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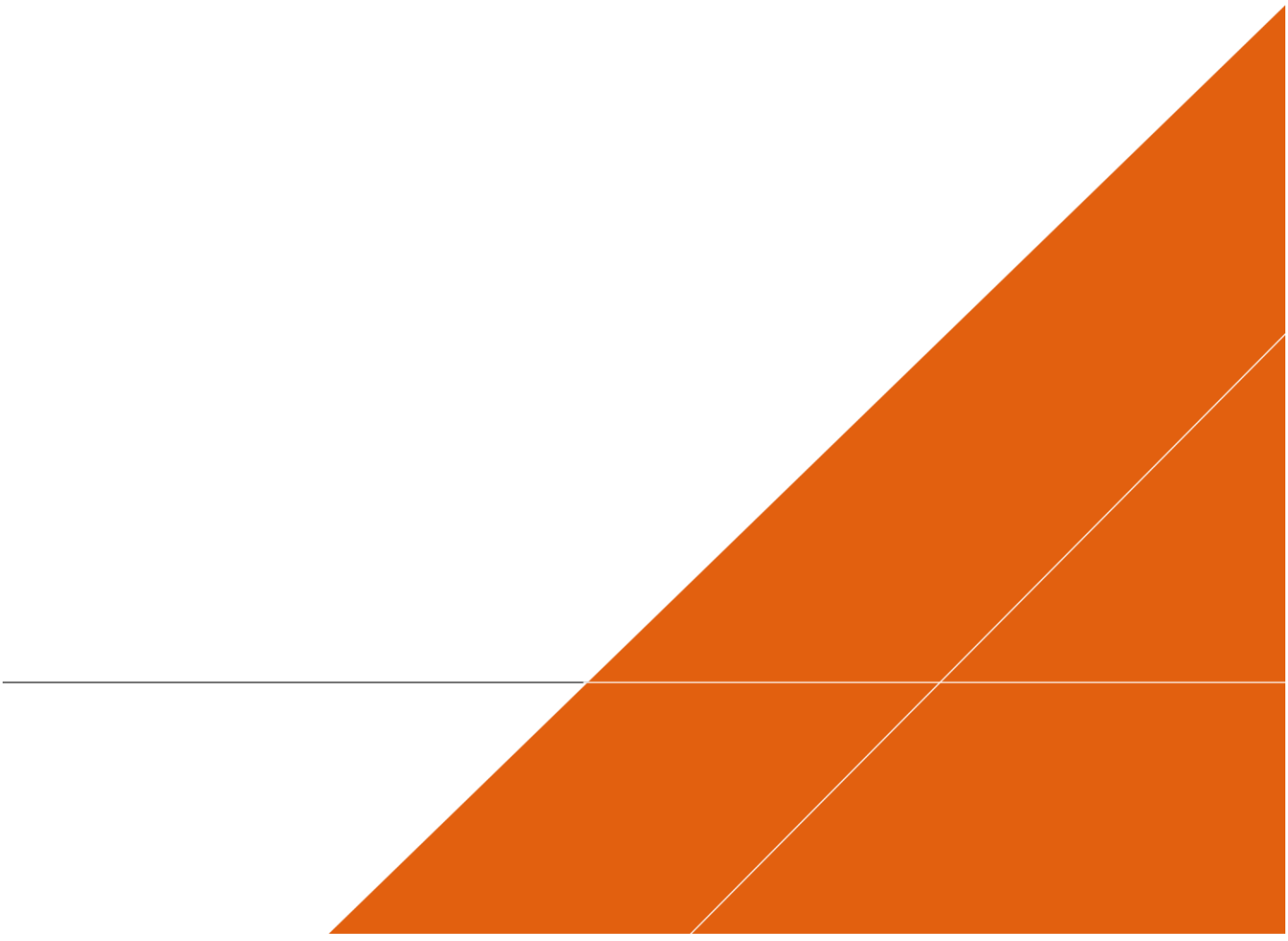
MOOREBANK PRECINCT EAST – OPERATIONAL FACILITY

Annual Flora and Fauna Monitoring Report

11 AUGUST 2023



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MOOREBANK PRECINCT EAST – OPERATIONAL FACILITY

Annual Monitoring Report

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A	13 June 2023	Draft report	TBH TK JB	NB
B	8 August 2023	Final report	TBH	NB

CONTENTS

APPENDICES

1 INTRODUCTION

Arcadis was commissioned to undertake monitoring inspections and deliver the annual flora and fauna monitoring report for the operation of the Moorebank Precinct East (MPE) facility (Figure 1-1). The requirement to monitor biodiversity values within the MPE operational facility and biodiversity values related to the approval of the project is specified in the following Conditions of Consent (CoC) and Conditions of Approval (CoA):

- Moorebank Precinct East EPBC Concept Approval (EPBC 2011/6229)
- Ministers' Conditions of Consent (CoC) (SSD 6766; SSD 7628)

Additional requirements to monitor biodiversity values are included in the following project documents:

- Moorebank Precinct East – Stage 1 (SSD 6766) and Moorebank Precinct East – Stage 2 (SSD 7628) Environmental Impact Statements (EIS)
- Riparian Vegetation Management Plan for SIMTA Intermodal Terminal Facility – Stage 1 (Hyder 2015)
- SIMTA Intermodal Terminal Facility – Stage 1. Riparian Vegetation Management Plan – 2017 Updated (AMBS 2017)
- Operational Flora and Fauna Management Plan for Moorebank Logistics Park – East Precinct (Arcadis 2020a)
- Threatened Flora Offset Management Plan (Arcadis 2020b)
- Nest Box Management Strategy. Moorebank Precinct East Stage 1 – Rail Link (CPB 2017)
- Moorebank Precinct West Stage 2. Koala Management Plan (Cumberland Ecology 2020)

1.1 Moorebank Precinct East

The Moorebank Logistics Park (MLP) is an integral component of the Freight, Ports and Transport strategies of both the NSW and Commonwealth governments to help manage the challenges of an expected tripling of freight volumes at Port Botany by 2031.

The MLP aims to streamline the freight logistics supply chain from port to store, deliver savings to businesses and consumers, and help service the rapidly growing demand for imported goods in south-west Sydney. It is located approximately 27 kilometres south-west of the Sydney Central Business District and approximately 26 kilometres west of Port Botany within the Liverpool Local Government Area. The MLP is divided into an East Precinct and a West Precinct, located east and west of Moorebank Avenue, respectively.

The main features of MPE include the following:

- An Import Export (IMEX) Terminal. The IMEX Terminal comprises:
- Truck processing, holding and loading areas with an entrance and exit from Moorebank Avenue
- Rail loading and container storage areas serviced by container handling equipment
- An Administration facility and associated car parking with light vehicle access from Moorebank Avenue
- An Operational Rail Link connecting the IMEX terminal and the Southern Sydney Freight Line (SSFL) traversing Moorebank Avenue, Anzac Creek, Georges River and Glenfield Waste Facility
- Associated ancillary infrastructure, including signage, lighting, landscaping, water management
- Warehouse and distribution facilities, including warehousing up to 21 metres in height, typically ranging in size from 20,000 meters squared to 62,000 meters squared
  - Office and administration facilities
  - Amenities

  - Car parking
  - Truck loading/unloading docks
  - Internal parking for pick-up and delivery vehicles (PUD)
  - Specialised sortation and conveyor equipment
  - Hardstand areas that provide trailer parking spaces, external PUD parking spaces, vehicle manoeuvring areas and access to the main internal site road
  - Signage for business identification purposes, including backlit illuminated signage on each warehouse
  - Internal fitout, comprising racking and storage
- A freight village including a mix of retail, commercial and light industrial spaces typically up to 15 metres in height and varying in size and design
- An internal road network to enable efficient movement of vehicles, dispatch of freight from the warehouses and transport of containers between the IMEX Terminal and warehouse and distribution facilities

In addition to the constructed assets of the MPE development, several other areas have been included within the MPE operational facility for flora and fauna monitoring. These include:

- Five designated offset sites for EPBC listed threatened flora species within Wattle Grove offset area
- Lands adjoining (within 10 meters of) the Rail Link
- Riparian vegetation management sites at Anzac Creek and Georges River
- Nest box locations within Moorebank and Wattle Grove offset areas

1.2 Monitoring objectives

Management of flora and fauna values within the MPE operational facility and associated lands is reviewed annually following a series of detailed monitoring surveys. The core objectives of flora and fauna monitoring are to:

- Monitor protected threatened flora species
- Monitor protected vegetated areas adjacent to the operational facility (including EPBC offset areas)
- Monitoring to minimise harm to fauna and maintain habitat offsets (nest boxes)
- Monitor works to protect and improve riparian and aquatic environments
- Monitor for weed occurrence and recruitment within the operational site

The results of flora and fauna monitoring across the MPE operational facility is the subject of this report. A series of recommendations are included to rectify any management issues identified during monitoring and enhance the biodiversity values within the MPE operational facility.

The methodologies and results of the nest box and EPBC offset site surveys have not been included in the body of this report. Both of these monitoring components have been described in separate documents, which have been included as appendices to this report:

- Appendix D. EPBC offset sites - Annual monitoring report
- Appendix J. Nest box monitoring report (Spring 2022)

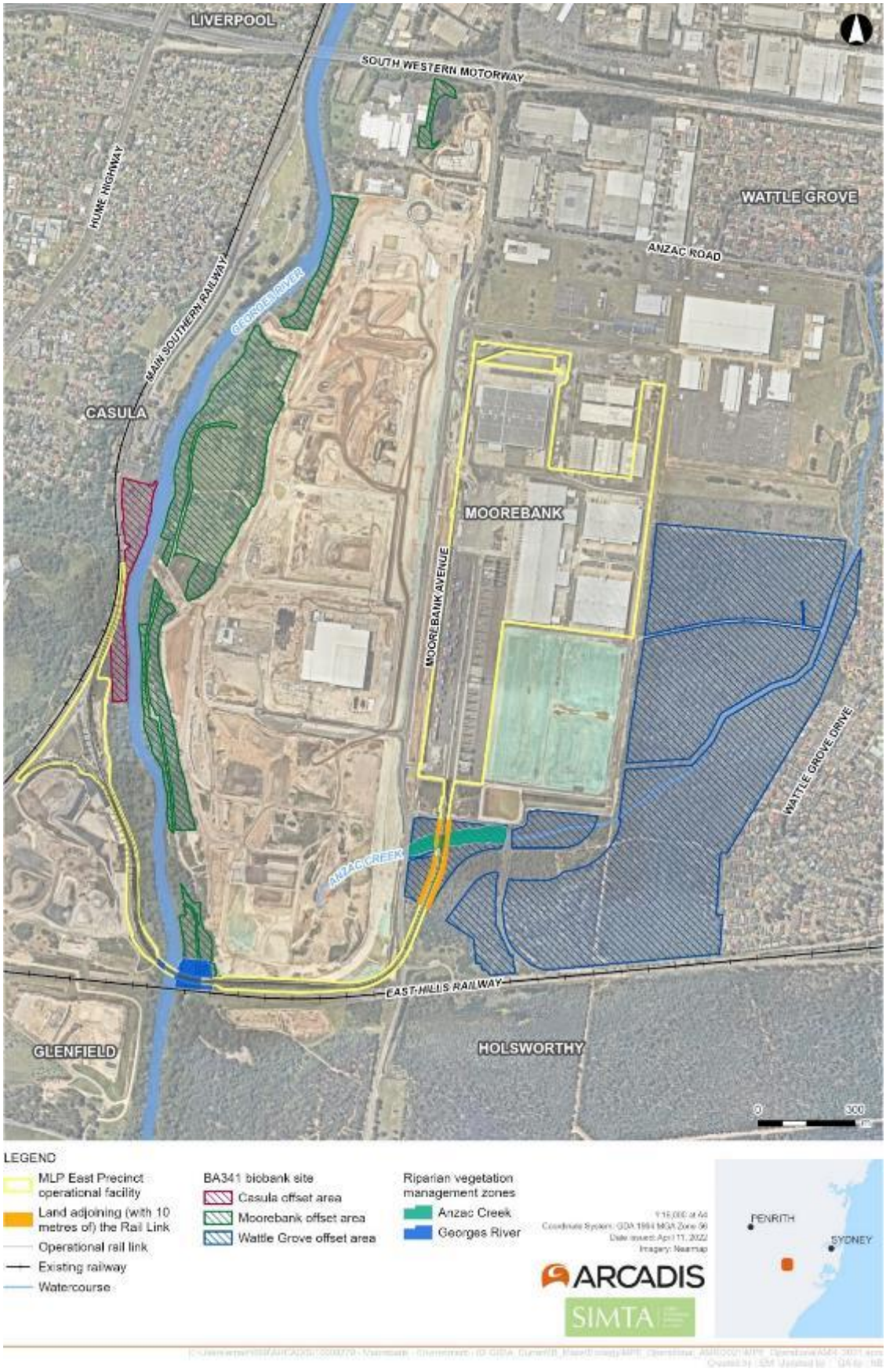

Figure 1-1. MPE operational facility and adjacent biobank site

1.3 Requirements for monitoring

The requirements to monitor biodiversity values during the operation of the MPE facility are summarised below in Table 1-1.

