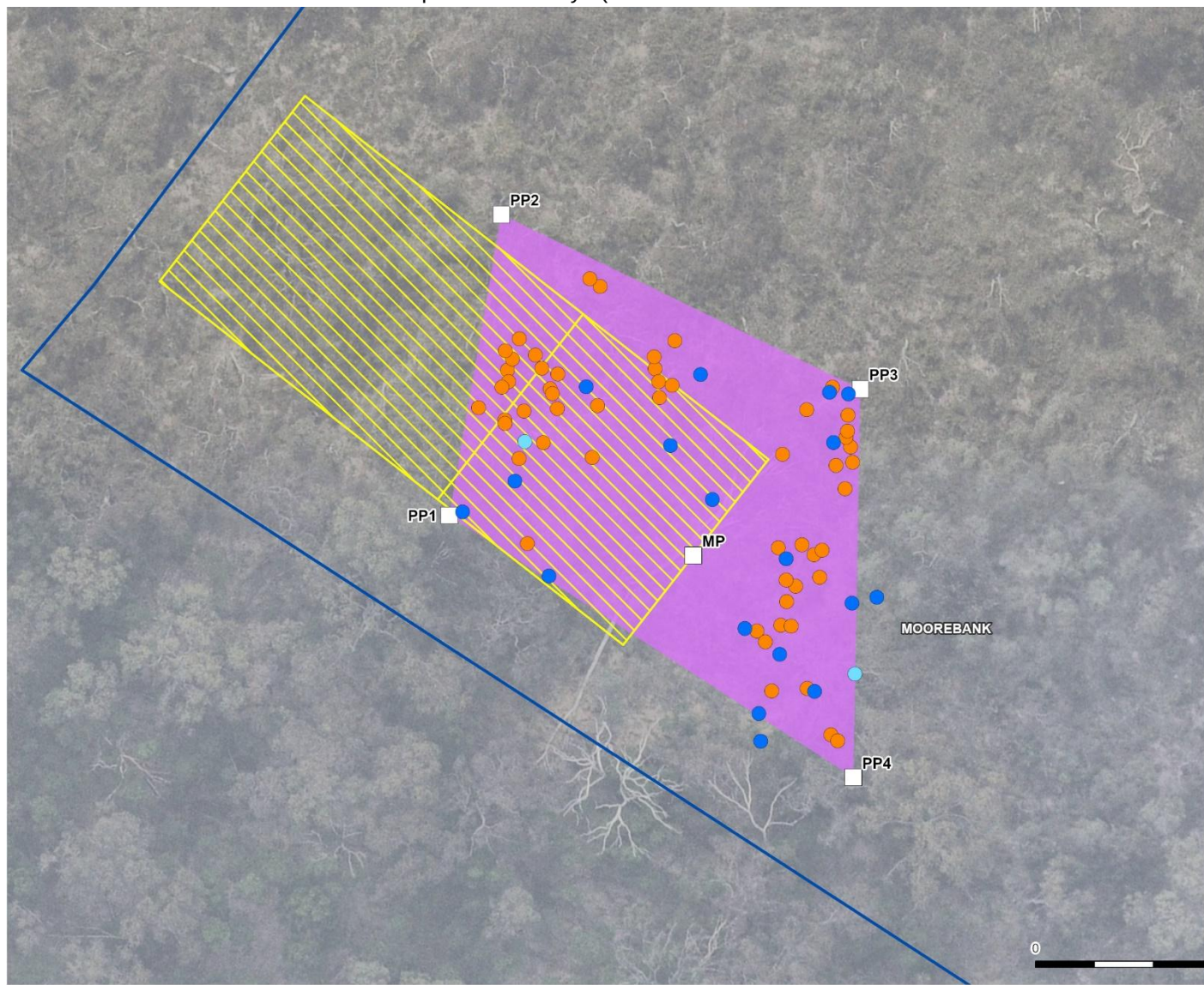


Figure 8).

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A summary of changes to the *Grevillea parviflora* subsp. *parviflora* population within offset site G1 across the annual monitoring events is presented in Table 12.

Table 12. Summary of changes to *Grevillea parviflora* subsp. *parviflora* population in offset site G1

Offset site G1	Count
Count of stems from 2019 survey	143
Count of stems from 2020 survey	60
Count of stems from 2021 survey	50
Count of stems from 2022 survey	112
Count of stems from 2023 survey	146
Count of stems from (current) 2024 survey	75

Grevillea parviflora subsp. *parviflora* stems were found throughout the site, with greater densities observed towards the northeast and southwest of the offset site, and lower densities of plants distributed centrally. Some *Grevillea parviflora* subsp. *parviflora* stems were observed to be flowering at the time of the survey but did not appear to have seed present. Plants were generally sparsely scattered. However, close groupings of up to five plants were occasionally observed, generally in areas where leaf litter and ground cover species were absent.

The tag of one previously tagged individual was located on the ground (unattached) inferring the death of an individual and additionally one individuals was identified as having poor health with high signs of insect damage. Generally, *Grevillea parviflora* subsp. *parviflora* within the offset site were observed to be in healthy condition, with 74 individuals were observed to be healthy. No evidence of impacts from mammals (trampling or grazing) was observed.

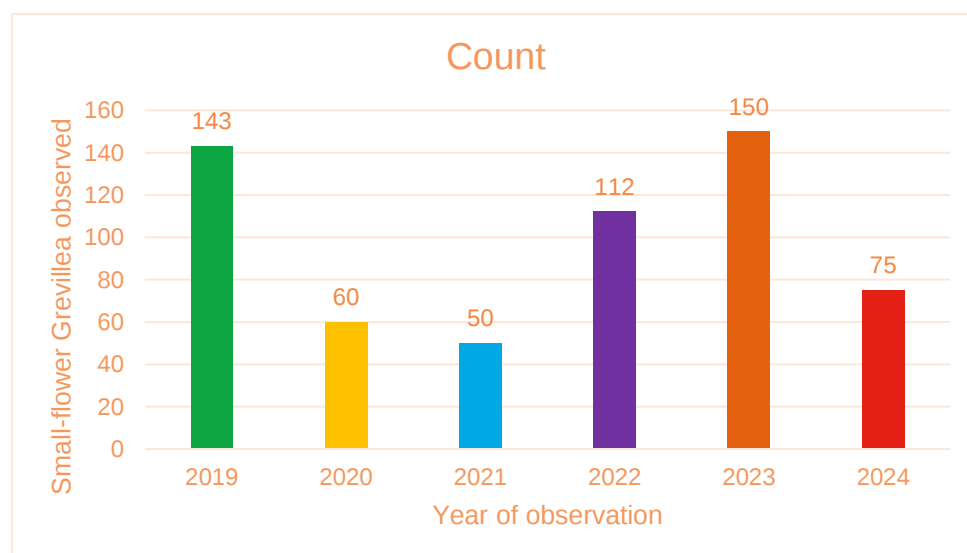


Figure 7. Total number of *Grevillea parviflora* subsp. *parviflora* observed at the site since observation began in 2019.

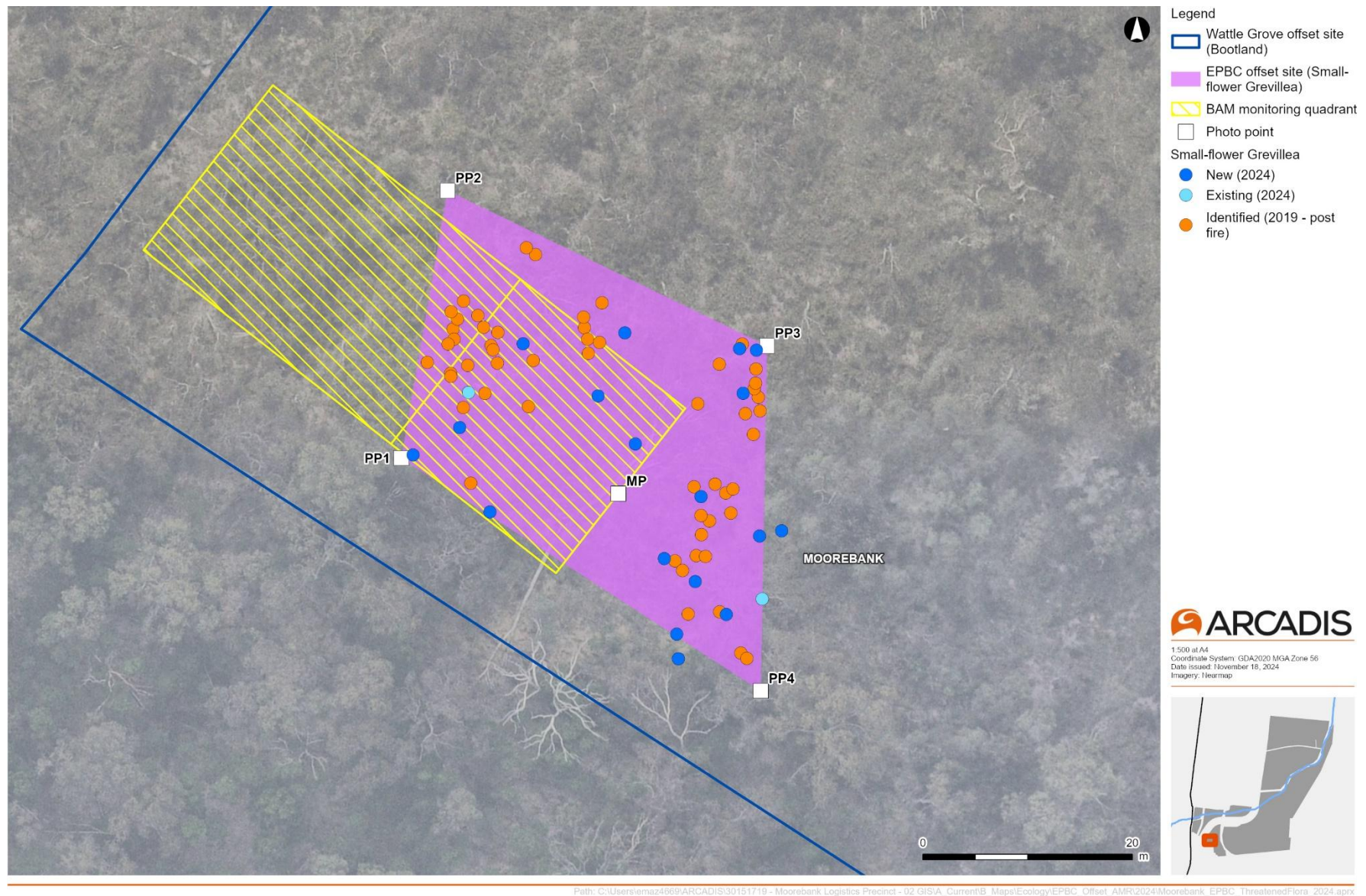


Figure 8. Offset site 4: *Grevillea parviflora* subsp. *parviflora* records 2024, whereby one record can be indicative of cluster of *Grevillea parviflora* subsp. *parviflora*

3.2 Habitat assessment

All five EPBC offset sites are situated within PCT 883 *Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion*. This community is one of several unique dry shrub woodland communities found on poorly consolidated sand deposits on hinterland plains and valleys of the Sydney region. This community occurs on old stream deposits at Holsworthy (Tozer et al. 2010).