Table 1-1. MPE operational facility flora and fauna monitoring requirements

Subject	Approval condition	Requirement	Where addressed
Weed and feral animal monitoring	CoC B110 (SSD 7628)	*B110. Prior to operation, the Applicant must prepare an Operational Flora and Fauna Management Plan (OFFMP) in consultation with OEH. The OFFMP must form part of the OEMP required by condition C3 and must include measures to ensure biodiversity values not intended to be impacted are protected, including but not limited to the following:* *i. Weed control* *ii. Feral animal control* *iii. Pathogen management procedures* *iv. Monitoring* v. *Rehabilitation actions.*	Sections:2.3, 3.3, 4.3 (weeds) 2.4.3, 3.4.3, 4.4.3 (feral animals)
	CoC B127 (SSD 7628)	*The Applicant must:* *a. Take all reasonable steps to manage pests and vermin on the site;* *b. Manage declared noxious weeds on the site in accordance with the requirements of the noxious weeds act 1993;* c. *Inspect the site on a regular basis, no less than every three months, to ensure that these measures are working effectively and that pests, vermin or noxious weeds are not present on site in sufficient numbers to pose an environmental hazard or cause the loss of amenity in the surrounding area*	
	CoA 5(h) (EPBC 2011.6229)	*For the better protection of EPBC-listed flora & the environment on Commonwealth land, the person taking the action must engage a suitably qualified expert to prepare a Flora and Fauna Management Plan (FFMP) for the approval of the Minister. The FFMP must include (but need not be limited to):* *h) measures to safeguard flora and fauna from the threat of weeds, fire, pathogens and unauthorised access, including (but not limited to) the commitments outlined in section 7.4.1 of the EIS (and summarised in Annexure A)*	
Riparian rehabilitation and management	CoC C21, E9 (SSD 6766)	*C21. The Georges River Bridge shall be designed to ensure fauna movement within the riparian corridor is maintained. The bridge shall be designed in consultation with DPI Water and DPI Fisheries and approved by the Certifying Authority. A copy of the final design shall be submitted to the Secretary for information and made available on the Project Website.*	Sections: 2.1.2, 3.1.2, 4.1.2

Subject	Approval condition	Requirement	Where addressed
		E9. All activities taking place in, on or under waterfront land, as defined in the Water Management Act 2000, should be conducted generally in accordance with the NSW Office of Water's Guidelines for Controlled Activities.	
	CoC B110 (i) (v) (SSD 7628)	*B110 (i),(v).* See above. Riparian vegetation monitoring will be conducted within the riparian management areas identified within the original MPE Stage 1 Riparian Vegetation Management Plan (Hyder 2015) and updated version (AMBS 2017). The monitoring requirements are also set out in these documents.	
EPBC-threatened flora offsets	EPBC CoA 6(e)	*6(e). measures for regular monitoring of the status of individuals of Nodding Geebung and Small-flower Grevillea and their habitat as measured against the baseline population and distribution, including:* *i. Fluctuations in population size and distribution; and* ii. *Response to disturbances and/or management actions*. Monitoring of threatened flora species (Nodding Geebung and Small-flowered Grevillea) within the EPBC offset areas will be completed in accordance with the Threatened Flora Offset Management Plan (Arcadis 2020).	Appendix B
Monitoring condition of threatened flora and vegetation adjacent to the Rail Link within BA341 lands	EPBC CoA 5(i)	*ongoing monitoring to inform the adaptive management of native vegetation adjoining the rail easement* Monitoring of threatened flora and vegetation conditions adjoining the Rail Link will be conducted in accordance with the OFFMP (Arcadis 2020a) and the BA341 Biobanking Agreement (OEH 2019) requirements.	Sections: 2.1.1, 2.2.1, 3.1.1, 3.2.1, 4.1.1, 4.2.1
Koala management	CoC B152 (SSD 7709)	*B152. Prior to clearing of native vegetation, a Koala Management Plan (KMP) must be prepared by a suitably qualified person in consultation with OEH and be submitted to the Planning Secretary for approval. KMP must:* *a. Identify habitat corridors of adequate dimension to provide Koala habitat corridors as supported by Koala specialists, to provide connectivity both within the Intermodal Precinct area and with other core koala habitat areas (i.e. To the south and the west along Georges River);* *b. Include details of structures to eliminate barriers to movement (presented by fences, roads, drainage culverts or pits, rail lines and the like) for koalas and other native fauna likely to use the site of the habitat corridor;*	Sections: 2.4.2, 3.4.2, 4.4.2

Subject	Approval condition	Requirement	Where addressed
		c. Include other measures to minimise the risk of harm to koalas. Koala fencing is to be installed along the interface of the occupied habitat (Wattle Grove offset area) and the MPE operational site. Annual monitoring of the fencing will be conducted to ensure it is functional and in agreement within the Koala Management Plan (Cumberland Ecology 2020).	
Nest Boxes	EPBC CoA Annexure A – Summary of mitigation measures	*Consider the installation of nest boxes in woodland vegetation in the rail corridor that may offer alternative nesting habitat to hollow-dependent species recorded in the study area.*	Appendix J
	CoC E34(d)(ii)(b) (SSD 6766)	*The identification of areas to be cleared and details of management measures to avoid residual habitat damage or loss and to minimise or eliminate time lags between the removal and subsequent replacement of habitat, such as:* *- clearing procedures (including nest box plan)* Requirements for nest box monitoring have been documented with the approved Nest Box Management Strategy for Moorebank East Precinct Stage 1 – Rail Link (CPB 2017)	
	CoC B108 (a) (b (SSD 7628))	*B108. Prior to clearing of native vegetation, the Applicant must prepare a Construction Flora and Fauna Management Plan (CFFMP) in consultation with OEH. The CFFMP must form part of the CEMP required by condition C1 and must include the following:* *a. Measures to minimise the loss of key fauna habitat, including tree hollows;* b. *Measures to minimise the impacts on fauna on site, including conducting fauna pre-clearance surveys prior to vegetation clearing and building demolition*	

2 METHODOLOGY

This annual monitoring report summarises the findings of field surveys conducted across the MPE operational facility and provides an assessment of the management actions being implemented. This report contains the results of surveys and site inspections undertaken during the monitoring period (May 2022 – May 2023), including details of:

- Date, time and location
- Nature of the inspection
- Name of the person conducting the inspection
- Weather observations.

Table 2-1 itemises the survey dates, including the monitoring actions completed and the prevailing weather conditions from the nearest weather station at Holsworthy Aerodrome AWS {station 066161} (BOM 2021).

Table 2-1. Timings and weather conditions on survey dates

Date	Survey type	Temperature (°C)		Rain	Attending ecologists
		Min	Max	(mm)	
20 April 2022	Bi-monthly weed inspection of the operational facility and Rail Link	11.9	23.5	11	Thea Kane
12 July 2022	Bi-monthly weed inspection of the operational facility and Rail Link	5.0	16.3	1.6	Thea Kane Jed Brown
25 August 2022	Bi-monthly weed inspection of the operational facility and Rail Link	4.7	18.0	0	Thea Kane Jed Brown
5 September 2022	BA341 lands adjoining rail link monitoring plots at MPE	5.8	17.4	1.0	Taylor Bliss-Henaghan Thea Kane Kate Mauger Jed Brown
7 September 2022	EPBC Offset Site monitoring (Nodding Geebung) Koala fencing inspection	5.8	19.6	0	Thea Kane Kate Mauger Jed Brown
15 September 2022	EPBC offset site monitoring (Nodding Geebung) Deployment of connectivity cameras and feral vertebrate cameras at MPE	8.3	16.8	0	Taylor Bliss-Henaghan Kate Mauger Jed Brown
16 September 2022	EPBC offset site monitoring (Nodding Geebung, Small-flower Grevillea) Deployment of feral vertebrate camera at MPE	9.8	23.6	17.2	Taylor Bliss-Henaghan Kate Mauger Jed Brown
26 September 2022	Nest-box monitoring EPBC offset site monitoring	8.3	19.8	0	Taylor Bliss-Henaghan William Terry Kate Mauger Thea Kane
27 September 2022	Nest-box monitoring EPBC offset site monitoring	11.4	22.7	1.2	Taylor Bliss-Henaghan William Terry Thea Kane Jed Brown Kate Mauger

Date	Survey type	Temperature (°C)		Rain	Attending ecologists
		Min	Max	(mm)	
28 September 2022	Nest-box monitoring EPBC offset site monitoring	12.4	22.0	9.6	Taylor Bliss-Henaghan William Terry Thea Kane Jed Brown Kate Mauger
11 October 2022	Nest-box monitoring, collection of connectivity cameras at MPE	10.1	19.0	0	Taylor Bliss-Henaghan Kate Carroll
31 October 2022	Bi-monthly weed inspection of the operational facility and Rail Link	14.5	28.5	0	Thea Kane
15 November 2022	EPBC offset site monitoring (Small-flower Grevillea) Deployment of connectivity cameras at MPW Collection of feral vertebrate cameras at MPE	13.0	24.2	0	Taylor Bliss-Henaghan Thea Kane
2 December 2022	Bi-monthly weed inspection of the operational facility and Rail Link	14.2	23.2	0	Nathan Banks Thea Kane
5 December 2022	Supervision of weed remediation works in the Rail Link	13.0	33.9	0	Nathan Banks Thea Kane
7 December 2022	Supervision of weed remediation works in the Rail Link	13.5	27.3	0	Thea Kane Kate Mauger
31 January 2023	Habitat connectivity fauna crossing supervision	19.3	27.4	25.6	Thea Kane
4 February 2023	Supervision of weed remediation works in the Rail Link	14.9	27.2	0	Thea Kane
5 February 2023	Supervision of weed remediation works in the Rail Link	13.2	29.3	0	Nathan Banks
23 February 2023	Bi-monthly weed inspection of the operational facility and Rail Link	15.3	22.8	0	Kate Mauger
07 March 2023	Supervision of weed remediation works in the Rail Link	19.9	35.6	0	Thea Kane
11 April 2023	Riparian vegetation management monitoring plots	7.2	22.7	0	Jed Brown Taylor Bliss-Henaghan
14 April 2023	Riparian vegetation management monitoring plots	13.5	22.3	12.8	Jed Brown Thea Kane
17 May 2023	Nest box corrective actions: repair, reinstallation, decommissioning	11.7	17.5	0.8	William Terry
18 May 2023	Nest box corrective actions: repair, reinstallation, decommissioning	7.4	16.8	0	William Terry

2.1 Native vegetation monitoring

The methodologies applied to monitoring native vegetation at riparian vegetation management sites and in the lands adjoining the Rail Link are discussed below, and the location of the surveys are presented in Figure 2-2.

2.1.1 Lands adjoining Rail Link

Native vegetation adjoining the Rail Link in the Wattle Grove offset area was assessed to determine whether operations within the Rail Link are resulting in edge effects that are impacting the condition of adjoining vegetation. Surveying was restricted to native vegetation adjoining (within 10 metres) the Rail Link. Monitoring of this vegetation is a requirement of the EPBC Condition of Approval (CoA) 5(i) (Table 1-1).

Vegetation condition was monitored by conducting 10 x 40-metre vegetation quadrats. Vegetation quadrats followed the Biodiversity Assessment Method (BAM) (DPIE EES 2020) however focused on composition and structure data; no function data was collected. Vegetation quadrats were conducted in the same location as the previous survey events to allow an accurate comparison of changes to composition across monitoring years. The location of vegetation quadrats was demarcated with a metal star picket and is given below in Table 2-2.

The following composition attributes were quantitatively assessed within vegetation quadrats:

- 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

Table 2-2. Location details of vegetation plots in lands adjoining the Rail Link

Plot number	Zone	Easting	Northing
Eastern side of Rail Link	56	308028	6240109
Western side of Rail Link	56	307993	6240098

2.1.2 Riparian vegetation management

Riparian vegetation monitoring is required to measure the success of bush regeneration works and track the regeneration and condition of native vegetation at Georges River and Anzac Creek management areas. Results are compared annually against the performance criteria identified in the Riparian Vegetation Management Plan (Table 4, Riparian vegetation management monitoring report Hyder 2015) to determine whether works are on track to achieving the RVMP objectives, which are to:

- Restore, conserve, and enhance the riparian vegetation in the Georges River and Anzac Creek sites that fall within the SIMTA Rail Corridor
- Achieve long-term eradication of weed species from the management sites
- Maintain an adequate width of riparian vegetation adjoining Georges River and Anzac Creek
- Protect and enhance fauna habitat connectivity along the Georges River and Anzac Creek riparian zone.

In April 2018, the Anzac Creek riparian management area was burned in a bushfire. Following the bushfire, asbestos was identified within the area, and since then, no bush regeneration works have been conducted within the Anzac Creek management zone. Subsequently, monitoring was not conducted by Arcadis to review bush regeneration activities within this management area. Anzac Creek riparian management area will not be reviewed further in this report.

Eight 5 x 5-metre monitoring plots were established across the Georges River management zones during the baseline survey in June 2018 (AMBS 2017). Two additional plots were established before works began on the western bank of the Georges River in September 2019 (AMBS 2017). These permanent monitoring plots were established to monitor changes in vegetation composition as well as monitor the success of plantings. The locations of each plot are detailed in Table 2-3.

At each monitoring plot, the following actions were conducted:

- Plots were divided into four segments, numbered 1 to 4, from the south east corner of the plot in a clockwise direction to the north-east corner of the plot.
- Vegetation attributes were assessed and recorded for each segment:
  - Percentage cover of weed species – percent cover in each segment was estimated for each weed species present, and a mean value for each species was calculated
  - Percentage cover of native species – percent cover in each segment was estimated for each structural layer (ground, mid and canopy), and a mean value for each structural later was calculated

  Naturally occurring (non-planted) native species – a list of all naturally occurring native species within the plot was recorded.
- Photographs of each plot were taken from the permanent stake

Previously, the number of planted natives and naturally occurring natives were recorded separately. However, due to difficulty in distinguishing between now established planted and naturally occurring native vegetation, the methodology has been updated to exclude this delineation.

Table 2-3 Riparian vegetation monitoring plot details

Management zone	Plot Number	Zone	Easting	Northing
GZ1	MR09	56	307302	6239796
GZ1	MR10	56	307310	6239809
GZ1	MR11	56	307296	6239829
GZ2	MR12	56	307261	6239813
GZ2	MR13	56	307249	6239834
GZ2	MR15	56	307245	6239769
GZ4	MR14	56	307229	6239815
GZ4	MR16	56	307222	6239778
GZ2	MR18	56	307152	6239797
GZ5	MR19	56	307158	6239818

Figure 2-1. Monitoring plot locations established by AMBS during early years of monitoring

2.2 Threatened flora monitoring

Threatened flora species were monitored on lands adjoining the Rail Link. The methodologies used to monitor threatened flora are discussed below.

2.2.1 Lands adjoining Rail Link

Monitoring of threatened flora in the areas adjoining (within 10 metres) the Rail Link was conducted to determine if operations within the Rail Link are resulting in edge effects that are impacting threatened species occurrence or individual condition.

Monitoring for threatened flora species occurrence was conducted by walking parallel field transects at three-metre spacings, marking the location of any threatened species on an Arc-GIS-enabled iPad. Notes were collected on the health of plants, including whether individuals were seeding, budding or flowering.

2.3 Weed management

Weed monitoring has been conducted by an ecologist on a bi-monthly basis over the 2022/2023 monitoring period: during April, July, August, October, December, and February.

The methodology employed to monitor weeds across the operational facility and in the Rail Link corridor is described in the bi-monthly reports, which have been included in Appendix A.

A summary of the changes to weed cover across the MPE operational facility and Rail Link for the monitoring year has been summarised in Section 3.3, and ongoing recommendations to manage weed are included in Section 4.3.

2.3.1 Weed control works

Arcadis has been engaged to oversee weed remediation works conducted by P&E Services to reduce weed cover and prevent the spread of weeds outside of the Rail Link. Sections of the Rail Link adjoin ecologically sensitive areas, which are susceptible to invasion. Eleven days of weed remediation works were conducted between December 2022 and May 2023.

The methodology employed to monitor weed remediation works in the Rail Link corridor is described in the weed remediation summary report, included in Appendix A.

A summary of the changes to weed cover across the Rail Link as result of the targeted weed control works has been summarised in Section 3.3. A more detailed memorandum has also been included in Appendix B.

2.4 Fauna monitoring

Surveys were undertaken to assess fauna habitat connectivity, determine feral animal presence and review the effectiveness of fauna habitat features relevant to the operation of the MPE facility. The surveys conducted have been discussed below.

2.4.1 Habitat connectivity monitoring

Anzac Creek culvert and the expanse beneath the Rail Link bridge (on the eastern side of Georges River) were monitored using remote cameras to determine whether native fauna are using the fauna connectivity structures to move between habitat patches. Four remote infrared cameras were deployed for approximately five weeks at each location to photograph animals moving between habitat patches (Figure 2-2). The locations of the cameras are described in Table 2-4.

Table 2-4 Location of remote cameras monitoring habitat connectivity

Description of location	Number of cameras	Total trap nights in location
Northern bank of Anzac Creek facing downstream	1	5 weeks
Northern bank of Anzac Creek facing upstream	1	5 weeks
Southern bank of Anzac Creek facing downstream	1	5 weeks
Southern bank of Anzac Creek facing upstream	1	5 weeks
Northern side of bridge facing south	2	5 weeks
Southern side of bridge facing north	2	5 weeks

The captured view of deployed cameras at each survey location is presented in Plate 2-1 and Plate 2-2.

Plate 2-1 Examples of remote camera deployment at Anzac Creek management site to monitor habitat connectivity. Left: Remote camera: Downstream south. Right: Remote camera: Upstream north.

Plate 2-2 Examples of remote cameras deployed to assess the connectivity value of the Georges River management site. Left: Remote camera facing southwest. Right: Remote camera facing southeast.

Following the collection of remote cameras, captured photographs were reviewed for animal presence. The species captured, date and time of the photograph were recorded.

2.4.2 Koala management monitoring

Arcadis ecologists visually inspected fencing and Koala structures Wattle Grove offset area from the MPE site. Koala fencing, bridges and culverts were assessed for installation and condition in accordance with *Figure 9. Location of Koala Grids and Bridges* of the Moorebank Precinct West Stage 2 Koala Management Plan (KMP) (Cumberland Ecology, 2020).

Visual inspections included an assessment of the following:

- The level of intactness of fences, identifying damage, holes, points of entry, and areas of collapse or corrosion
- Presence and condition of koala bridges across cyclone fencing
- Presence and condition of koala gates and grids at management access points Wattle Grove offset area (Plate 2-3)

Where issues were identified, photographs were captured, and locations recorded using an Arc-GIS-enabled iPad.

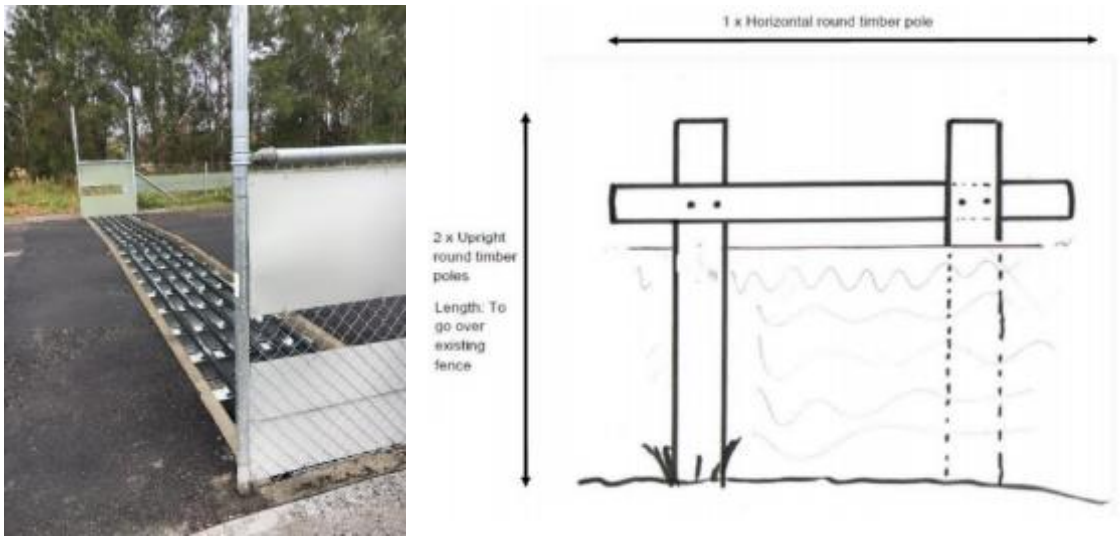

Plate 2-3 Koala structures to be constructed along the perimeter fencing. Left: Koala grids. Right: Koala bridges.

2.4.3 Feral animal monitoring

Feral animal presence was investigated within the MPE operational facility through the deployment of remote cameras. Six remote infra-red cameras were set up along the access roads that follow the boundary fence of MPE, where it interfaces with the Wattle Grove offset area. Cameras were left at a single location for approximately two months to detect feral animal activity, following which the captured images were reviewed and processed. A species list for each camera was documented.

Cameras were placed in areas that had evidence of feral species presence (burrows and animal trails) and along access trails, internal roads and connecting passages that are likely to be used by feral animals when moving across the landscape. Locations of cameras are shown in Figure 2-2, and examples of the captured views of deployed cameras are presented in Plate 2-4.

Plate 2-4 Examples of feral animal remote camera deployment. Left: Remote camera focusing on drainage line to the north of the Wattle Grove offset area. Right: Remote camera focusing on access road within Wattle Grove offset area.