This vegetation has a woodland formation comprising an open, low-growing eucalypt cover dominated by *Eucalyptus racemosa* (Hard-leaved Scribbly Gum), *Angophora bakeri* (Narrow-leaved Apple) and *Eucalyptus parramattensis* subsp. *parramattensis* (Parramatta Red Gum). A sparse cover of *Melaleuca decora* (Tall Paperbark) and *Melaleuca nodosa* (Prickly-leaved Paperbark) is often present. *Banksia* spp., *Hakea* spp., *Acacia* spp., *Leptospermum* spp., and *Melaleuca* spp., provide a well-developed shrub layer. The ground layer typically supports a diverse mix of species, including a high cover of grasses and sedges (Tozer et al. 2010).

3.2.1 *Persoonia nutans*

3.2.1.1 General habitat preference (OEH, 2019)

The ecology of *Persoonia nutans* is poorly known, and this species has a disjunct distribution. The southern population of *Persoonia nutans*, which includes this population, is isolated and consists of relatively small populations in the Liverpool, Campbelltown, Bankstown and Blacktown local government areas. The southern population occupies tertiary alluvium extending onto shale sandstone transition communities into Cooks River/Castlereagh Ironbark Forest.

Habitat preference is not well understood; however, abundance at sites appears to be related to disturbance history, as sites with higher abundance appear to be more disturbed. The frequency of disturbance, particularly fire, is of vital importance for the management and conservation of *Persoonia nutans*.

The species prefers low woodland communities dominated by Hard-leaved Scribbly Gum and Narrow-leaved Apple with a diverse understorey of sclerophyllous shrub species. *Persoonia nutans* is an obligate seeder and, therefore, may be difficult to detect during targeted surveys even if it is present, as it can be stored in the seed bank, and the number of above-ground individuals will fluctuate in space and time (DEC 2006).

3.2.1.2 Offset Site P1 (*Persoonia nutans*)

The patch of Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland within offset site P1 recorded a VI score of **77.3/100**. This patch of vegetation had a complete structure including native species from each vegetation stratum, canopy, shrub and ground layer. Weed cover across the offset site was low, with only scattered occurrences of African Lovegrass present (0.5% cover). The habitat assessment results for site P1 are presented within Table 13 and discussed below.

Table 13. Habitat assessment summary: EPBC Offset Site P1

Attributes	PCT Benchmark	Survey results	Dominant species
Tree cover	28	16.5	<i>Angophora bakeri</i> (10%), <i>Eucalyptus racemosa</i> (5%), <i>Eucalyptus parramattensis</i> (1%)
Shrub cover	82	61.4	<i>Melaleuca nodosa</i> (35%), <i>Leptospermum trinervium</i> (20%), <i>Hakea sericea</i> (2%)

Attributes	PCT Benchmark	Survey results	Dominant species
Ground cover	66	3.2	<i>Entolasia stricta</i> (2%), <i>Microlaena stipoides</i> (0.5%), <i>Lomandra longifolia</i> (0.5%)
Exotic cover	NA	0.5	<i>Eragrostis curvula</i> (0.5%)
VI Score	100	77.3	

The upper stratum comprised four tree species: *Acacia paramatensis* (Parramatta Wattle), *Angophora bakeri* (Narrow-leaved Apple), *Eucalyptus paramatensis* (Parramatta Red Gum) and *Eucalyptus racemosa* (Hard-leaved Scribbly Gum). Canopy cover was 16.5 percent across the quadrat.

Native shrub cover was 61.4 percent across the quadrat, with 14 different species identified in this stratum. The dominant shrub species included *Melaleuca nodosa* (Prickly-leaved Paperbark), *Hakea sericea* (Bushy Needlewood), *Leptospermum trinervium* (Slender Tea-tree), *Acacia longifolia* (Sydney Green Wattle), *Leptospermum parvifolium* (Lemon-scented tea-tree) and *Melaleuca decora* (Tall Paperbark).

Eleven ground layer species were recorded within the BAM vegetation quadrat, having a combined cover of 3.2 percent. The dominant ground cover species included *Entolasia stricta* (Wiry Panic), *Microlaena stipoides* (Weeping Grass), and *Lomandra longifolia* (Spiny-headed Mat Rush).

Weeds cover was generally low across the offset site, with one exotic flora species being identified. Weed cover was recorded as 0.5 percent, comprising of African Lovegrass. This species was sparse within the bushland but became more prominent on the northern edge of the offset site nearest the access road. A representative photograph of the habitat within the P1 offset site is provided in Plate 2 below.



Plate 2 Vegetation within EPBC Offset Site P1

3.2.1.3 Offset Site P2 (*Persoonia nutans*)

The patch of Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland within offset site P2 recorded a VI score of **59.2/100**. The vegetation assemblage is fully structured with an established canopy, shrub layer and developing ground layer. There is little to no weed occurrence within the core of the offset site. Invasive grasses are present on the northern boundary of the offset site, on the peripheries of natural bushland next to a vehicle access track.

The habitat assessment results for site P2 are presented within Table 14 and discussed below.

Table 14. Habitat assessment summary: EPBC Offset Site P2

Attribute	PCT Benchmark	Survey results	Dominant species
Tree cover	28	23.0	<i>Eucalyptus racemosa</i> (15%), <i>Acacia parramattensis</i> (5%), <i>Eucalyptus parramattensis</i> (2%)
Shrub cover	82	26.4	<i>Melaleuca nodosa</i> (20%), <i>Exocarpos cupressiformis</i> (3%), <i>Melaleuca decora</i> (2%)
Ground cover	66	13.4	<i>Lomandra longifolia</i> (10%), <i>Microlaena stipoides</i> (2%)
Exotic cover	NA	2.1	<i>Eragrostis curvula</i> (3%)
VI Score	100	59.2	

Four species were present within the canopy stratum: *Acacia paramatensis* (Parramatta Wattle), *Angophora bakeri* (Narrow-leaved Apple), *Eucalyptus paramatensis* (Parramatta Red Gum) and *Eucalyptus racemosa* (Hard-leaved Scribbly Gum). The canopy recorded a cover of 23 percent across the quadrat.

A total of 11 shrub species were identified in the vegetation quadrat. The dominant shrubs species present include *Melaleuca nodosa* (Pricly-leaved Paperbark), *Exocarpos cupressiformis* (Native Cherry) and *Melaleuca decora* (Tall Paperbark). The total shrub cover recoded for the quadrat was 26.4 percent.

The ground stratum covered 13.4 percent, including 13 different flora species. The dominant ground covers species included Spiny-headed Mat-rush, *Lomandra longifolia* (Spiny-headed Mat Rush), *Microalena stipoides* (Weeping grass) and *Entolasia stricta* (Wiry Panic).

Weeds cover was generally low across the offset site, with one exotic flora species being identified. Weed cover was recorded as 2.1 percent, comprising African Lovegrass. Patches of African Lovegrass are present along the northern boundary of the offset site on the periphery of bushland next to an access track.

A representative photograph of the habitat within the P2 offset site is provided in Plate 3 below.



Plate 3 Vegetation within EPBC Offset Site P2

3.2.1.4 Offset Site P3 (*Persoonia nutans*)

The patch of Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland within offset site P3 recorded a VI score of **59.2/100**. The assemblage has recovered significantly since the wildfire and contains a diverse shrub and ground cover stratum. Within the natural bushland, weed occurrence is sparse. Weed occurrence was only observed on the northern boundary, on the peripheries of bushland adjacent to a vehicle access track.

The habitat assessment results for site P3 are presented within Table 15 and discussed below.

Table 15. Habitat assessment summary: EPBC Offset Site P3

Attributes	PCT Benchmark	Survey results	Dominant species
Tree cover	28	26.0	<i>Angophora bakeri</i> (20%), <i>Eucalyptus racemosa</i> (5%) <i>Acacia binervia</i> (1%)
Shrub cover	82	12.6	<i>Petrophile pulchella</i> (2%), <i>Hakea sericea</i> (2%) <i>Melaleuca decora</i> (2%), <i>Leptospermum parvifolium</i> (2%)
Ground cover	66	22.1	<i>Entolasia stricta</i> (15%), <i>Microlaena stipoides</i> (5%) <i>Cyathochaeta diandra</i> (1%)
Exotic cover	NA	0.5	<i>Eragrostis curvula</i> (0.5%)
VI Score	100	64.9	

Three canopy species were identified within the vegetation quadrat: *Angophora bakeri* (Narrow-leaved Apple), *Eucalyptus racemosa* (Hard-leaved Scribbly Gum) and *Acacia binervia* (Coast Myall). Canopy cover accounted for 26 percent across the quadrat.

Shrubs accounted for 12.6 percent cover across the quadrat. A total of 19 native shrubs species were identified, including *Petrophile pulchella* (Conesticks), *Hakea sericea* (Bushy needlewood), *Melaleuca decora* (Tall Paperbark) and *Leptospermum parvifolium* (Lemon-scented Tea Tree).

A total of 21 ground cover species was recorded within the vegetation quadrat, accounting for a cover of 22.1 percent. Groundcover species identified included *Entolasia stricta* (Wiry Panic), *Cyathochaeta diandra* (Sheath Rush), and *Microlaena stipoides* (Weeping Grass).

African Lovegrass was the only exotic species recorded within the vegetation quadrant. This invasive species recorded a percentage cover of 0.5 percent. Similarly to other Nodding Geebung offset sites, weed occurrence was mainly restricted to the peripheries of intact bushland adjacent to a vehicle access track.

A representative photograph of the habitat within the P3 offset site is provided in Plate 4 below.



Plate 4 Vegetation within EPBC Offset Site P3

3.2.1.5 Offset site P4 (*Persoonia nutans*)

The patch of Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland within offset site P4 recorded an average VI score of **64.9/100** across the two vegetation quadrats. Due to the large size of the offset site, two vegetation quadrats were conducted to give a representative condition score for vegetation. The results of each quadrat area are summarised in Table 16 **Error! Reference source not found.** and Table 17 and discussed below. The 2018 wildfire did not impact this patch of bushland. This assemblage has an established canopy and a well-developed tall shrub layer, transitioning from a densely shrubby woodland to open woodland. Where shrubs density was less, ground covers were more prominent.