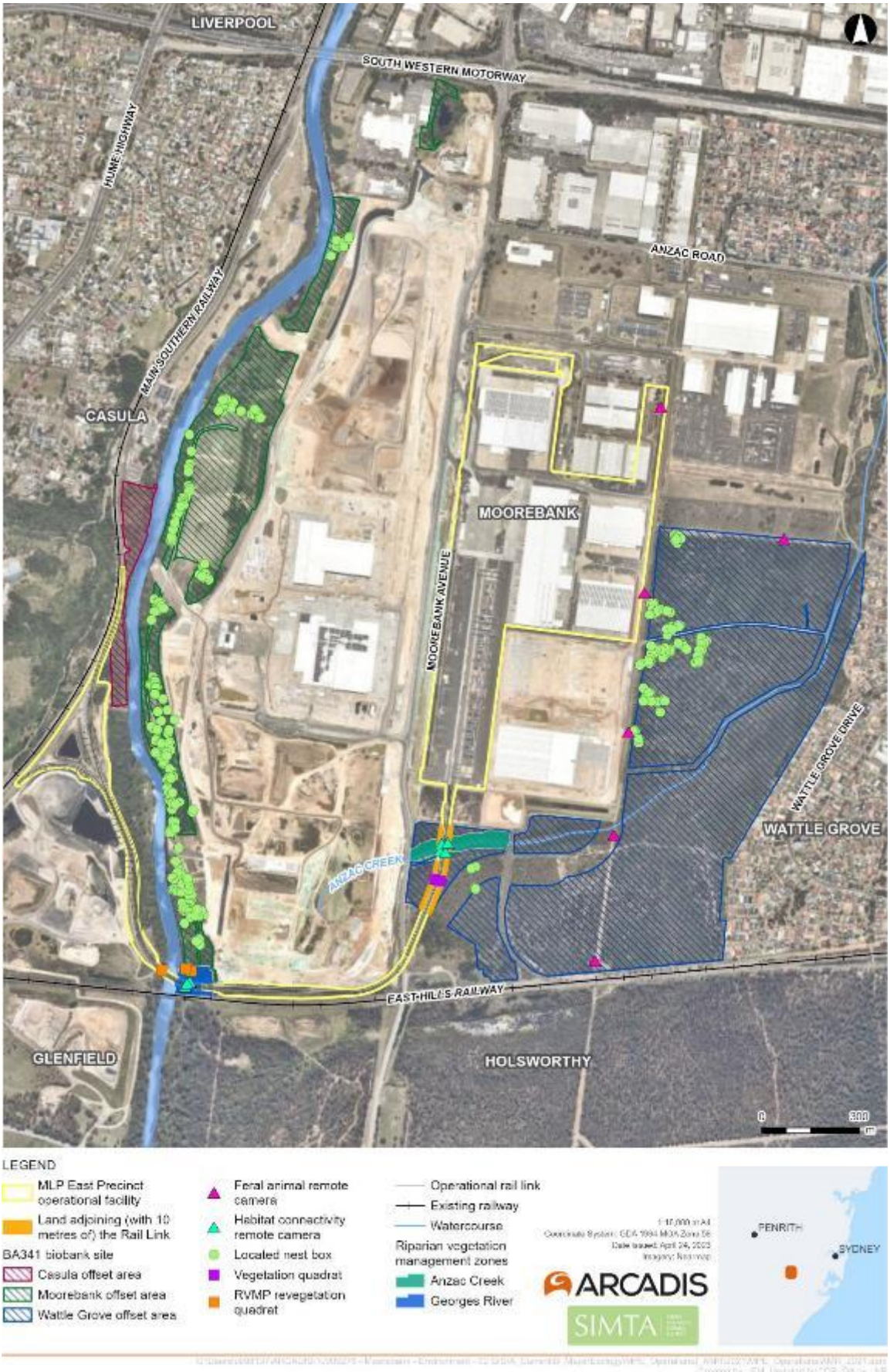

Figure 2-2. Monitoring surveys conducted across MPE operational facility

3 RESULTS

The results of the monitoring surveys undertaken to assess the condition of the biodiversity values within the MPE operational facility are discussed below.

3.1 Native vegetation

The result of monitoring native vegetation at riparian vegetation management sites and in the lands adjoining the Rail Link are discussed below.

3.1.1 Lands adjoining Rail Link

Native vegetation on either side of the Rail Link is Plant Community Type (PCT) 883 Castlereagh Scribbly Gum woodland. Assemblages on either side of the Rail Link are in good condition with low levels of weed occurrence and a diversity of native plant species. Both patches of native woodland are fully structured, including trees, shrubs and groundcover vegetation. No signs of natural dieback were observed during monitoring surveys, nor were any signs observed to suggest that operations within the Rail Link are having a negative impact on native vegetation. Vegetation was observed to be gaining biomass in comparison to last year.

Two vegetation quadrats were conducted within the lands adjoining the Rail Link, one on the eastern side and one on the western side. A summary of the results of quadrat monitoring is presented in Table 3-1.

Table 3-1. Results of vegetation quadrat monitoring

Vegetation attribute	Monitoring quadrat on western side of Rail Link (Q1)		Monitoring quadrat on eastern side of Rail Link (Q2)	
	Cover	Richness	Cover	Richness
Native canopy	17%	3	12.2%	4
Native shrub	49%	20	28.7%	25
Native groundcover	14.6%	23	11.5%	23
Total native	80.7%	46	52.6%	52
Total exotic	0.6%	5	0.5%	10
High threat exotic	0.1%	1	0.1%	2

Seven species of exotic plants were recorded during quadrat monitoring, including *Senecio madagascariensis* (Fireweed), *Trifolium repens* (White Clover), *Secale cereale* (Rye Grass), *Conyza sumatrensis* (Guernsey fleabane), *Plantago lanceolata* (Lambs Tongue), *Hypochaeris glabra* (Smooth Catsear) and *Hypochaeris radicata* (Catsear). Exotic species accounted for a low cover across both quadrats, equating to 0.6 and 0.5 percent, respectively, in each quadrat. Exotic species were mainly restricted to disturbed areas immediately adjacent to the Rail Link. Weeds are mostly present in areas that were disturbed during the construction of the Rail Link rather than in areas of intact native vegetation that did not experience disturbance.

3.1.2 Riparian vegetation management

The 2022/2023 survey marked the fifth time monitoring has occurred for revegetated areas on the eastern side of the Georges River management site. A total of 44 exotic species and 50 native species were recorded across the management site. A summary of exotic and native vegetation cover is presented in Appendix G.

The results demonstrate an increase in exotic cover at five of the monitoring quadrats (MR09, MR10, MR13, MR18 and MR19), with the largest increase in exotic cover observed at MR18, which increased from 51.75% to 76.75% between November 2021 and April 2023, represented as navy in Figure 3-1. Since receiving plantings, the location sampled by plot MR18 on the western side of the Georges River

has been largely unsupported and weeds have increased in cover colonising the revegetated areas. Despite native plantings still being present weeds have quickly colonised all bare areas and have suppressed native species from colonising and having high increases in cover; MR18 has recorded an increase of 9.5% native species cover since the last monitoring event. Other locations where increases in weed cover has been recorded is positioned on the edges of the management zone due to experiencing weed encroachment from less managed adjoining areas.

Five monitoring quadrats recorded a decrease in exotic cover (MR11, MR12, MR14, MR15, MR16). The lowest exotic cover was recorded at MR12, which decreased from 2.5% in November 2021 to 2% during current surveys. Exotic vegetation cover has remained low across all monitoring periods in MR12 and MR10 in comparison to the other eight monitoring quadrats, represented as red and yellow in Figure 3-1. The locations sampled by these vegetation plots received a high density of native plantings during the revegetation project and follow-up maintenance by a trained bush regeneration contractor. Subsequently native plantings in these locations quickly established and begun colonising bare areas. This resulted in establishment of a vegetation assemblage resilient to high levels of weed intrusion.

The average weed cover for the entire management site was 24.3%, which was greater than what was recorded during the 2021/2022 monitoring event (22.1%). The eastern side had an average cover of 19.4% and the western side 43.7%.

Five monitoring quadrats recorded a decrease in exotic cover (MR11, MR12, MR14, MR15, MR16) with the largest decrease observed in MR16. MR16 decreased from 27.3 percent in November 2021 to 7.4 percent in April 2023, represented as dark blue in Figure 3-1. However, there was an average increase across all monitoring quadrats of 2.2% exotic cover. It should be noted that MR18 had a substantially higher increase in exotic cover than any other monitoring quadrat. MR18 aside , there is an average decrease in exotic cover of 0.4% across all quadrats.

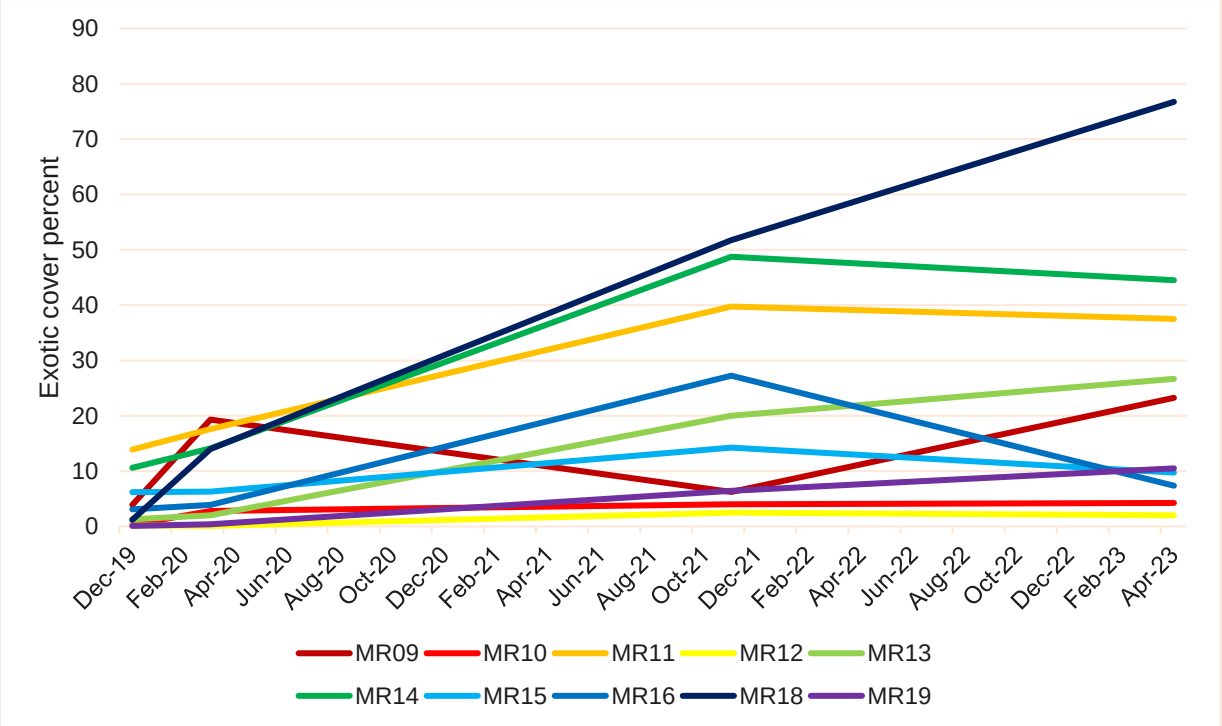

Figure 3-1 Line plot outlining the trajectory of the exotic cover percent over the past four years of monitoring at all ten monitoring sites

An increase in native species cover was observed at five of the monitoring quadrats (MR10, MR11, MR12, MR18, MR19), while the other five quadrats recorded a decrease in native cover. The largest increase in native species cover was recorded at MR19, which increased from 2.8% to 24.1% between November 2021 and April 2023. Vegetation at this quadrat consisted of sparse stands of *Themeda triandra* (Kangaroo Grass) and *Cymbopogon refractus* (Barbed Wire Grass) with no established canopy. While MR19 had the greatest increase in native cover, it also had large areas of bare ground with 34.6%

vegetation cover and 65.4% bare ground. MR09 saw the greatest decrease in native cover between November 2021 and April 2023, with a decrease from 44% to 20.6%. Encroachment from weeds from areas outside of the management site resulted in decrease in native cover at this location from 6.3% in November 2021 to 23.3% in April 2023. Native vegetation cover in all monitoring quadrats decreased by an average of 1.5%, remaining relatively constant over the past three years across all sites (Figure 3-2).

The average native cover for the entire management site was 29.4%, which was less than what was recorded during the 2021/2022 monitoring event (30.8%). The eastern side had an average cover of 35.3% and the western side 12.6%.

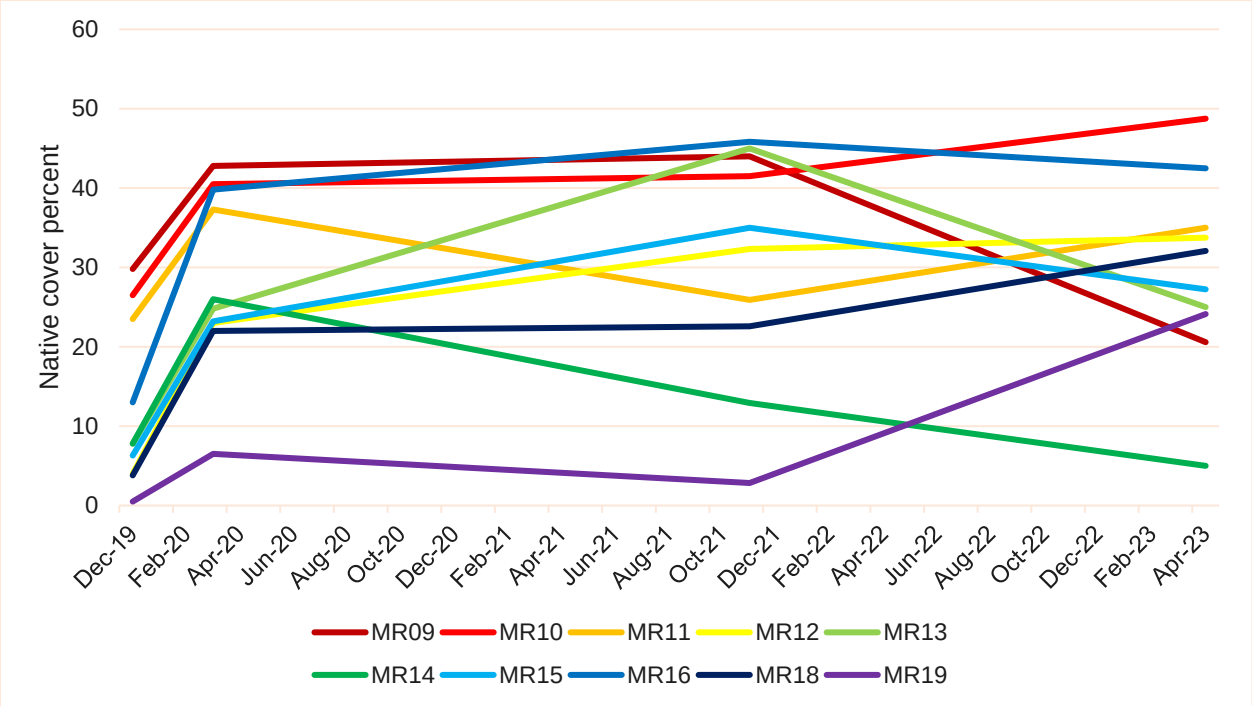

Figure 3-2 Line plot outlining the trajectory of the native cover percent over the past four years of monitoring at all ten monitoring sites

Plantings on the western side of the Georges River were monitored for the second time, and photographs were taken to compare against previous monitoring periods (Appendix H).

Plantings for the Georges River management site were selected based on species included in the River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (RFEFCF) Endangered Ecological Community (EEC). Ongoing monitoring of the revegetation areas focused on reviewing the survival and persistence of planted species commensurate with the EEC. A suite of shrub and groundcovers species were recorded which are characteristic of RFEFCF, including *Acacia parramattensis* (Parramatta Wattle), *Bursaria spinosa* (Native Blackthorn), *Echinopogon ovatus* (Forest Hedgehog Grass) and *Melaleuca styphelioides* (Prickly-leaved Tea Tree). A comparison of the species recorded during plot monitoring with species characteristic of the RFEFCF EEC is included in Appendix F.

Plantings have displayed significant growth over the past two years. Individual plantings are now indistinguishable from each other and have contiguous patches of native ground cover. Native and exotic cover within plot locations varied over the past four years of monitoring.

For example, plots MR09 and MR13 sample areas which have been subject to weed removal and revegetation with native tubestock plantings, had a native cover of 44% and 45% in November 2021 but have dropped to 20.6% and 25% in April 2023, respectively. However, MR11 and MR19 increased in native cover from 25.9% and 2.8% in November 2021 to 35% and 24.1% in April 2023, respectively. Prior to works commencing, MR11 recorded a native cover score of 12.5% and an exotic cover of 43.8%. MR19 has not yet received weed remediation works.

An inventory of native flora species recorded within the fixed monitoring quadrats has been included in Appendix F, and photo points are included in Appendix G.

3.2 Threatened flora

The results of monitoring threatened flora are discussed below.

3.2.1 Lands adjoining Rail Link

Parallel field transect identified three threatened plant species within 10 metres of the Rail Link corridor fencing. All species had been recorded during previous monitoring surveys:

- *Persoonia nutans* (Nodding Geebung)
- *Grevillea parviflora* subsp*. parviflora* (Small-flower Grevillea)
- *Hibbertia puberula* subsp*. puberula*

Acacia bynoeana (Bynoe's Wattle) was recorded in the 2021 monitoring survey but was not found again in the 2022 monitoring survey. Two individuals of *Persoonia* nutans (Nodding Geebung) were identified at the northern-eastern extent of the survey area, which marks the second occurrence of this species within 10 metres of the Rail Link in the past two years of monitoring. Nodding Geebung was first observed during the 2021 monitoring survey.

Nodding Geebung and Small-flower Grevillea were observed to be sparsely scattered, whereas *Hibbertia puberula* subsp. *puberula* was observed in high numbers, particularly at the southern extent of the survey area on the eastern side of the Rail Link. Individuals appeared to be in a healthy condition, with some bearing flowers and seeds. The locations of threatened plants have been presented in Figure 3-3.

Table 3-2 provides the listing status for the threatened plant species located and a count for the number of individuals found.

Table 3-2. Threatened plant species identified within lands adjoining the operational Rail Link

Species	Listing status	Number of individuals identified
Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)	BC Act: Vulnerable EPBC Act Vulnerable	1
Hibbertia puberula subsp. *puberula*	BC Act: Endangered EPBC Act: Not listed	70
Persoonia nutans (Nodding Geebung)	BC Act: Endangered EPBC Act Endangered	2

Changes to the number of individuals of the observed threatened plant species are shown below in Table 3-3.

Table 3-3 Changes to numbers of individuals of the four threatened plant species identified on lands adjoining the Rail Link

Species	Number of individuals identified 2021/2022	Number of individuals identified 2022/2023	Change
Acacia bynoeana (Bynoe's Wattle)	3	0	**-3**
Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)	2	1	**-1**
Hibbertia puberula subsp. *puberula*	126	70	**-56**
Persoonia nutans (Nodding Geebung)	1	2	**+1**

No impacts were observed to native vegetation or threatened species outside of the rail corridor as a result of operation or ongoing management activities within the Rail Link.

Figure 3-3. Results of monitoring lands adjoining the operational Rail Link

3.3 Weed management

Seven priority weed species, as listed for the Greater Sydney Local Land Services Region, were identified on the MPE operational facility and Rail Link during the monitoring year, including *Alternanthera philoxeroides* (Alligator Weed), *Asparagus asparagoides* (Bridal Creeper), *Lantana camara* (Lantana), *Ludwigia peruviana* (Ludwigia), *Nassella neesiana* (Chilean Needle Grass), *Olea europaea* subsp. *cuspidate* (African Olive) and *Senecio madagascariensis* (Fireweed). Priority weeds were sparsely scattered, mainly located within the Rail Link corridor. As of May 2023 all Priority weeds were removed except for Fireweed which requires ongoing control to eradicate. Each bi-monthly weed monitoring survey site are included in Appendix A.

Weed cover across the MPE operational facility was generally low throughout the monitoring year. Minor changes in weed cover and exotic species diversity were observed in landscaped areas around warehousing units, within trunk drainage infrastructure running along the western boundary, and in drainage swales at the north-eastern extent of the site. Ongoing, periodic weed control works carried out in these areas were observed to be sufficient in maintaining a low weed cover and promoting an increase in cover of native species like *Daviesia ulicifolia* (Gorse Bitter Pea), *Acacia falcata* (Sickle Wattle), *Persicaria decipiens* (Slender Knotweed), *Typha orientalis* (Bulrush) and *Ficinia nodosa* (Knobby Club Rush.

Plate 3-1 Photographs captured during the February 2023 inspection showing low weed cover and established native plants observed on soft batters surrounding the basins and drainage channel at the north-eastern extent of the operation facility

The Rail Link experienced a fluctuation in weed cover across the monitoring year. A large-scale remediation project commenced in early spring 2020 in the Rail Link to remove weeds from soft landscaped areas and revegetate with native plant species. Bi-monthly surveys over the past year have monitored the progress of this remediation project and provided an ongoing assessment of the cover of weeds and the striking of native seeds. Generally, an increase in the cover of exotic plant species was observed since the initial clearing/weed removal event, with native seedlings only becoming apparent in summer 2021/2022. The biomass of weeds greatly outweighed that of native seedlings with a suite of exotic grasses, herbaceous and woody weeds being recorded including *Acacia saligna* (Golden Wreath Wattle), *Chloris gayana* (Rhodes Grass), *Eragrostis curvula* (African Love Grass), *Briza maxima* (Quaking Grass), *Cirsium vulgare* (Spear Thistle) and *Trifolium michelianum* (Bolansa Clover).

A targeted large-scale effort to reduce the biomass of exotic species and eradicate aggressive grasses impacting native seedlings commenced in December 2022. As of May 2023, eleven days of weed control works had been completed. The weed control works conducted by P&E Services and overseen by Arcadis successfully reduced weed biomass whilst maintain native species. These works were specific to the Rail Link. Efforts to control/suppress weeds were focused on weed species that were having a detrimental impact on native seedlings, mainly competitive exotic grass species. Targeted weed control works included herbicide spraying and slashing (Plate 3-2). Further weed remediation works occurred in December 2022 and have continued into 2023.

Plate 3-2. P&E Service undertaking weed control works within the Rail Link

Over the period that weed control works were undertaken native plants were observed to be increasing in size and colonising new areas. Native species observed included *Cymbopogon refractus* (Barbed Wire Grass), Sickle Wattle, *Lachnagrostis filiformis* (Blown Grass), *Cynodon dactylon* (Couch Grass), *Themeda triandra* (Kangaroo Grass), *Indigofera australis* (Australian Indigo), and *Chloris truncata* (Windmill Grass) (Plate 3-3).

***Plate** 3-3 Australian Indigo (left) and Blown Grass (right) were observed setting seed in the Rail Link during the weed control works.*

During the February and March 2023 works, spraying was avoided across all areas of soft batter in the Rail Link due to the presence of native species. The reduced competition from weeds as a result of ongoing weed control works resulted in increased growth and cover of native species. In some locations increased native biomass has been observed suppressing weed colonisation.

Plate 3-4. Soft batters in the Rail Link corridor following weed removal works by P&E Services. Note the reduced cover of exotic species and retention of native species next to pink survey flags.

The following reports have been completed throughout the year to document weed control works being undertaken within the Rail Link and broader operational area. These reports have been included as Appendices to this report:

- Bi-monthly weed monitoring reports (April 2022 – February 2023) (Appendix A)
- Rail Link weed remediation memorandum (Appendix B)

3.4 Fauna

The results of monitoring fauna habitat connectivity, feral animals and the effectiveness of fauna habitat features across the MPE operational area are discussed below.

3.4.1 Habitat connectivity

Remote infra-red cameras captured a suite of native and introduced fauna utilising the Anzac Creek culvert to move between patches of bushland within Wattle Grove offset area. Native terrestrial fauna recorded included Common Wallaroo (*Macropus robustus*) and Swamp Wallaby (*Wallabia bicolor*) (Plate 3-5). Introduced fauna recorded included Red Fox (*Vulpes vulpes*), Black Rat (*Rattus rattus*) and Domestic Cat (*Felis catus*).