Table 16. Habitat assessment summary: EPBC Offset Site P4(A)

Attributes	PCT Benchmark	Survey result	Dominant species
Tree cover	28	10.0	<i>Eucalyptus parramattensis</i> (5%), <i>Angophora bakeri</i> (5%)
Shrub cover	82	39.8	<i>Melaleuca nodosa</i> (20%), <i>Hakea sericea</i> (12%), <i>Leptospermum trinervium</i> (5%)
Ground cover	66	24.2	<i>Empodisma minus</i> (20%), <i>Lomandra longifolia</i> (2%) <i>Entolasia stricta</i> (2%)
Exotic cover	NA	0	None
VI Score	100	65.7	

Table 17. Habitat assessment summary: EPBC Offset Site P4(B)

Attributes	PCT Benchmark	Survey results	Dominant species
Tree cover	28	10.0	<i>Eucalyptus racemosa</i> (5%), <i>Angophora bakeri</i> (2%) <i>Eucalyptus parramattensis</i> (2%)
Shrub cover	82	34.8	<i>Melaleuca nodosa</i> (25%), <i>Kunzea capitata</i> (3%) <i>Hakea sericea</i> (2%)
Ground cover	66	32.7	<i>Empodisma minus</i> (25%), <i>Entolasia stricta</i> (5%)
Exotic cover	NA	0	None
VI Score	100	70.5	

The dominant canopy species at offset site P4 is Hard-leaved Scribbly Gum; however, a number of other tree species are present, albeit at lower abundances, including *Angophora bakeri* (Narrow-leaved apple) and *Eucalyptus parramattensis* (Parramatta Red Gum). Canopy cover was recorded at 10 percent at both plot locations within the offset site. Both canopy cover scores were lower than the benchmark tree cover scores for the Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland community.

Shrub cover differs through the offset site, with some areas having a more open shrubby structure and others a dense thicket of shrubs. Shrub cover at two locations recorded 39.8 percent and 34.8 percent. A suite of tall shrub species are common across the site, including *Melaleuca nodosa* (Prickly-leaved Paperbark), *Hakea sericea* (Bushy Needlewood), *Leptospermum trinervium* (Slender Tea-tree) and *Kunzea capitata* (Heath Kunzea). A total of 18 different shrubs species was recorded across vegetation quadrats conducted within the offset site.

A total of 21 ground cover species were recorded across the two vegetation quadrats conducted within offset site P4. The ground covers differed across the sites measuring 24.2 percent at one location and 32.7 percent at another. Forbs and twining plants were common within the ground stratum. Ground species present included Spiny-head Mat-rush, *Trachymene incisa* (Wild Parsnip), Sheath Rush, *Billardiera scandens* (Hairy Apple Berry), *Hardenbergia violacea* (False Sarsaparilla) and *Cassytha glabella* (Slender Devil's Twine). *Empodisma minus* (Wire Rush) and *Entolasia stricta* (Wiry Panic) were dominant across both sites.

No exotic species were recorded across the two vegetation quadrats conducted within offset site P4.

A representative photograph of the habitat within the P4 offset site is provided in Plate 5 below.



Plate 5. Vegetation within EPBC Offset Site P4

3.2.2 Small-flower Grevillea

3.2.2.1 General habitat preference (OEH, 2019)

Small-flower Grevillea has a habitat preference for sandy or light clay soils, usually over thin shales, often with lateritic ironstone gravels and nodules. Populations of Small-flower Grevillea in the Sydney region usually occur on Tertiary sands and alluvium and soils derived from the Mittagong Formation.

This species occurs in a range of vegetation types, from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Southern Sydney occurrences are typically at 100-300m ASL. Often occurs in open, slightly disturbed sites such as along tracks.

Habitat preference of this species also includes open, slightly disturbed sites such as along tracks.

3.2.2.2 Offset Site G1 (Small-flower Grevillea)

The Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland patch within offset site G1 recorded a VI score of **54.5/100**. The assemblage has a sparse canopy cover and a well-developed shrub and ground stratum. A diversity of native flora species are present, and the occurrence of weeds was absent. The habitat assessment results for site G1 are presented within Table 18 and discussed below.

Table 18. Habitat assessment summary: EPBC offset site G1

Attributes	PCT Benchmark	Survey results	Dominant species
Tree cover	28	20.5	<i>Eucalyptus parramattensis</i> (15%), <i>Eucalyptus racemosa</i> (3%), <i>Angophora bakeri</i> (2%)
Shrub cover	82	13.8	<i>Leptospermum trinervium</i> (5%), <i>Melaleuca nodosa</i> (5%) <i>Hakea sericea</i> (2%)
Ground cover	66	25.4	<i>Empodisma minus</i> (20%), <i>Entolasia stricta</i> (5%)
Exotic cover	NA	0	
VI Score	100	54.5	

The canopy stratum comprises three different tree species and recorded a cover of 20.5 percent within the vegetation quadrat. Trees species within the offset site include *Angophora bakeri* (Narrow-leaved Apple), *Eucalyptus paramatensis* (Parramatta Red Gum) and *Eucalyptus racemosa* (Hard-leaved Scribbly Gum).

Shrub cover was relatively uniform across the offset site and continues to regenerate following the wildfire in 2018, recording a cover of 13.8 percent albeit less than the cover recorded in 2023. A total of 13 different shrubs species were identified, including *Melaleuca nodosa* (Prickly-leaved Paperbark), *Hakea sericea* (Bushy Needlwood) and *Leptospermum trinervium* (Flaky-barked Tea-tree).

Ground cover species, including grasses, forbs, herbs and scrambling plants, recorded a cover of 25.4 percent across the vegetation quadrat, a significant increase in the past year. 17 different species were identified, dominated by *Empodisma minus* (Wire Rush) and *Entolasia stricta* (Wiry Panic). The offset site vegetation quadrat recorded no weed cover. A representative photograph of the habitat within the P4 offset site is provided in Plate 5 below.



Plate 6. Vegetation within EPBC Offset Site G1

3.3 Photo point monitoring

Annual monitoring photographs are presented in Appendix C.

4 REVIEW OF CURRENT MANAGEMENT ACTIONS

The offset sites were established within high-condition patches of native vegetation within the BA341 biobank site. This has minimised the need for management actions to protect the extant populations of *Grevillea parviflora* subsp. *parviflora* and *Persoonia nutans* since 2019. Despite the 2018 wildfire (a stochastic event) which killed a large proportion of the adult plants in the southern offset sites (P1, P2, P3 and G1), other threats including feral animal grazing, inappropriate access from public leading to trampling or habitat degradation (i.e. dumping), which can be managed are not apparent or jeopardising the remaining individuals. However, invasive weed species, namely African Lovegrass, are increasingly threatening the preferred habitat for *Persoonia nutans* in P1, P2 and P3.

Being a biobank site, native vegetation and biodiversity values are subject to improvement through a combination of management activities including weed removal, bush regeneration, soil stabilisation and habitat enhancement. In 2022, EcoLogical was engaged by National Internodal (owner of the BA341 biobank site) to commence active management of the site. Prior to this the biobank site was being passively managed, which was restricted to maintenance of infrastructure (i.e. fencing, gates), erosion and sediment control works and annual monitoring.

In 2024 EcoLogical have conducted a suite of bush regeneration activities (weed removal, revegetation, and brush matting) across the broader biobank site, however, have not undertaken these activities in the locations of the offset sites. Previously, management actions were better focused in other areas which have a high cover of aggressive weed species and ongoing issues with erosion. However, given the evidence that increasing cover of the exotic African Lovegrass is decreasing the effectiveness of juvenile *Persoonia nutans* recruitment, weed control measures, such as selective granular herbicide, should be implemented along the access tracks of the P1, P2 and P3 offset areas.

Some targeted weed control has occurred along the access and firetails in the Wattle Grove Offset site, which are located near to the threatened species offset sites, including brush cutting and careful spot spraying with herbicide targeting the following aggressive weed species: African Lovegrass, *Senecio madagascariensis* (Fireweed), *Conyza* sp. (Fleabane), *Cortaderia selloana* (Pampass Grass), *Paspalum* sp. (Paspalum), *Setaria* sp. (Pigeon Grass) and *Andropogon virginicus* (Whiskey Grass). Both African Lovegrass and (*Andropogon virginicus*) Whisky grass have been identified as weeds occurring in proximity to *Persoonia nutans* despite the Conservation Advice indicating that the poor nutrient soil communities within which these species having a low susceptibility to weed invasions (NSW NPWS, 2004). Treatment of these weeds along access trails and nearby areas will reduce the potential for further weed encroachment which would likely lead to habitat degradation. However, it will not resolve the ongoing issues of weed encroachment and inundation from African Lovegrass currently ongoing in P1, P2 and P3 offset areas.

An evaluation of the management and performance of offset sites against the recovery strategies of *Grevillea parviflora* subsp. *parviflora* (DEWHA 2008) and *Persoonia nutans* (DEC 2006) has been included Table 19.

Table 19. Assessment of the offset sites and implemented management action against the recovery strategies of Small-flowered Grevillea (DEWHA 2008) and Persoonia nutans (DEC 2006)

Threatened species	Recovery strategies	Timing and duration	Performance criteria		Comments
			Objective	Status (2024)	
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Restrict access to sites	Year 1: 20 years	Fencing installed and maintained to remain functional	Achieved	An existing cyclone fence follows the external boundary of the Wattle Grove offset site. All EPBC offset sites are within the Wattle Grove offset site boundary fence. EPBC offset sites have been demarcated with metal pickets. Exclusion fencing for individual offset sites has not been erected. All areas within the boundary fence are secure and can only be accessed by relevant personnel with a regulated key managed by Knight Frank. Additional fencing has been installed along the MPE operational Rail Link passing through the western corner of the Wattle Grove offset site, delineating the bushland environment from the rail corridor. During the 2024/2025 survey period, the boundary fence was found to have numerous breaches along its length. At its worst, a minimum of 15m of fence line is missing. It is recommended that fence management issues be corrected urgently to ensure the protection of the Wattle Grove offset site.
	Create and maintain weed-free bushland areas	Primary weed control: Year 1-5	<5% weed cover	Achieved	No weed control works have been conducted within the <i>Grevillea parviflora</i> subsp. <i>parviflora</i> offset site during the 2024/2025 monitoring year. However, weed levels within the offset site remain low and don't threaten <i>Grevillea parviflora</i> subsp. <i>parviflora</i> at this stage. Site inspection did not identify any notable weed infestations.
	Ensure appropriate fire regimes for species	Conduct ecological burns	Monitoring of burn site is to be undertaken every	Achieved	A wildfire directly impacted the EPBC offset site in April 2018.