Plate 3-5 Fauna captured on remote cameras moving between patches of bushland using the Anzac Creek culvert. Left: Common Wallaroo. Right: Swamp Wallaby.

Four terrestrial fauna species were recorded on remote cameras moving beneath the Rail Link bridge (on the eastern side of Georges River), including one native species, Swamp Wallaby and three pest

species, Red Fox, Black Rat and Domestic Cat (Plate 3-6). No cameras captured fauna using the woody debris to cross the ballast.

Plate 3-6 Fauna recorded crossing the ballast under the Rail Link. Left: Swamp Wallaby. Right: Feral/Domestic Cat

A complete list of fauna recorded on remote cameras at Anzac Creek culvert and beneath the Rail Link bridge has been included in Appendix C.

3.4.2 Koala management

Arcadis ecologists traversed the fence line separating the Wattle Grove offset area from the MPE operational facility on 7 September 2022.

To date, no Koala bridges or grids have been constructed as per the MLP Koala Management Plan (KMP) (Cumberland Ecology 2020). Fauna ramps were located at Anzac Creek culvert, which may provide connectivity between patches of bushland for Koala. Fauna ramps were observed to be in good condition.

The condition of perimeter fencing separating the Wattle Grove offset area from the MPE operation facility is similar to what was observed during the previous year's monitoring event. The fencing had a good structure and was observed to be intact along most of its alignment. Over the 2022/2023 monitoring year, a number of sections along the perimeter fence and at access gates, which were identified to have holes or facilitate Koala access to the MPE operational facility, were reinforced with additional lengths of Cyclone fencing. Cyclone fencing was approved by Koala expert Dr Phillips for being suitable Koala exclusion fencing at the MLP site (Cumberland Ecology 2020).

Fencing inspection identified two locations that had gaps of approximately 15 centimetres between the ground and fence (Figure 3-4). These gaps were also present in the 2021/2022 survey. While the gaps are too small currently for Koala to move through, these areas should be monitored to ensure erosion or use by other species does not increase the size of gaps over time. There is evidence that feral animals have been using these gaps to enter and exit the Wattle Grove offset area.

At least one Koala was recorded using internal access roads on several remote cameras deployed to detect feral species within the Wattle Grove offset area. Three cameras captured Koalas across several nights between 4 October and 15 November 2022.

Figure 3-4. Locations of Koala fencing issues

3.4.3 Feral animals

Remote camera monitoring identified four feral animal species within Wattle Grove offset area, immediately adjacent to the MPE operational facility. Feral animals recorded include Brown Hare (*Lepus europaeus*), Domestic Cat (*Felis catus*), Red Fox (*Vulpes vulpes*) and Black Rat (*Rattus rattus*) (Plate 3-7). It is anticipated that these feral animals are using the MPE operational facility when moving around the local landscape.

Remote cameras were deployed at six locations along the north and western boundaries of the Wattle Grove offset area, nearest to the operational facility. Red Fox was captured on all cameras. The four remote cameras deployed at Anzac Creek assessing connectivity also all captured Red Fox, Black Rat and Domestic/Feral Cat. At least two distinct cats and four Red Fox individuals were detected on remote cameras in MPE, including two juvenile foxes demonstrating breeding is likely to be occurring onsite. Foxes were also recorded predating on unidentifiable small mammals on several occurrences. These feral animals are having a direct impact on native wildlife within adjacent bushland areas.

A complete list of fauna recorded on remote cameras has been included in Appendix C.

Plate 3-7 Feral animal species within the MPE operational facility. Top left: European Hare. Top right: Domestic Cat. Bottom left: Red Fox mother and juvenile. Bottom right: Black Rat.

4 DISCUSSION AND RECOMMENDATIONS

An assessment of the various monitoring requirements for the MPE operation facility has been discussed below. Where necessary, recommendations have been included to improve or enhance the management of biodiversity values.

4.1 Native vegetation

A discussion of the monitoring results for assemblages of native vegetation required to be managed as a component of operations of the MPE operational facility is included below with recommendations to further improve the condition.

4.1.1 Lands adjoining Rail Link

Castlereagh Scribbly Gum woodland (PCT 883) adjacent to the Rail Link is in good condition and has low levels of weeds. There was a high diversity of native plant species within the patches, with the native woodland assemblage being fully structured, including trees, shrubs and native groundcover vegetation.

No signs of change (i.e. dieback) were observed by ecologists in vegetation either side of the Rail Link. A comparison of quadrat data with previous years monitoring data does not indicate that the patches have changed significantly. Composition and cover is relatively similar for native species. An increase in exotic species diversity was recorded across both quadrats, however the total cover was largely the same as what was observed in 2022/2022.

Table 4-1. Comparison of vegetation quadrat data between 2021/2022 and 2022/2023 monitoring events

Plot	Eastern		Western	
Survey period	2021/2022	2022/2023	2021/2022	2022/2023
Native cover	49.7	52.6	80.9	80.7
Native richness	46	52	48	46
Exotic cover	0.4	0.5	0.4	0.6
Exotic richness	3	10	3	5

Data collected over the last two years indicates that the operation of the Rail Link is having a negligible impact on adjoining patches of native vegetation. Although minor increases in exotic species cover and richness have been recorded, these have been mostly restricted to already disturbed edges within the former construction footprint of the Rail Link. Over the period that these patches of native vegetation have been monitored encroachment of weeds into non-disturbed, natural areas has been minor. Of the weeds species recorded only *Senecio madagascariesis* (Fireweed) has been observed successfully colonising the natural areas. The lower nutrient soils of natural areas which have a high composition of sand is likely to be unsuitable to the exotic species growing in the Rail Link and is inhibiting encroachment.

Ongoing operation of the Rail Link should include management of soft landscaped areas within the corridor to minimise the movement of weeds into adjacent areas of native vegetation. Contractors undertaking weed control works should employ techniques that do not risk impacts to native vegetation like hand weeding, targeted slashing and spot spraying with herbicide. Indiscriminate hi-volume spraying should be avoided. The management contractor for the Wattle Grove offset site should be made aware of minor weed encroachment from the Rail Link and undertake semi-regular targeted weed control works be undertaken to remove any colonising weeds and maintain the good condition of native vegetation within the 10-metre corridor. Recommended management actions to maintain/enhance the condition of native vegetation adjacent to the Rail Link have been summarised in Table 4-2.

Table 4-2. Recommended management actions to maintain/enhance the condition of native vegetation adjacent to the Rail Link

Identified Issue	Recommended action
Increased cover and abundance of weeds on soft landscapes areas within the rail link corridor which are encroaching on adjacent patches of native vegetation.	Hi-volume spraying of herbicide within the Rail Link in areas adjacent to native vegetation (specifically the BA341 biobank site) should not be conducted. Weed control works within these areas should include manual removal or spot spraying with herbicide. Spot spraying with herbicide should only be undertaken during optimal conditions to avoid spray drift.
Occurrence of weeds immediately outside the rail corridor fencing on areas disturbed during construction of the Rail Link. Potential for these weeds to infiltrate the adjacent native vegetation.	These areas should be subject to on-going monitoring to determine whether weeds from the Rail Link are infiltrating and degrading the condition of native vegetation. The management contractor for the Moorebank biobank site should be made aware of potential weed encroachment form the Rail Link and undertake semi-regular targeted weed control works to remove any colonising weeds and maintain the good condition of native vegetation.

4.1.2 Riparian vegetation management

With the Georges River management site, on the eastern side of the Georges River, being incorporated into the BA341 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 the first half of last year (2022) EcoLogical was engaged by National Internodal (owner of the BA341 biobank site) to commence active management of the biobank site (which includes this management site). EcoLogical has been undertaking targeted weed control works throughout this area including brush cutting, careful spot spraying with herbicide and hand weeding targeting the following aggressive weed species: Asparagus asparagoides (Bridal Creeper), Senecio madagascariensis (Fireweed), Conyza sp. (Fleabane), Lantana camara (Lantana), Ligustrum sp. (Privet) and Acetosa sagitta (Turkey Rhubarb). This report should be provided the bush regeneration contractor for their reference and consideration when planning and scheduling works over the coming year.

The Georges River management site on the western side of the Georges River is not incorporated into the BA341 biobank site and is not subject to the management activities being undertaken by EcoLogical. No evidence of bush regeneration works has been observed in this location since the last monitoring survey in 2021. It is recommended that a bush regeneration contractor should be procured (or EcoLogical's scope extended to include these areas) to remove weeds and support native plantings. Weeds should be removed and native species cover increased. The removal of weeds may create enough space for native species to naturally colonise surrounding areas, however if this is not observed additional tube stock plantings should be installed.

The following trends in vegetation condition have been observed across the management site since the previous monitoring year:

- The edges the management site which adjoin areas of degraded native vegetation with high composition of weeds have recorded an increase in weed cover.
- Areas which recorded a moderate cover (>30 percent) of native species in the 2021/2022 monitoring event have maintained or slightly increased in native cover and have demonstrated resilience to weed intrusion.
- Areas which recorded a low cover (<30 percent) of native species in the 2021/2022 monitoring event have seen greater increases in weed cover.

A review of the monitoring data and observed trends in vegetation condition across the management site has been assessed against the Key Performance Indicators (KPIs) of the Riparian Vegetation Management Plan (RVMP) (Hyder 2015) in Appendix E. A summary of performance against the relevant KPIs has been included below in Table 4-3.

Table 4-3. Summary of performance against project KPIs

Key Performance Indicator	Status
Gradual improvement of native plant establishment with the aim of achieving 80 percent cover of native vegetation after five years following the initial planting	KPI completion date: Western side (June 2024); Eastern side (December 2024) Plans in place to undertake works – works required
Gradual reduction in weed density to 5 percent of the total area of each management site (eastern bank of Georges River)	In progress – works required
Reduction in weed density to 5 percent of the total area of management site 5 years after construction (western bank of Georges River only)	KPI completion date: June 2023 Plans in place to undertake works – works required
Gradual extension of native plant cover in each management site through natural regeneration	In progress – works required
Stability of riparian banks, including maintenance or reduction of erosion within management sites	Achieving
Re-establish and maintain connectivity for fauna habitat, particularly in the Georges River management site.	In progress – works required and review of adequacy

Additional works are required across the management site to achieve the KPIs and restore native riparian vegetation across the Georges River management site. Recommendations for revegetation, weed control and connectivity enhancement are included in Table 4-4.

Table 4-4. Recommended actions to increase the ecological value of the Georges River management site

Identified Issue	Recommended action
Increased weed coverage within revegetation areas	The bush regeneration contractor for the BA341 biobank site should be notified of the RVPM and the objectives for the Georges River management site. A Bush regeneration contractor should be on-boarded to undertake weed control and revegetation in the Casula offset area. The condition of revegetated areas should be improved through weed removal. Scattered weeds and isolated infestations should be removed from the management site. Natural regeneration of native species should be assisted, however if this is not observed tube stock plantings should; be installed in areas where weeds have been removed.
Encroachment of weed species from adjacent areas of infested bushland	The installation of a sediment fence to limit the amount of weed seed being transported into the revegetated site should be considered if the encroachment is continuing despite routine weeding exercises.
Bare patches between plantings on the eastern side of Georges River	Encourage natural recruitment of native species by maintaining low levels of weeds in bare areas between plantings.
Bare and weedy areas surrounding plantings on the western side of Georges River.	Infill planting with native tube stock should be considered if natural recruitment is not observed in bare areas beneath the Rail Link bridge. Plantings should be commensurate with species present in the RFEFCF vegetation community.

4.2 Threatened flora

4.2.1 Lands adjoining the Rail Link

Threatened species transect identified three threatened plant species within 10 metres of the Rail Link corridor fencing, including Nodding Geebung, Small-flower Grevillea and *Hibbertia puberula subsp. puberula*. Individuals of these threatened species were mostly observed to be in good condition. The number of individuals of Nodding Geebung and Small-flowered Grevillea remained similar the number observed during the previous monitoring event however the populations of *Hibbertia puberula subsp. puberula* has decreased. The threatened plant species *Acacia bynoeana* (Bynoe's Wattle) was not recorded during the survey and is likely to have perished in this location.

Large amounts of rainfall experienced during winter 2022 was observed to negatively impact populations of Bynoe's Wattle in adjoining areas of habitat. It is possible that the large amounts of water has also resulted in the demise of individuals with 10 metres of the RaiL Link corridor. No evidence was observed to indicate that the operation or ongoing management of Rail Link contributed to the loss of individuals. It should be noted that the Rail Link does not increase surface run off into areas outside of the rail link corridor. Despite the loss of three individuals, it is likely that propagules of this species are present in the soil profile and will germinate during optimal conditions in the future.

Similarly, a reduction in the number of *Hibbertia puberula* subsp. *puberula* is not thought to be a result of the operation or ongoing management of Rail Link. It is possible that in the warmer periods (spring and summer) following the period of high rainfall, prolific growth of native groundcovers and shrubs in the understorey occurred. As a result of understorey growth some individuals of *Hibbertia puberula* subsp. *puberula* may have demised due to increased competition, however it is also possible that a number of individuals were not re-found during surveys due to be obscured and are in fact still present. If individuals are being obscured overtime as the shrub stratum lifts and provides more space these individuals will become more detectable.

Cover and abundance of weeds in areas occupied by these threatened flora species was observed to be low. Intrusion of weeds into areas of habitat is mainly restricted to sparse scatterings of *Senecio madagascariesis* (Fireweed). No dense infestations of exotic perennial grass species or other aggressive weed species was observed. At current the occurrence of weeds in the Rail Link is not deemed to be impacting upon the presence or persistence of Bynoe's Wattle, Nodding Geebung, Small-flower Grevillea and *Hibbertia puberula* subsp. *puberula*.

Recommended management actions to protect and promote the persistence of threatened flora species in lands adjoining the Rail Link are identified in Table 4-5.

Table 4-5. Recommended management actions to protect threatened flora species in lands adjoining the Rail Link

Identified Issue	Recommended action
Increased cover and abundance of weeds on soft landscapes areas within the rail link corridor which are encroaching on habitat of threatened flora species.	Hi-volume spraying of herbicide within the Rail Link in areas adjacent to native vegetation (specifically the BA341 biobank site) should not be conducted. Weed control works within these areas should include removal or spot spraying with herbicide. Spot spraying with herbicide should only be undertaken during optimal conditions to avoid spray drift.
Occurrence of weeds immediately outside the rail corridor fencing on areas disturbed during construction of the Rail Link. Potential for these weeds to encroaching on habitat of threatened flora species	These areas should be subject to on-going monitoring to determine whether weeds from the Rail Link are infiltrating and degrading the condition of threatened flora species habitat. The management contractor for the Moorebank biobank site should be made aware of potential weed encroachment from the Rail Link. It is recommended that semi-regular targeted weed control works to remove any colonising weeds and maintain the good condition of threatened flora species habitat.

4.3 Weed management

Based on what has been observed over the past year, it is anticipated that over time, providing ongoing weed control works occur, the cover of native species in soft landscaped areas will increase. Existing plantings, with support from bush regenerators, will continue to colonise surrounding areas and outcompete annual common herbaceous weeds.

To maintain low weed covers and promote the regeneration of native plant species across the MPE operational facility, the recommended management actions identified in Table 4-6 and 43 should be implemented.

Table 4-6. Recommended actions to achieve/maintain low weed cover across MPE operational area and Rail Link

Identified issue	Recommended action
Weed growth on soft landscaped areas within the MPE operational facility	Weeds on soft batters within the trunk drainage system and retention basin/swale at the north-eastern extent of the facility should continue to be suppressed through a combination of herbicide application, slashing and hand weeding.
Weed growth on soft landscaped areas within the Rail Link	Weed control works targeting exotic species listed as 'priority' for the Greater Sydney Local Land Services region and the exotic grass species: *Melinus repens* (Red Natal Grass), *Chloris gayana* (Rhodes Grass), *Eragrostis curvula* (African Love Grass), *Hyparrhenia hirta* (Coolatai Grass) and *Themeda quadrivalvis* (Grader Grass). Large patches of African Lovegrass and Rhodes Grass between the Rail Link and the East Hills train line should be slashed on a regular basis to prevent seeding events.
Low cover of native species on revegetated soft batters in the Rail Link	To support the continued regeneration and colonisation of native species: • a trained bush regeneration contractor should be onboarded to conduct regular ongoing weed control work targeting weed species that have a detrimental impact on native seedlings, mainly competitive exotic grasses • retention of mature native species particularly seeding native grasses during weed control works promote colonisation of surrounding areas. • monitoring of rehabilitated areas of the Rail Link to identify areas that may require additional support to increase native plant cover (i.e. seeding) or any novel exotic species which may be detrimental to the survival of natives

4.4 Fauna

4.4.1 Fauna habitat connectivity

Fauna habitat connectivity monitoring identified that several species, both native and invasive, are regularly utilising the Anzac Creek corridor to move between patches of native vegetation within the Wattle Grove offset area. The fauna ramps installed at the culvert are being readily used by native fauna and provide access and egress between patches of bushland on either side of the operation Rail Link.

During periods of high rainfall, Anzac Creek culverts have been inundated with water resulting in the fauna ramps moving slightly. Regular monitoring inspections should be made of the culvert to ensure fauna ramps remain in situ and vegetation growth within crossing passages does not begin to obstruct movement or cause an issue to the culvert infrastructure or operation of the Rail Link.

Large logs and coarse woody debris placed on rock ballast remain as the habitat connectivity measure linking riparian vegetation within the MLP precinct with bushland to the south. This alternative habitat connectivity measure was adopted following the placement of ballast in the 20-metre-wide gap cleared for the bridge on the eastern side of the Georges River during construction. During the 2022 spring monitoring period, no fauna was observed using the woody debris. The number of large logs appears to have been reduced in comparison to previous monitoring years, with high water levels potentially moving

existing logs and debris. Placing additional woody debris and logs should be considered to improve accessibility to local terrestrial fauna.

Plate 4-1. Large logs and piles, of course, woody debris placed to facilitate movement of fauna across ballast at Georges River beneath the rail link bridge

Mobile native species recorded within the Georges River offset site which are likely to move along riparian vegetation corridors include *Petaurus breviceps* (Sugar Glider), *Pseudocheirus peregrinus* (Common Ringtail Possum), *Trichosurus vulpecula* (Common Brushtail Possum), *Wallabia bicolor* (Swamp Wallaby), *Tachyglossus aculeatus* (Short-beaked Echidna), *Pseudechis porphyriacus* (Red-bellied Black Snake) and *Macropus robustus* (Common Wallaroo). Remote camera monitoring for the Rail Link area identified three species as using the corridor, including Red Fox, Domestic Cat and Swamp Wallaby. Evidently, only a small subset of the native species known to occur within MLP have been recorded using the corridor. Arboreal mammals often will not cross areas with low tree cover (Soanes & van der Ree, 2009), and no evidence of use by these species has been recorded by remote cameras. It is likely that the current habitat connectivity measures in place are not facilitating dispersal for some species along the vegetated Georges River corridor.

Additionally, a six-foot-high cyclone fence with top-lined barbed wire installed to the south of the Georges River management site is likely a barrier to the movement of some fauna species between the MLP site and bushland to the south. Ground-dwelling fauna like macropods are unlikely to be able to pass this cyclone fence, and due to the barbed wire lined top, arboreal fauna is also likely prevented from climbing the fence and dispersing across the landscape. Koalas have been recorded in riparian bushland along the Georges River as well as bushland to the south outside of the MLP precinct. Koalas would readily move along this corridor for various reasons (foraging, dispersal, breeding), and cyclone fencing may be inhabiting these movements.

Plate 4-2. Cyclone fence at the southern extent of the management site

If revegetation works were conducted as per the RVMP (Hyder 2015) and the six-foot-high cyclone fencing was removed, a greater diversity of fauna species would likely be recorded using the passage to move along the Georges River riparian corridor. Recommended actions to increase the connectivity value of the Georges River management site are identified in Table 4-7. These actions integrate components of the methodology outlined in the RVMP to maintain and enhance fauna habitat beneath the Rail Link bridge.

Table 4-7. Recommended actions to improve habitat connectivity at Anzac Creek culvert and beneath the Rail Link bridge on the eastern banks of the Georges River

Identified Issue	Recommended action
Vegetation growth within crossing passages on the northern and southern sides of the Anzac Creek culvert.	Intermittent monitoring inspections should be made of the culvert to ensure fauna ramps remain in situ and vegetation growth within crossing passages does not begin to obstruct movement or cause an issue to the culvert infrastructure or operation of the Rail Link
Inadequate habitat connectivity beneath the Rail Link bridge	Review of rock ballast as the necessary means for erosion and sediment control beneath the Rail Link bridge. If rock ballast is not deemed necessary for the entire 20-metre wide gap, it should be removed and replaced with alternative soil stabilisation materials (i.e. coir logs, jute and coir mesh). Planting of native species should be undertaken in conjunction with the installation of soft stabilisation materials as per the original habitat connectivity enhancement plan from the RVMP (Hyder 2015). If rock ballast cannot be removed, improvement of current crossing designs should be considered, such as the installation of crossings to support arboreal mammal dispersal.
Installation of a six-foot-high cyclone fence at the southern extent of the management site restricting the movement of fauna along the Georges River riparian corridor	A review of the fencing location and design should be conducted to determine whether it is necessary and/or whether it can be modified to allow the movement of fauna from the MLP site to bushland south of the site. Fencing design should not include barbed wire, and existing fencing should be modified to improve connectivity. Considerations should be made for the installation of crossing mechanisms for fauna (i.e. Koala bridges) or replacement of the current Cyclone fence with a rural style fence with wooden bollard and five straight wires, as is to be installed around MLP drainage channels.

4.4.2 Koala management monitoring

Cyclone mesh fencing is present along the interface between Wattle Grove offset area and the MPE operational facility restricting the movement of Koalas into unsuitable areas. Inspection of the perimeter identified two areas where there was a small gap between the fence and the ground. The gaps were a maximum of 15 centimetres which were unlikely to enable a Koala to pass under. However, these areas should be checked throughout the year to ensure gaps do not increase in size due to erosion or use by smaller animals such as hares.

Currently, no structures (bridges, culverts, refuge posts) have been installed which facilitate the movement of Koalas from the Wattle Grove offset area to adjoining areas of suitable habitat. Koala bridges are yet to be installed along the southern boundary of the offset area as per the KPM (Cumberland Ecology 2020) to facilitate Koala movement into bushland areas within the Holsworthy defence area. It is noted in the KPM that prior to installing Koala bridges, “Transport for NSW and Department of Defence will need to be consulted…to gain necessary access/permits.” Additionally, a series of other actions are required to increase suitability for Koala movement across the rail line, as discussed in Section 8.3.5.2 of the KMP (Cumberland Ecology 2020).

As development continues across the MLP site, Koala fences, bridges, gates and grids will be installed in accordance with the plans outlined in the KMP (Cumberland Ecology, 2020).

Table 4-8. Recommended management actions to maintain Koala fencing adjacent to the MPE operational facility

Identified Issue	Recommended action
No connectivity between Wattle Grove offset area and bushland in Holsworthy defence area	Discussions should commence with TfNSW and the Department of Defence to determine the feasibility of implementing connectivity measures outlined in the KMP (Cumberland Ecology 2020) to allow Koalas and other fauna to move between the Wattle Grove offset area and bushland in the Holsworthy defence area. Barbed wire should not be used in fence design in these areas.