Annual EPBC Offset Site Monitoring (2024-25)

Threatened species	Recovery strategies	Timing and duration	Performance criteria		Comments
			Objective	Status (2024)	
	(minimum fire-free period of 8 - 15 years)	every 6-20 years in winter: 20 years	six months. The net gain in the number of stems over the duration of management to meet the offset obligation		No ecological burns will be conducted within the EPBC offset site until 2026. At this time, the appropriateness of an ecological burn will be assessed to determine whether it will positively impact the populations of <i>Grevillea parviflora</i> subsp. <i>parviflora</i> .
	Avoid spraying herbicide within the vicinity of the species	At all times (monitored annually in spring): 20 years	No damage to threatened species through inappropriate herbicide use. Evidence would trigger corrective actions	Achieved	During the monitoring year, no herbicide spraying has been conducted within the offset site.
	Monitor species for grazing or damage, this may indicate large macropod overabundance to inform control frequency	Monitored annually in spring: 20 years	Evidence of excessive grazing would trigger corrective actions under the overabundant herbivore management action plan	Achieved	No evidence was observed to suggest that <i>Grevillea parviflora</i> subsp. <i>parviflora</i> have been impacted through grazing or trampling by large macropods.
	Protect individuals from pedestrian traffic along formal tracks, use fencing if required	Year 1: 20 years	Fencing installed and maintained to remain functional	Achieved	The location of EPBC offset sites have been demarcated using metal star pickets with secured yellow caps. The delineation of boundaries will act to remind personnel working within the Wattle Grove offset area of a sensitive area. All personnel working with the Wattle Grove offset area should be aware of sensitive areas during the initial biobank site induction. During the 2024/2025 survey period, the boundary fence was found to have numerous breaches along its length. At its worst, a minimum of 15 metres of fence line is missing.
	Ensure that this species is considered	At all times: 20 years	Net gain in the number of stems over the duration of management	Achieved	The Moorebank Avenue Realignment Works (MARW) project is currently in detailed design phase. The project dissects the southern position of the Wattle Grove Offset Area, following an easement

Annual EPBC Offset Site Monitoring (2024-25)

Threatened species	Recovery strategies	Timing and duration	Performance criteria		Comments
			Objective	Status (2024)	
	in all works and future planning matters		to meet the offset obligation		through the BA341 biobanks site, and passes approximately 30 metres to the north-west of the G1 offset site. The project will not directly impact the offset site; however, it is possible that indirect impacts could occur through construction and operation of the project like introduction of novel weeds and weed encroachment which could lead to habitat degradation. It is anticipated that mitigation measures have been considered and adopted by the MARW during detailed design that will minimise impact to native vegetation beyond the construction limits of the project. Regardless, being a biobank site increased focus will likely be shifted to locations (i.e. new edges) which are adjacent to the new road corridor. The bush regeneration contractor will likely have an increased focus on minimising/preventing indirect impacts including introduction of novel weeds and weed encroachment into the biobank site.
<i>Persoonia nutans</i>	Restrict access to sites	Year 1 - 20 years	Fencing installed and maintained to remain functional	Achieved	An existing cyclone fence follows the external boundary of the Wattle Grove offset site. All EPBC offset sites are within the Wattle Grove offset site boundary fence. EPBC offset sites have been demarcated with metal pickets. Exclusion fencing for individual offset sites has not been erected. All areas within the boundary fence are secure and can only be accessed by relevant personnel with a regulated key managed by Knight Frank. Additional fencing has been installed along the MPE operational Rail Link passing through the western corner of the Wattle Grove offset site, delineating the bushland environment from the rail corridor.

Annual EPBC Offset Site Monitoring (2024-25)

Threatened species	Recovery strategies	Timing and duration	Performance criteria		Comments
			Objective	Status (2024)	
					During the 2024/2025 survey period, the boundary fence was found to have numerous breaches along its length. At its worst, a minimum of 15 metres of fence line is missing. It is recommended that fence management issues be corrected urgently to ensure the protection of the Wattle Grove offset site.
	Create and maintain weed-free bushland areas	Primary weed control: Year 1-5	<5% weed cover	Achieved	Weed levels across <i>Persoonia nutans</i> offset sites have plateaued. BAM vegetation quadrat conducted within offset sites P1, P2, P3 and P4(A and B) recorded weed covers of less than five percent; 0.5, 2.1, 0.5, 0 and 0 respectively. Weed covers at each <i>Persoonia nutans</i> offset site are estimated at less than 5 percent cover. Weed presence consists, of individuals on the peripheries of natural bushland. The invasive grass species African Lovegrass was observed at three of the offset areas, P1, P2 and P3. Most occurrences of this species are restricted to the disturbed edges of bushland parallel to existing access tracks. There is some evidence to suggest that weeds identified within the offset sites are negatively impacting <i>Persoonia nutans</i> individuals with smothering from African Lovegrass observed to be hindering the spread of <i>Persoonia nutans</i> in P1, P2 and P3 offset areas
	Ensure appropriate fire regimes for species (minimum fire-free period of 10 years)	Annually in spring: 20 years	Monitoring of burn site is to be undertaken every six months. Net gain in the number of plants over the duration of management to meet the offset obligation	Not achieved	A wildfire directly impacted the EPBC offset sites in April 2018. This wildfire did not coincide with timings or suitable conditions for ecological burning with respect to <i>Persoonia nutans</i>. No ecological burns will be conducted within the EPBC offset site until 2026. At this time, the appropriateness of an ecological burn will be assessed to determine whether it will positively impact the populations of <i>Persoonia nutans</i>.

Annual EPBC Offset Site Monitoring (2024-25)

Threatened species	Recovery strategies	Timing and duration	Performance criteria		Comments
			Objective	Status (2024)	
	Monitor site for <i>Acacia baileyana</i> , which may outcompete species	Annually in spring: 20 years	Evidence of encroachment by this species would trigger corrective actions (see section)	Achieved	<i>Acacia baileyana</i> was not identified within the BAM monitoring quadrates undertaken to assess habitat quality, nor was it identified in other areas of the offset sites.
	Monitor species for grazing or damage, this may indicate large macropod overabundance to inform control frequency	Monitored annually in spring: 20 years	Evidence of excessive grazing would trigger corrective actions under the overabundant herbivore management action plan (see Section 7.2)	Achieved	No evidence was observed to suggest that <i>Persoonia nutans</i> have been impacted through grazing or trampling by large macropods.
	Protect individuals from pedestrian traffic along formal tracks, use fencing if required	Year 1: 20 years	Fencing installed and maintained to remain functional	Not achieved	The location of EPBC offset sites have been demarcated using metal star pickets with secured yellow caps. The delineation of boundaries will act to remind personnel working within the Wattle Grove offset site of a sensitive area. All personnel working with the Wattle Grove offset area should be aware of sensitive areas during the initial biobank site induction. During the 2024/2025 survey period, the boundary fence was found to have numerous breaches along its length. At its worst, a minimum of 5 metres of fence line is missing.
	Ensure that this species is considered in all works and future planning matters	At all times: 20 years	Net gain of 16 plants over the duration of management to meet the offset obligation	Achieved	The Moorebank Avenue Realignment Works (MARW) project is currently in detailed design phase. The project dissects the southern position of the Wattle Grove Offset Area, following an easement through the BA341 biobanks site. The project will not directly impact the offset sites of <i>Persoonia nutans</i> and is unlikely to indirectly impact habitat or the present populations due being separated from the project footprint by Anzac Creek. It is possible that removal and remediation of a section of disused rail spur (DURS) at the southern

Annual EPBC Offset Site Monitoring (2024-25)

Threatened species	Recovery strategies	Timing and duration	Performance criteria		Comments
			Objective	Status (2024)	
					extent of the Wattle Grove offset area may be initiated as part of the MARW project of works. The remediation/rehabilitation footprint of DURS does not intersect EPBC offset sites. It is anticipated that the MPE Stage 1 CEMP (under which the DURS works will be undertaken) would include appropriate mitigation measures to manage impacts associated with the surrounding vegetation (within the EPBC offset site).

5 DISCUSSION & RECOMMENDATIONS

The 2024 survey marked the sixth monitoring event for offset sites P1, P2, P3 and G1 and the fifth monitoring event for offset site P4. Comparisons can be made between this year's data and the results of previous monitoring events to analyse population dynamics of *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* within EPBC offset sites (P1-P4 and G1), specifically:

- Fluctuations in population size and distribution; and
- Response to disturbance and/or management actions.

The condition of vegetation has been scored, and a habitat assessment has been conducted for offset sites across monitoring periods to provide more context to changes in *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* populations.

Changes to *Persoonia nutans* and *Grevillea parviflora* subsp. *parviflora* populations across offset sites P1, P2, P3, P4 and G1 are discussed below.

5.1.1 *Persoonia nutans*

A comparison of results for *Persoonia nutans* between the 2019 and 2024 monitoring events are discussed below.

Population assessment

5.1.1.1.1 Population Census Summary

A total of 46 individuals of *Persoonia nutans* were identified across offset sites P1, P2 and P3 during the 2024 monitoring event in comparison to 36 individuals recorded in 2023, 37 individuals recorded in 2022, 51 individuals recorded in 2021, 90 individuals recorded in 2020, and 112 individuals recorded in 2019.

A total of 34 individuals were recorded in P4, which is a decrease from 41 individuals recorded during the establishment of the site in 2020. Across all sites, the number of *Persoonia nutans* individuals has decreased from 92 (2021) to 80 individuals recorded during the 2024 surveys.

The offset populations of *Persoonia nutans* have decreased and remained below the start number of individuals (155) since 2020 across all offset sites (P1-P4). One *Persoonia nutans* was identified within P2 for the third year in a row and seven in P1 for the second year in a row. Since 2023 an increase has been observed in offset sites P3 and P4. A comparison of population counts at each offset site across survey years is presented in Appendix E.

5.1.1.1.2 Population Threats and Dynamics

Of the 68 individuals recorded during the previous survey (2023) across all four sites, 16 were juvenile plants considered to be sensitive to environmental variables and at reasonable risk of perishing. During the current surveys only 12 of the 80 individuals were identified as juveniles. Considering 60 of these 80 individuals were existing (20 new individuals), 8 marked individuals have perished since the 2023 surveys. Of the 60 individuals that were relocated 56 were adults, and 4 were juveniles, inferring that 4 juveniles recorded in 2023 survived to adult hood whilst the majority have perished, replaced with 12 new recruits. The 12 "new" adults are best explained by having lost tags or not previously been observed as *Persoonia nutans* take longer than one year to reach maturity. The high turnover rate of recruitment and mortality may result from the 2018 fires that burnt sites P1, P2 and P3. Following the fires, habitat space may have been made available to *Persoonia nutans*, allowing them

to access limiting resources of soil moisture, light, and nutrients. As other plants in the fire-affected sites recover, they may have shaded out the juvenile *Persoonia nutans* plants, resulting in plant mortality. However, too frequent fire is thought to be detrimental to *Persoonia nutans* populations, although the critical fire frequency for *Persoonia nutans* has not yet been determined.

Persoonia nutans populations are known to be dynamic throughout the landscape and fluctuations in space and time of above ground individuals is considered to be a natural occurrence (DEC 2005). These fluctuations make the number of individuals and populations difficult to estimate (DEC 2005). To reach the offset requirements, the total number of individuals needs to reach 155 with only 80 individuals counted in this monitoring year. To achieve 155 individuals of *Persoonia nutans*, a higher persistence of juveniles is required.

It was anticipated that a proportion of the juvenile *Persoonia nutans* observed during monitoring events would not survive the following year due to several environmental and ecological factors. The majority of juvenile plants recorded are in dense clusters containing many individuals. It is possible that the death of the juvenile plants represents a natural dieback whereby the strongest plants in the cluster survive and utilise the available resources. In other locations of the Wattle Grove offset area, which were unaffected by the 2018 wildfire, large numbers of adult *Persoonia nutans* are present though are rarely observed in close proximity to each other. It is expected that only a small number of individuals within clusters of *Persoonia nutans* juveniles will persist to become adult plants.

The current surveys recorded a net increase of 12 individuals (20 new and 8 deaths), across the four *Persoonia nutans* offset sites with offset areas P1 and P2 recording the same total number of individuals and an increase of 10 and 2 respectively across sites P3 and P4. New recruitment at sites P3 and P4 is a positive sign that *Persoonia nutans* is continuing to germinate and replace individuals that perish. While potentially at sites P1 and P2 the population has stabilised. **This is the first reported overall increase in *Persoonia nutans*' population trend since the establishment of the offset site.**

New individuals were generally recorded within or in close proximity to existing clusters of juveniles. At P3, juvenile individuals were also re-located in areas away from dense clusters, similar to where some juveniles were recorded during the 2023 surveys. This could indicate that an increase in the distribution of *Persoonia nutans* across the site will reduce interspecies competition and may provide a greater chance of individuals persisting to maturity.

5.1.1.1.3 Conclusions

Using the EPBC offsetting policy, it was calculated that 155 *Persoonia nutans* require conservation and management within offset sites, with a net gain of 16 *Persoonia nutans* individuals over a 20-year period to achieve the required offset target (total population of 171 individuals). Unforeseen impacts from the 2018 wildfire saw the majority of the *Persoonia nutans* population within offset sites burnt. Regeneration of the species over the past four years has seen a fluctuation in the recovery of the population, with 133 individuals recorded in 2020 survey, 92 in the 2021 survey, 68 individuals recorded in the 2022 and the 2023 survey and 80 individuals recorded in the 2024 survey. Whilst this survey year has marked the first population growth of *Persoonia nutans*, it is considered that some level of intervention will be required to achieve the final net gain population size (171 individuals) across the offset sites. Corrective actions were suggested in previous reports to promote the germination of *Persoonia nutans*. This included the establishment of experimental disturbance plots for offset sites P1, P2 and P3 (discussed in more detail below). Another corrective action to be considered includes the planting of individuals. This would involve seed collection, germination and establishment of seedlings in a greenhouse, followed by planting during the appropriate seasonal and climatic conditions.

However, these corrective actions have yet to be put in place and implemented. It is anticipated that with adaptive management and ongoing monitoring, the population of *Persoonia nutans* within offset sites will increase to 171 individuals within the 20-year time frame.

Habitat assessment and potential impacts

5.1.1.1.4 Current Habitat Conditions

Current surveys found that patches of Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland within offset site P1, P2, P3 and P4 achieved a significantly greater VI score across the board, than was recorded in 2023 (Table 20). An increasing or decreasing vegetation condition does not necessarily reflect an increase in habitat value for *Persoonia nutans*, as the abundance of this species can often be related to disturbance history. Sites with higher abundance appear to be more disturbed (DPIE 2019). Exotic species cover was recorded to be relatively low across all offset sites over the 2024 monitoring period. Of note there was a considerable increase in shrubs at P1 from 20.2 per cent cover in 2023 to 61.4 per cent cover in 2024, an increase in 41.2 per cent shrub cover in one year.

Table 20. A summary of changes to vegetation condition at offset sites P1, P2, P3, P4a and P4b across monitoring periods

Offset site	Monitoring year	Cover across BAM quadrat				VI score
		Tree	Shrub	Groundcover	Exotic	
P1	2019	11.5	47.7	4.2	0.2	52.5
	2020	16	46	6.8	0.1	64.8
	2021	20	41.1	14.1	0.2	64.4
	2022	20	43.7	9.6	0.3	68.6
	2023	7.5	20.2	1.2	0.1	68.6
	2024	16.5	61.4	4.6	0.8	77.3
P2	2019	52.5	4.7	19.4	0.6	51.8
	2020	47.3	15.5	22.1	0	56.5
	2021	47	21.5	41.9	0.2	67.2
	2022	30.2	10.4	6.5	0.5	41.8
	2023	15	47	18.3	3	41.8
	2024	23	26.4	14.5	2.1	59.2
P3	2019	22.5	8	17.3	0.1	51.5
	2020	36	5.7	22.9	0.2	59.6
	2021	37.2	12.6	26	0.2	63.5
	2022	37	9.7	17.6	0.2	55.8

Offset site	Monitoring year	Cover across BAM quadrat				VI score
		Tree	Shrub	Groundcover	Exotic	
	2023	25.1	3.1	3.1	0.5	55.8
	2024	26	12.6	23.2	0.5	64.9
P4a	2020	45	43.9	25.4	0	73.4
	2021	40.5	49.8	26.2	0	72.4
	2022	8.1	15	7.4	0	37
	2023	0.8	37.9	26.9	0	37
	2024	10	39.8	25	0	65.7
P4b	2020	32.4	18	8.2	50	50
	2021	32.2	46.4	19.7	0.1	70.6
	2022	12.1	40.1	4.3	0.1	59.7
	2023	17	56.9	23.3	0	59.7
	2024	10	34.8	33.6	0	70.5

5.1.1.1.5 Current Threats

No obvious signs of impact on *Persoonia nutans* were observed within the offset sites. Some minor insect damage was observed on a few individuals; however, it appears that this damage may be existing from previous years. There were no signs of foraging or trampling upon this species by mammals.

Adult *Persoonia nutans* is at less risk of being outcompeted by other plant species compared to juveniles of its species. Populations of *Persoonia nutans* at offset sites P1 and P3 consist mainly of juvenile plants, which are more susceptible to being outcompeted by native and exotic plants than mature plants. Currently, there is significant competition in the shrub and understorey layers as there is an overabundance of post-fire recruiters like *Acacia decurrens* (Black Wattle), *Imperata cylindrica* (Blady Grass), *Pimelea linifolia*, *Platysace ericoides*, *Pultenaea villosa* (Hairy Bush-pea) and *Trachymene incisa*. An increase in native shrub and ground stratum vegetation cover within offset sites P1, P2 and P3 may be reducing the availability of space and resources (light, water etc.) for *Persoonia nutans* to regenerate. Juvenile *Persoonia nutans* were observed being smothered by the native vine Devils Twine in offset site P3. However, it is not considered likely that this would result in the death of plants. Increased competition by native species provides reasoning for why the majority of *Persoonia nutans* individuals in offset sites P1 and P3 are located on the peripheries of intact bushland in disturbed, more open areas, amongst the exotic species African Lovegrass where there is less competition from other plants.

The cover of African Lovegrass is increasing on the edges of native bushland, with monitoring during this year and previous years demonstrating that juvenile *Persoonia nutans* in the areas adjacent to the access tracks in P1-P3 prefer areas with less African Lovegrass cover.

It is likely that too frequent disturbance, and potentially a long-term absence of disturbance, may be detrimental to the persistence of *Persoonia nutans* in local populations. In this instance, the presence of a seed bank is essential for persistence after a fire event. If fires occur at an interval too small to allow the re-establishment of a soil-stored seed bank following a previous fire event, then local extinction will occur. A long-term absence of fire may also be detrimental to the persistence of the species, as recruitment is likely to be largely dependent upon disturbance. This critical fire frequency rate has not yet been determined. However, the NSW National Parks and Wildlife Service (NPWS) suggests greater than 7-year intervals, and the Threatened Species Hazard Reduction List for the Bushfire Environmental Assessment Code states that fire should not occur more frequently than once every ten years in the habitat of *Persoonia nutans* (DEC 2006).

Corrective actions

It is evident that *Persoonia nutans* populations within offset sites that burned in 2018 are fluctuating, with new individuals germinating and other juvenile plants perishing. This fluctuation is due to the opportunistic nature of post-bushfire vegetation recovery and the high levels of competition amongst post-fire recruitment specialist species. Although a moderate proportion of juvenile *Persoonia nutans* identified during the 2019 monitoring period have perished, each proceeding monitoring event has recorded recruitment suggesting that population recovery is ongoing.

Nothing is known of the longevity of the soil-stored seed bank of *Persoonia nutans*. It appears germination is promoted, not only by fire, but also by physical disturbance (NSW NPWS 1996; D. Wotherspoon pers. com.). It is not known whether the seed bank is completely exhausted by a single fire. The extent to which germination occurs in the absence of disturbance is unknown, although observations during the 1996 survey (NSW NPWS 1996) indicate such germination is likely to be rare.

The localised nature of recruitment/regeneration of *Persoonia nutans* on the disturbed edge of offset sites due to increasing competition by native species has initiated a management response to support the germination of individuals within bushland areas of the offset sites, specifically for P1, P2 and P3. Experimental disturbance plots will be positioned in areas of the offset sites where individuals do not currently occur but have been recorded as occurring prior to the 2018 wildfire. In each of the experimental plots, the following actions will be implemented:

- Disturbance stimulus - a disturbance stimulus, including raking of leaf litter back to bare earth, will be trialled to promote germination in areas where viable seed may be present
- Competition control - selective pruning or removal of ground layer and shrubs to reduce competition to *Persoonia nutans* and encourage recruitment/survival of juvenile plants

A conservative methodology will be developed for each offset site considering all present biodiversity values prior to implementation. As per the requirements of the TFOMP, NSW DPIE (EES) and the Commonwealth Department of Climate Change, Environment and Water (DCCEW) will be consulted prior to the implementation of the proposed adaptive management measure. Further, approvals and endorsement from the Biodiversity Conservation Trust and National Intermodal (responsible for implementing the BA341 biobank site) will also need to be sought prior to implementing. The methodology and results of experimental disturbance plots will be presented in the 2025 -2026 annual monitoring report for the EPBC offset sites.

Weed control works already occurring in the EPBC offset site should also include the access tracks adjacent to P1, P2 and P3 offset areas to control the spread of African Lovegrass and encourage the growth of more juvenile individuals. Other weed control works include the control and removal

Camphor laurel within offset site P4, and the control of blackberry bushes encroaching the monitoring sites.

If *Persoonia nutans* populations across offset sites shows a decline in future surveys, a translocation project could be initiated whereby seeds collected from adult individuals in offset sites P3 and P4 are propagated at an offsite location and re-introduced at a later stage as young plants.

Table 21. Recommended corrective actions

Identified issues	Offset site	Recommended action
Patch of the woody weed Camphor Laurel within offset site P4	P4	Bush regenerators to remove the occurrence of Camphor laurel.
Encroaching Blackberry at offset site P4	P4	Blackberry infestation should be monitored and controlled as necessary to prevent encroachment into the offset site.
Increased cover of African Lovegrass along the edges of offset sites and nearest access roads	P1, P2, P3	Continued monitoring of African Lovegrass adjacent to access roads within EPBC offset sites. Weed control methods targeting African Lovegrass should be immediately implemented to reduce further inundation. Manual control methodologies should be prioritised unless a targeted herbicide treatment that has no risk of over spray or off-target poisoning can be used. An example of a selective herbicide that is suitable for the control of African Lovegrass within offset areas is Flupropanate granular herbicide.
Native plant species outcompeting <i>Persoonia nutans</i> (i.e. smothering, occupying open areas)	All offset sites	Juvenile <i>Persoonia nutans</i> in plots P1, P2 and P3 should be monitored for smothering from native plant species. On a quarterly basis, inspection should be made of juvenile <i>Persoonia nutans</i> with offset sites P1, P2 and P3. Any native plants observed to be crushing or smothering individuals should be cut back. i.e. Slender Devils Twine observed on juvenile <i>Persoonia nutans</i> should be removed.
Lack of recruitment of <i>Persoonia nutans</i> in bushland areas at offset sites P1, P2 and P3	P1, P2, P3	Establishment of experimental disturbance plots in offset sites to: • Encourage the germination of <i>Persoonia nutans</i> individuals within bushland • Increase distribution of <i>Persoonia nutans</i> across sites • Reduce competition from native and exotic vegetation • Increase overall population numbers of <i>Persoonia nutans</i>

5.1.2 *Grevillea parviflora* subsp. *parviflora* offset sites

A comparison of results for *Grevillea parviflora* subsp. *parviflora* between the 2020 and 2024 monitoring events have been discussed below.

Population assessment

The 2024 monitoring survey saw a decrease in the number of stems of *Grevillea parviflora* subsp. *parviflora* within offset site G1. The population has decreased from 146 to 75 stems, marking a decrease of 49 percent. Despite this the distribution of *Grevillea parviflora* subsp. *parviflora* remained consistent, with greatest densities observed in the northwest and southeast.

Fire impacted the G1 site in 2018, removing all above-ground biomass of *Grevillea parviflora* subsp. *parviflora*. The findings from the 2024 survey reveals that the population of *Grevillea parviflora* subsp. *parviflora* is semi-resilient with the population flourishing in 2022 and 2023 and stabilising to above the density present in 2021. The fluctuations and the ability to recover could be attributed to the soil seed banks or more likely the capability of suckering from rootstock. Counts of individual genets in a population is very difficult as new shoots can be mistaken for distinct plants, as *Grevillea parviflora* subsp. *parviflora* demonstrate a degree of vegetative spread particularly after disturbances such as fire (DPIE 2019a). During 2024 an overall increase in shrub cover and specifically ground cover was observed compared to previous survey years, which may partially explain the decrease in *Grevillea parviflora* subsp. *parviflora* observed in 2024. The observed increase in shrub and ground cover would allow decreased light and to reach the ground layer preventing *Grevillea parviflora* subsp. *parviflora* to access this resource. This observation acts as evidence that *Grevillea parviflora* subsp. *parviflora* does not effectively compete in areas of high biomass.

Habitat assessment and potential impacts

It was calculated using the EPBC offsetting policy that 142 *Grevillea parviflora* subsp. *parviflora* require conservation and management within offset sites to achieve a net gain of at least 17 individuals over a 20-year period. Due to unforeseen impacts from the 2018 wildfire, all *Grevillea parviflora* subsp. *parviflora* within the offset site perished. The 2023 survey was promising as the recorded *Grevillea parviflora* subsp. *parviflora* population last year met the EPBC offsetting policy conservation and management requirements. However, this year the 49% decrease confirms that fluctuating biomass, disturbance and climatic variability impact this result. Habitat assessment and potential impacts

The condition of Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland within the offset site has improved in condition as demonstrated by a VI score of 54.5, greater than the VI score of the previous survey in 2023 (Table 22). The patch has seen a large increase in the groundcover and shrub vegetation which may be responsible for the decrease in *Grevillea parviflora* subsp. *parviflora*. Weed cover has remained absent with no weed cover recorded in the 2023/2024/2025 survey period.

Table 22. Changes in vegetation cover at offset site G1 across monitoring periods (2019 - 2024)

Census year	Tree	Shrub	Groundcover	Exotic	VI score
2019	9.1	22.6	9.2	0.1	37.7
2020	24	21.2	17	0.1	47
2021	27.3	41.2	41.9	0.1	55.7
2022	21	28.5	15.4	0.5	49.3
2023	5.5	16	1.2	0	49.3
2024	20.5	13.8	26.5	0	54.5

Some signs of impact on this species were observed. One individuals showed signs of high damage from insects. One individual that had been previously tagged is reported to have perished with the tag observed unattached on the ground. Individuals were not observed to have been foraged by animals.

Most individuals were recorded to be in a healthy condition (99%). Weed occurrence within the offset area is not impacting the occurrence or persistence of this species.

The results of low ground cover and high *Grevillea parviflora* subsp. *parviflora* last year (2023) and high ground cover with reduced *Grevillea parviflora* subsp. *parviflora* this year (2024), supports that areas of open woodland with a sparser shrub and ground layer vegetation have healthy populations of *Grevillea parviflora* subsp. *parviflora* with many individuals. It is evident that the numbers of *Grevillea parviflora* subsp. *parviflora* are greatest in open woodland areas with reduced competing shrub and ground covers.

Corrective actions

It is recommended that the population be monitored for another year prior to implementing any management actions to increase the population of *Grevillea parviflora* subsp. *parviflora* considering the high degree of fluctuation evident in the past monitoring year. However, considering the growing support that the *Grevillea parviflora* subsp. *parviflora* does better in areas of open forest with low ground-cover management actions could emulate this by reducing competing groundcovers.

It is not suggested that individuals be tracked for monitoring as has been done for *Persoonia nutans*. *Grevillea parviflora* subsp. *parviflora* is capable of suckering from a rootstock, and most populations demonstrate a degree of vegetative spread, particularly after disturbances such as fire. Therefore, it would be futile trying to track individuals via stems to monitor recruitment and death rates.

Table 23. Recommended corrective actions

Identified issues	Recommended action
Moderate infestation of African Lovegrass, is beginning to encroach on the <i>Persoonia nutans</i> offset sites	Infestations of African Lovegrass should be monitored and controlled as necessary to prevent encroachment into the offset site.
Native plant species outcompeting <i>Grevillea parviflora</i> subsp. <i>parviflora</i> (i.e. smothering, occupying open areas)	Monitoring of the <i>Grevillea parviflora</i> subsp. <i>parviflora</i> population over the following year to determine whether individuals are reducing in areas that are becoming increasingly vegetated by other native plant species.

5.1.3 Adaptive management

In terms of the provisions to revise the Management Action Plan under the Biobanking agreement, these are conducted at five yearly intervals and are specifically driven by the result of annual reporting and effectiveness of biodiversity gain at the direct offset site(s). Any revision or modification of the Management Action Plan must be approved by NSW DPIE (EES).

6 REFERENCES

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APPENDIX A BAM MONITORING QUADRAT DATA SET

Table 24 Summary of vegetation C* (cover) and A* (abundance) per BAM plot.

Scientific name	Common name	G1		P1		P2		P3		P4(A)		P4(B)	
		C	A	C	A	C	A	C	A	C	A	C	A
<i>Acacia binervia</i>	Coast Myall							1	20				
<i>Acacia brownii</i>	Heath Wattle			0.2	25	0.1	3	0.2	15	0.1	2		
<i>Acacia decurrens</i>	Black Wattle	0.5	20										
<i>Acacia falcata</i>						0.5	10						
<i>Acacia longifolia</i>				1	25					0.1	1	0.1	2
<i>Acacia parramattensis</i>	Parramatta Wattle			0.5	35	5	10						
<i>Angophora bakeri</i>	Narrow-leaved Apple			10	7	1	4	20	30	5	6	2	5
<i>Austrostipa pubescens</i>								0.1	1				
<i>Austrostipa sp.</i>						0.1	1						
<i>Banksia oblongifolia</i>	Fern-leaved Banksia							0.5	2	0.2	3	0.2	3
<i>Banksia spinulosa</i>	Hairpin Banksia			0.1	1					0.2	20	1	20
<i>Billardiera scandens</i>	Hairy Apple Berry			0.1	5			0.1	3				

Annual EPBC Offset Site Monitoring (2024-25)

Scientific name	Common name	G1		P1		P2		P3		P4(A)		P4(B)	
		C	A	C	A	C	A	C	A	C	A	C	A
<i>Bossiaea heterophylla</i>	Variable Bossiaea							0.1	30				
<i>Brachyloma daphnoides</i>	Daphne Heath							0.2	20	0.1	1		
<i>Burchardia umbellata</i>	Milkmaids	0.1	20							0.1	3	0.1	5
<i>Caladenia catenata</i>	White Caladenia							0.1	1				
<i>Callistemon linearis</i>	Narrow-leaved Bottlebrush							0.2	2				
<i>Callistemon pinifolius</i>	Pine-leaved Bottlebrush	0.2	1	0.5	20					0.1	1	1	20
<i>Calochilus campestris</i>	Copper Beard Orchid							0.1	25	0.1	10		
<i>Cassytha glabella</i>				0.1	20	0.1	25	0.1	50	0.1	40	0.1	30
<i>Casuarina glauca</i>	Swamp Oak											1	2
<i>Cheilanthes sieberi</i>	Rock Fern			0.1	25								
<i>Coronidium scorpioides</i>	Button Everlasting	0.1	1	0.1	20								
<i>Cyathochaeta diandra</i>		0.1	2					1	50			1	40
<i>Cynodon dactylon</i>	Common Couch			0.1	2	0.1	10	0.1	30				
<i>Daviesia ulicifolia</i>	Gorse Bitter Pea					0.1	1						

Annual EPBC Offset Site Monitoring (2024-25)

Scientific name	Common name	G1		P1		P2		P3		P4(A)		P4(B)	
		C	A	C	A	C	A	C	A	C	A	C	A
<i>Dianella longifolia</i>	Blueberry Lily	0.1	1	0.1	5			0.1	5	0.1	1		
<i>Dianella longifolia</i> var. <i>longifolia</i>						0.1	25						
<i>Drosera peltata</i>		0.1	3	0.1	5								
<i>Empodisma minus</i>		20	100							20	100	25	100
<i>Entolasia stricta</i>	Wiry Panic	5	50	2	60	1	35	15	0	2	40	5	30
<i>Epacris microphylla</i>	Coral Heath	0.1	5	0.1	5								
<i>Eragrostis brownii</i>	Brown's Lovegrass							0.1	2				
<i>Eragrostis curvula</i>	African Lovegrass			0.5	30	2	50	0.5	25				
<i>Erigeron</i> spp.				0.1	1								
<i>Eucalyptus parramattensis</i>	Parramatta Red Gum			1	3	2	2					2	7
<i>Eucalyptus racemosa</i>	Narrow-leaved Scribbly Gum			5	2	15	3	5	2	5	2	5	3
<i>Exocarpos cupressiformis</i>	Cherry Ballart					3	10						
<i>Gahnia aspera</i>	Rough Saw-sedge	0.1	1					0.5	10			0.5	10

Annual EPBC Offset Site Monitoring (2024-25)

Scientific name	Common name	G1		P1		P2		P3		P4(A)		P4(B)	
		C	A	C	A	C	A	C	A	C	A	C	A
<i>Glycine clandestina</i>	Twining glycine			0.1	2	0.1	1						
<i>Gompholobium minus</i>	Dwarf Wedge Pea							0.1	5				
<i>Gonocarpus teucroides</i>	Germander Raspwort									0.1	5	0.1	5
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	0.1	3										
<i>Hakea sericea</i>	Needlebush			2	30	0.2	20	2	40	12	50	2	40
<i>Hardenbergia violacea</i>	False Sarsaparilla			0.1	5	0.1	1	0.1	5			0.1	1
<i>Hibbertia aspera</i>	Rough Guinea Flower					0.1	15	0.1	2	0.1	3		
<i>Hypericum gramineum</i>	Small St John's Wort	0.1	20										
<i>Kunzea ambigua</i>	Tick Bush	0.1	1	0.1	3			0.2	5	0.2	30		
<i>Kunzea capitata</i>		0.1	1							0.2	30	3	30
<i>Leptospermum parvifolium</i>		0.2	5	1	20	0.1	2	2	35	0.2	2		
<i>Leptospermum trinervium</i>	Slender Tea-tree			20	60					5	30	0.5	20
<i>Leucopogon ericoides</i>	Pink Beard-heath			0.1	5								

Annual EPBC Offset Site Monitoring (2024-25)

Scientific name	Common name	G1		P1		P2		P3		P4(A)		P4(B)	
		C	A	C	A	C	A	C	A	C	A	C	A
<i>Leucopogon juniperinus</i>	Prickly Beard-heath	0.1	1										
<i>Leucopogon virgatus</i>								0.1	2				
<i>Lobelia purpurascens</i>	whiteroot					0.1	10	0.1	10	0.1	10	0.1	10
<i>Lomandra filiformis</i>	Wattle Matt-rush	0.1	1			0.2	20			0.1	10	0.1	1
<i>Lomandra gracilis</i>				0.1	5			0.1	5			0.1	2
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	0.1	1	0.5	10	10	60	0.1	1	2	30	1	10
<i>Melaleuca decora</i>				1	5	2	10	2	10			1	2
<i>Melaleuca nodosa</i>				35	100	20	50	1	20	20	60	25	100
<i>Microlaena stipoides</i>	Weeping Grass			0.5	60	2	50	5	100	0.1	2		
<i>Mitrasacme pilosa</i>		0.1	1							0.1	1		
<i>Opercularia diphylla</i>	Stinkweed			0.1	30							0.1	5
<i>Patersonia sericea</i>	Silky Purple-Flag	0.1	1					0.1	2				
<i>Persoonia levis</i>	Broad-leaved Geebung											0.2	1
<i>Persoonia linearis</i>	Narrow-leaved Geebung					0.2	1	1	3	0.2	1	0.5	2

Annual EPBC Offset Site Monitoring (2024-25)

Scientific name	Common name	G1		P1		P2		P3		P4(A)		P4(B)	
		C	A	C	A	C	A	C	A	C	A	C	A
<i>Persoonia nutans</i>	Nodding Geebung							0.1	2	0.1	2	0.2	1
<i>Petrophile pulchella</i>	Conesticks			0.1	2			2	40	1	30	0.1	10
<i>Pimelea linifolia</i>	Slender Rice Flower			0.2	50								
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>						0.1	50	0.5	30				
<i>Pomax umbellata</i>	Pomax							0.1	1			0.1	1
<i>Poranthera microphylla</i>	Small Poranthera			0.1	1								
<i>Pteridium esculentum</i>	Bracken									0.1	1		
<i>Pultenaea villosa</i>	Hairy Bush-pea							0.1	1				
<i>Richardia humistrata</i>						0.1	5						
<i>Ricinocarpos pinifolius</i>	Wedding Bush							0.2	3				
<i>Rytidosperm a sp.</i>								0.1	1				
<i>Trachymene incisa</i>	Trachymene	0.1	10	0.1	5	0.1	20	0.1	10	0.1	20	0.1	50
<i>Tricoryne elatior</i>	Yellow Autumn-lily	0.1	5					0.1	2				
<i>Xanthorrhoe a spp.</i>				0.2	10								

Annual EPBC Offset Site Monitoring (2024-25)

Scientific name	Common name	G1		P1		P2		P3		P4(A)		P4(B)	
		C	A	C	A	C	A	C	A	C	A	C	A
<i>Lomandra gracilis</i>				0.1	5			0.1	5			0.1	2
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	0.1	1	0.5	10	10	60	0.1	1	2	30	1	10
<i>Lomandra multiflora</i>	Many-flowered Mat-rush												
<i>Melaleuca decora</i>				1	5	2	10	2	10			1	2
<i>Melaleuca erubescens</i>	Pink Honeymyrtle												
<i>Melaleuca linariifolia</i>	Flax-leaved Paperbark												
<i>Melaleuca nodosa</i>				35	100	20	50	1	20	20	60	25	100
<i>Melaleuca thymifolia</i>	Thyme Honey-myrtle												
<i>Microlaena stipoides</i>	Weeping Grass			0.5	60	2	50	5	100	0.1	2		
<i>Mitrasacme polymorpha</i>													
<i>Mitrasacme spp.</i>													
<i>Notodanthonia longifolia</i>	Long-leaved Wallaby Grass												
<i>Olea spp.</i>													
<i>Olearia microphylla</i>													
<i>Opercularia diphylla</i>	Stinkweed			0.1	30							0.1	5

Annual EPBC Offset Site Monitoring (2024-25)

Scientific name	Common name	G1		P1		P2		P3		P4(A)		P4(B)	
		C	A	C	A	C	A	C	A	C	A	C	A
<i>Opercularia varia</i>	Variable Stinkweed												
<i>Paspalum urvillei</i>	Vasey Grass												
<i>Patersonia sericea</i>	Silky Purple-Flag	0.1	1					0.1	2				
<i>Persoonia laurina</i>	Laurel Geebung												
<i>Persoonia linearis</i>	Narrow-leaved Geebung					0.2	1	1	3	0.2	1	0.5	2
<i>Persoonia nutans</i>	Nodding Geebung							0.1	2	0.1	2	0.2	1
<i>Petrophile pulchella</i>	Conesticks			0.1	2			2	40	1	30	0.1	10
<i>Pimelea linifolia</i>	Slender Rice Flower			0.2	50								
<i>Platysace ericoides</i>													
<i>Pomax umbellata</i>	Pomax							0.1	1			0.1	1
<i>Pratia purpurascens</i>	Whiteroot												
<i>Ptilothrix deusta</i>													
<i>Pultenaea villosa</i>	Hairy Bush-pea							0.1	1				
<i>Ricinocarpus pinifolius</i>	Wedding Bush							0.2	3				

Annual EPBC Offset Site Monitoring (2024-25)

Scientific name	Common name	G1		P1		P2		P3		P4(A)		P4(B)	
		C	A	C	A	C	A	C	A	C	A	C	A
<i>Schizaea bifida</i>	Forked Comb Fern												
<i>Schoenus imberbis</i>													
<i>Senecio madagascariensis</i>	Fireweed												
<i>Stackhousia</i> spp.													
<i>Stylidium graminifolium</i>	Grass Triggerplant												
<i>Stylidium</i> spp.													
<i>Themeda australis</i>	Kangaroo Grass												
<i>Themeda triandra</i>													
<i>Trachymene incisa</i>	Trachymene	0.1	10	0.1	5	0.1	20	0.1	10	0.1	20	0.1	50
<i>Tricoryne elatior</i>	Yellow Autumn-lily	0.1	5					0.1	2				
<i>Xanthorrhoea</i> spp.				0.2	10								

APPENDIX B BAM QUADRATS VEGETATION SCORE SUMMARY

Table 25 Vegetation score summary across Offset Plots P1, P2 and P3.

Vegetation Attributes	P1						P2						P3					
	"19	"20	"21	"22	"23	"24	"19	"20	"21	"22	"23	"24	"19	"20	"21	"22	"23	"24
Total Count Tree (TG)	3	4	4	4	5	4	3	4	3	3	4	4	3	3	4	4	3	3
Total Count Shrub (SG)	11	11	12	13	11	14	11	13	11	11	14	11	19	20	22	25	21	19
Total Count Grass & grasslike (GG)	7	7	7	7	3	5	8	5	6	6	5	6	7	8	9	10	8	10
Total Count Forb (FG)	6	5	6	8	2	7	4	3	3	3	2	3	4	8	10	10	6	8
Total Count Fern (EG)	1	1	1	1	1	1	0	0	0	0	1	0	0	1	1	1	1	0
Total Count Other (OG)	6	6	6	6	5	5	3	5	5	4	4	4	3	3	3	3	3	3

Annual EPBC Offset Site Monitoring (2024-25)

Vegetation Attributes	P1						P2						P3					
	"19	"20	"21	"22	"23	"24	"19	"20	"21	"22	"23	"24	"19	"20	"21	"22	"23	"24
Total Cover Tree (TG)	11.5	16	20.00	20	7.5	16.5	52.5	47.3	47.0	30.2	15	23	22.5	36	37.2	37	25.1	26
Total Cover Shrub (SG)	47.7	46	41.10	43.7	20.2	61.4	4.7	15.7	21.5	10.4	47	26.4	8	5.7	12.6	9.6	3.1	12.6
Total Cover Grass & grasslike (GG)	1.2	4.5	8.30	7.1	0.4	3.2	18.7	20.7	40.2	5.8	16.3	13.4	16.6	21.5	24.5	15.9	1.7	22.1
Total Cover Forb (FG)	1	1	1.20	0.9	0.2	0.7	0.4	0.8	1.2	0.3	0.6	0.3	0.4	0.9	1.1	1.3	0.9	0.8
Total Cover Fern (EG)	0.1	0.1	0.20	0.1	0.1	0.1	0	0	0.0	0	0.1	0	0	0.1	0.0	0	0	0
Total Cover Other (OG)	1.9	1.2	4.40	1.5	0.5	0.6	0.3	0.6	0.5	0.3	1.3	0.8	0.3	0.4	0.4	0.4	0.5	0.3
Total Cover Exotics	0.2	0.1	0.2	0.3	0.1	0.8	0.6	0	0.2	0.5	3.0	2.1	0.1	0.2	0.2	0.2	0.5	0.5
Total Cover	0.2	0.1		0.1	0.1	0.5	0.5	0	0.2	0.5	3.0	2	0.1	0.2	0.2	0.2	0.5	0.5

Annual EPBC Offset Site Monitoring (2024-25)

Vegetation Attributes	P1						P2						P3					
	"19	"20	"21	"22	"23	"24	"19	"20	"21	"22	"23	"24	"19	"20	"21	"22	"23	"24
High Threat Weeds																		
Vegetation Integrity Score	52.5	64.8	64.4	68.6	68.6	77.3	51.8	56.5	67.2	41.8	41.8	59.2	51.5	59.6	63.5	55.8	55.8	64.9

Table 26 Vegetation score summary across Offset Plots P4a, P4b and G1

Vegetation attributes	P4A					P4B					G1					
	"20	"21	"22	"23	"24	"20	"21	"22	"23	"24	"19	"20	"21	"22	"23	"24
Total Count Tree (TG)	2	3	4	3	2	5	5	5	3	4	3	5	5	5	2	4
Total Count Shrub (SG)	17	16	18	16	16	14	15	15	13	13	12	11	11	12	9	13
Total Count Grass & grasslike (GG)	4	10	10	5	5	6	7	7	7	7	10	9	5	7	4	6
Total Count Forb (FG)	7	6	6	2	7	2	3	3	2	6	9	11	7	10	6	9
Total Count Fern (EG)	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Total Count Other (OG)	3	3	3	3	1	5	4	4	3	3	2	2	2	2	1	2

Annual EPBC Offset Site Monitoring (2024-25)

Vegetation attributes	P4A					P4B					G1					
	"20	"21	"22	"23	"24	"20	"21	"22	"23	"24	"19	"20	"21	"22	"23	"24
Total Cover Tree (TG)	45	40.5	8.1	0.8	10	32.4	32.2	12.1	17	10	9.1	24	27.3	21	5.5	20.5
Total Cover Shrub (SG)	43.9	49.8	15	37.9	39.8	18	46.4	40.1	56.9	34.8	22.6	21.2	41.2	28.5	16	13.8
Total Cover Grass & grasslike (GG)	24.2	24.4	2.9	11	24.2	7	17.6	3.4	17.7	32.7	7.5	13.5	14.7	6.3	0.5	25.4
Total Cover Forb (FG)	0.7	0.9	0.4	0.3	0.7	0.2	0.4	0.1	0.4	0.6	1.4	2.2	9.9	2.1	0.6	0.9
Total Cover Fern (EG)	0.1	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0
Total Cover Other (OG)	0.4	0.9	4.1	15.6	0.1	1	1.7	0.8	5.2	0.3	0.3	1.2	16.0	7	0.1	0.2
Total Cover Exotics	0	0	0	0	0	0	0.1	0.1	0	0	0.1	0.1	0.1	0.5	0	0
Total Cover High Threat Weeds	0	0	0	0	0	0	0.1	0.1	0	0	0.1	0.1	0.1	0.5	0	0
Vegetation Integrity Score	73.4	72.4	37	37	65.7	50	70.6	59.7	59.7	70.5	37.7	47	55.7	49.3	49.3	54.5

APPENDIX C ANNUAL MONITORING PHOTOGRAPHS

Monitoring Photographs – *Persoonia nutans* Offset site P1

					
PP_MP(North) - 2019	PP_MP(North) - 2020	PP_MP(North) - 2021	PP_MP(North) - 2022	PP_MP(North) - 2023	PP_MP(North) - 2024
					
PP_MP(East) - 2019	PP_MP(East) - 2020	PP_MP(East) - 2021	PP_MP(East) - 2022	PP_MP(East) - 2023	PP_MP(East) - 2024
					
PP_MP(South) - 2019	PP_MP(South) - 2020	PP_MP(South) - 2021	PP_MP(South) - 2022	PP_MP(South) - 2023	PP_MP(South) - 2024

Annual EPBC Offset Site Monitoring (2024-25)

Monitoring Photographs – *Persoonia nutans* Offset site P1

					
PP_MP(West) - 2019	PP_MP(West) - 2020	PP_MP(West) - 2021	PP_MP(West) - 2022	PP_MP(West) - 2023	PP_MP(West) - 2024
					
PP1 – 2019	PP2 – 2020	PP1 - 2021	PP1 - 2022	PP1 - 2023	PP1 - 2024
					
PP2 – 2019	PP2 – 2020	PP2 - 2021	PP2 - 2022	PP2 - 2023	PP2 - 2024

Annual EPBC Offset Site Monitoring (2024-25)

Monitoring Photographs – *Persoonia nutans* Offset site P1

					
PP3 – 2019	PP3 – 2020	PP3 - 2021	PP3 - 2022	PP3 - 2023	PP3 - 2024
					
PP4 – 2019	PP4 – 2020	PP4 - 2021	PP4 - 2022	PP4 - 2023	PP4 - 2024

Monitoring Photographs – *Persoonia nutans* Offset site P2

			Not captured		
PP_MP(North) - 2019	PP_MP(North) - 2020	PP_MP(North) - 2021	PP_MP(North) - 2022	PP_MP(North) - 2023	PP_MP(North) - 2024

Annual EPBC Offset Site Monitoring (2024-25)

Monitoring Photographs – *Persoonia nutans* Offset site P2

			Not captured		
PP_MP(East) - 2019	PP_MP(East) - 2020	PP_MP(East) - 2021	PP_MP(East) - 2022	PP_MP(East) - 2023	PP_MP(East) - 2024
			Not captured		
PP_MP(South) - 2019	PP_MP(South) - 2020	PP_MP(South) - 2021	PP_MP(South) - 2022	PP_MP(South) - 2023	PP_MP(South) - 2024
			Not captured		
PP_MP(West) - 2019	PP_MP(West) - 2020	PP_MP(West) - 2021	PP_MP(West) - 2022	PP_MP(West) - 2023	PP_MP(West) - 2024

Annual EPBC Offset Site Monitoring (2024-25)

Monitoring Photographs – *Persoonia nutans* Offset site P2

					
PP1 – 2019	PP2 – 2020	PP1 - 2021	PP1 - 2022	PP1 - 2023	PP1 - 2024
					
PP2 – 2019	PP2 – 2020	PP2 - 2021	PP2 - 2022	PP2 - 2023	PP2 - 2024
					
PP3 – 2019	PP3 – 2020	PP3 - 2021	PP3 - 2022	PP3 - 2023	PP3 - 2024

Annual EPBC Offset Site Monitoring (2024-25)

Monitoring Photographs – *Persoonia nutans* Offset site P2

					
PP4 – 2019	PP4 – 2020	PP4 - 2021	PP4 - 2022	PP4 - 2023	PP4 - 2024

Monitoring Photographs – *Persoonia nutans* Offset site P3

					
PP_MP(North) - 2019	PP_MP(North) - 2020	PP_MP(North) - 2021	PP_MP(North) - 2022	PP_MP(North) - 2023	PP_MP(North) - 2024
					

Annual EPBC Offset Site Monitoring (2024-25)

Monitoring Photographs – *Persoonia nutans* Offset site P3

PP_MP(East) - 2019	PP_MP(East) - 2020	PP_MP(East) - 2021	PP_MP(East) - 2022	PP_MP(East) - 2023	PP_MP(East) - 2024
					
PP_MP(South) - 2019	PP_MP(South) - 2020	PP_MP(South) - 2021	PP_MP(South) - 2022	PP_MP(South) - 2023	PP_MP(South) - 2024
					
PP_MP(West) - 2019	PP_MP(West) - 2020	PP_MP(West) - 2021	PP_MP(West) - 2022	PP_MP(West) - 2023	PP_MP(West) - 2024
					
PP1 – 2019	PP2 – 2020	PP1 - 2021	PP1 - 2022	PP1 – 2023	PP1 - 2024

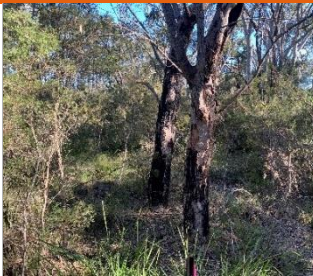
Annual EPBC Offset Site Monitoring (2024-25)

Monitoring Photographs – *Persoonia nutans* Offset site P3

					
PP2 – 2019	PP2 – 2020	PP2 - 2021	PP2 - 2022	PP2 – 2023	PP2 - 2024
			Not captured		
PP3 – 2019	PP3 – 2020	PP3 - 2021		PP3 - 2023	PP3 - 2024
					
PP4 – 2019	PP4 – 2020	PP4 - 2021	PP4 - 2022	PP4 – 2023	PP4 - 2024

Annual EPBC Offset Site Monitoring (2024-25)

Monitoring Photographs – *Persoonia nutans* Offset site P4

N/A	N/A				
		PP_MP(A)_(North) - 2021	PP_MP(A)_(North) - 2022	PP_MP(A)_(North) - 2023	PP_MP(A)_(North) - 2024
N/A	N/A				
		PP_MP(A)_(East) - 2021	PP_MP(A)_(East) - 2022	PP_MP(A)_(East) - 2023	PP_MP(A)_(East) - 2024
N/A	N/A				
		PP_MP(A)_(South) - 2021	PP_MP(A)_(South) - 2022	PP_MP(A)_(South) - 2023	PP_MP(A)_(South) - 2024

Annual EPBC Offset Site Monitoring (2024-25)

Monitoring Photographs – *Persoonia nutans* Offset site P4

N/A	N/A				
		PP_MP(A)_(West) - 2021	PP_MP(A)_(West) - 2022	PP_MP(A)_(West) - 2023	PP_MP(A)_(West) - 2024
N/A	N/A				
		PP_MP(B)_(North) - 2021	PP_MP(B)_(North) - 2022	PP_MP(B)_(North) - 2023	PP_MP(B)_(North) - 2024
N/A	N/A				
		PP_MP(B)_(East) - 2021	PP_MP(B)_(East) - 2022	PP_MP(B)_(East) - 2023	PP_MP(B)_(East) - 2024