4.4.3 Feral animals

The abundance of feral animals recorded on cameras is difficult to determine based on our camera monitoring. Impacts from these species on native biota have been observed in the field as well as on our remote camera photographs. The results suggest an abundance of feral animals occur within the Wattle Grove Offset area. However, a limitation is that there has been a lack of camera trap monitoring within the Georges River Corridor, creating a bias in the data. We would expect feral animals to be equally abundant throughout the Wattle Grove and Georges River Corridors.

European Hare can cause significant damage when gnawing the bark of young trees and shrubs and can cause severe damage to revegetation sites (Agriculture Victoria 2021). Ongoing revegetation activities in the Rail Link and onsite detention basins (OSDs) may be at risk from this species.

Domestic Cat and Red Fox were recorded on remote cameras at five locations on the boundary of the MPE operational facility. It is likely that these species regularly traverse the operational area whilst moving across the landscape. Two distinct domestic cats were captured repeatedly across the Wattle Grove offset area and one additional cat below the rail bridge at Georges River. At least four individual foxes have been recorded across the offset sites, with one visibly sick adult fox recorded at both Anzac Creek and Georges River, demonstrating there is movement between the two offset sites. This fox was recorded with two juveniles, and a healthy adult individual has been seen at both offset sites. However, no distinction can be made between healthy adults, so it is possible these records are of several individuals. A Red Fox den has also been located within the Wattle Grove offset area.

The occurrence of Black Rat within the MPE operational facility is not considered to be a significant issue. This species is common across the landscape. No significant infestations of this species or signs of infestation have been observed across the facility or within the adjacent Wattle Grove offset area. In large numbers, this species has the potential to impact native fauna through predation and competition for resources. Four nest boxes were found to be occupied by Black Rats during 2022 nest box surveys indicating this species may predate on native bird eggs and/or compete for nesting space with hollow-dependant fauna (Zarzoso-Lacoste et al. 2011).

The landholder should support the implementation of a feral animal control program predominately focusing on the control of Red Fox in the bushland immediately adjacent to the operation facility (Wattle Grove offset area). The MPE property manager should communicate with Liverpool City Council and surrounding landholders (Glenfield Waste Facility, National Intermodal and Holsworthy Army Barracks) to discuss the feasibility and willingness to undertake a coordinated feral animal control program. Live trapping of feral/domestic cats is recommended in both offset areas to remove these individuals and determine if they are owned or feral individuals. As per Liverpool City Council's Urban Cat Management Plan and the *Companion Animals Act 1998 (revised 2019),* cats should not be free roaming in wildlife protection areas. The council has animal management services available to support the collection of cats from the Wattle Grove and Georges River management areas.

Table 4-9. Recommended monitoring for feral animals within the MPE operational facility

Identified Issue	Recommended Corrective Action
Vertebrate pests within the MPE operational facility and surrounds	Ongoing opportunistic monitoring should be conducted through MPE operational facility and surrounds to determine whether populations of European Hare, Red Fox, Black Rat and Domestic Cat are having a negative impact on native biota. Any signs of novel pests within the biobank site should also be recorded.
Increased observation of Red Fox, which may indicate an increasing population	Communicate with Liverpool City Council and surrounding landholders (Glenfield Waste Facility and Holsworthy Army Barracks) to discuss feasibility and willingness to undertake a coordinated Red Fox control program.
Increased observation of Domestic/Feral Cats in offset site.	Communicate with Liverpool City Council to discuss collection of cats in the offset areas.

4.5 Summary of recommendations

Table 4-10 compiles management issues identified during the 2022/2023 monitoring period within the MPE operational facility and recommend appropriate corrective actions.

Table 4-10. Compiled list of management issues identified within the MPE operational facility and recommended corrective actions

	Identified issue and reference number	Recommended action
Native vegetation: Lands adjoining the Rail Link		
1	Increased cover and abundance of weeds on soft landscapes areas within the rail link corridor which are encroaching on adjacent patches of native vegetation.	Hi-volume spraying of herbicide within the Rail Link in areas adjacent to native vegetation (specifically the BA341 biobank site) should not be conducted. Weed control works within these areas should include manual removal or spot spraying with herbicide. Spot spraying with herbicide should only be undertaken during optimal conditions to avoid spray drift.
2	Occurrence of weeds immediately outside the rail corridor fencing on areas disturbed during construction of the Rail Link. Potential for these weeds to infiltrate the adjacent native vegetation.	These areas should be subject to on-going monitoring to determine whether weeds from the Rail Link are infiltrating and degrading the condition of native vegetation. The management contractor for the Moorebank biobank site should be made aware of potential weed encroachment form the Rail Link and undertake semi-regular targeted weed control works to remove any colonising weeds and maintain the good condition of native vegetation.
Native vegetation: Riparian vegetation management		
3	Increased weed coverage within revegetation areas	The bush regeneration contractor for the BA341 biobank site should be notified of the RVPM and the objectives for the Georges River management site. A Bush regeneration contractor should be on-boarded to undertake weed control and revegetation works on the western side of Georges River. The condition of revegetated areas should be improved through weed removal. Scattered weeds and isolated infestations should be removed from the management site. Natural regeneration of native species should be assisted, however if this is not observed tube stock plantings should; be installed in areas where weeds have been removed.
4	Encroachment of weed species from adjacent areas of infested bushland	The installation of a sediment fence to limit the amount of weed seed being transported into the revegetated site should be considered if the encroachment is continuing despite routine weeding exercises.
5	Bare patches between plantings on the eastern side of Georges River	Encourage natural recruitment of native species by maintaining low levels of weeds in bare areas between plantings.
6	Bare and weedy areas surrounding plantings on the western side of Georges River.	Infill planting with native tube stock should be considered if natural recruitment is not observed in bare areas beneath the Rail Link bridge. Plantings should be commensurate with species present in the RFEFCF vegetation community.
Threatened flora: Lands adjoining the Rail Link		

Identified issue and reference number		Recommended action
7	Increased cover and abundance of weeds on soft landscapes areas within the rail link corridor which are encroaching on habitat of threatened flora species.	Hi-volume spraying of herbicide within the Rail Link in areas adjacent to native vegetation (specifically the BA341 biobank site) should not be conducted. Weed control works within these areas should include manual removal or spot spraying with herbicide. Spot spraying with herbicide should only be undertaken during optimal conditions to avoid spray drift.
8	Occurrence of weeds immediately outside the rail corridor fencing on areas disturbed during construction of the Rail Link. Potential for these weeds to encroaching on habitat of threatened flora species	These areas should be subject to on-going monitoring to determine whether weeds from the Rail Link are infiltrating and degrading the condition of threatened flora species habitat. The management contractor for the Moorebank biobank site should be made aware of potential weed encroachment form the Rail Link and undertake semi-regular targeted weed control works to remove any colonising weeds and maintain the good condition of threatened flora species habitat.
Weed management		
9	Weed growth on soft landscaped areas within the MPE operational facility	Weeds on soft batters within the trunk drainage system and retention basin/swale at the north-eastern extent of the facility should continue to be suppressed through a combination of herbicide application, slashing and hand weeding.
10	Weed growth on soft landscaped areas within the Rail Link	Weed control works targeting exotic species listed as 'priority' for the Greater Sydney Local Land Services region and the exotic grass species: *Melinus repens* (Red Natal Grass), *Chloris gayana* (Rhodes Grass), *Eragrostis curvula* (African Love Grass), *Hyparrhenia hirta* (Coolatai Grass) and *Themeda quadrivalvis* (Grader Grass). Large patches of African Lovegrass and Rhodes Grass between the Rail Link and the East Hills train line should be slashed on a regular basis to prevent seeding events.
11	Low cover of native species on revegetated soft batters in the Rail Link	To support the continued regeneration and colonisation of native species: • a trained bush regeneration contractor should be onboarded to conduct regular ongoing weed control work targeting weed species that have a detrimental impact on native seedlings, mainly competitive exotic grasses • retention of mature native species particularly seeding native grasses during weed control works promote colonisation of surrounding areas. • monitoring of rehabilitated areas of the Rail Link to identify areas that may require additional support to increase native plant cover (i.e. seeding) or any novel exotic species which may be detrimental to the survival of natives
Fauna: Fauna habitat connectivity		
12	Vegetation growth within crossing passages on the northern and southern sides of the Anzac Creek culvert.	Intermittent monitoring inspections should be made of the culvert to ensure fauna ramps remain in situ and vegetation growth within crossing passages does not begin to obstruct movement or cause an issue to the culvert infrastructure or operation of the Rail Link

Identified issue and reference number		Recommended action
13	Inadequate habitat connectivity beneath the Rail Link bridge	Review of rock ballast as the necessary means for erosion and sediment control beneath the Rail Link bridge. If rock ballast is not deemed necessary for the entire 20-metre wide gap, it should be removed and replaced with alternative soil stabilisation materials (i.e. coir logs, jute and coir mesh). Planting of native species should be undertaken in conjunction with the installation of soft stabilisation materials as per the original habitat connectivity enhancement plan from the RVMP (Hyder 2015). If rock ballast cannot be removed, improvement of current crossing designs should be considered, such as the installation of crossings to support arboreal mammal dispersal.
14	Installation of a six-foot-high cyclone fence at the southern extent of the management site restricting the movement of fauna along the Georges River riparian corridor	A review of the fencing location and design should be conducted to determine whether it is necessary and/or whether it can be modified to allow the movement of fauna from the MLP site to bushland south of the site. Considerations should be made for the installation of crossing mechanisms for fauna (i.e. Koala bridges) or replacement of the current Cyclone fence with a rural style fence with wooden bollard and 5 straight wires, as is to be installed around MLP drainage channels.
Fauna: Koala management monitoring		
15	No connectivity between Wattle Grove offset area and bushland in Holsworthy defence area	Discussions should commence with TfNSW and the Department of Defence to determine the feasibility of implementing connectivity measures outlined in the KMP (Cumberland Ecology 2020) to allow Koalas and other fauna to move between the Wattle Grove offset area and bushland in the Holsworthy defence area.
Fauna: Feral animals		
16	Vertebrate pests within the MPE operational facility and surrounds	Ongoing opportunistic monitoring should be conducted through MPE operational facility and surrounds to determine whether populations of European Hare, Red Fox, Black Rat and Domestic Cat are having a negative impact on native biota. Any signs of novel pests within the biobank site should also be recorded.
17	Increased observation of Red Fox, which may indicate an increasing population	Communicate with Liverpool City Council and surrounding landholders (Glenfield Waste Facility and Holsworthy Army Barracks) to discuss feasibility and willingness to undertake a coordinated Red Fox control program.
18	Increased observation of Domestic/Feral Cats in offset site.	Communicate with Liverpool City Council to discuss collection of cats in the offset areas.

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6 APPENDICES

APPENDIX A . WEED MONITORING REPORTS (APRIL 2022 – FEBRUARY 2023)

APPENDIX B . RAIL LINK WEED REMEDIATION - SUMMARY OF WORKS

APPENDIX C . REMOTE CAMERA: FAUNA SPECIES INVENTORY

APPENDIX D . EPBC OFFSET SITES - ANNUAL MONITORING REPORT

APPENDIX E . KEY PERFORMANCE INDICATORS (KPIS) FOR RVMP WORKS

APPENDIX F . RIPARIAN VEGETATION MANAGEMENT – NATIVE FLORA INVENTORIES

APPENDIX G . RIPARIAN VEGETATION COMPARISON OF EXOTIC AND NATIVE COVER PERCENTAGES FOR EACH VEGETATION QUADRAT ACROSS MONITORING EVENTS (JUNE 2018 – APRIL 2023)

APPENDIX H . RIPARIAN VEGETATION MANAGEMENT – PHOTO POINTS

APPENDIX I . BA341 LANDS ADJOINING RAIL LINK - QUADRAT MONITORING DATA

APPENDIX J . NEST BOX MONITORING REPORT (SPRING 2022)

APPENDIX A. WEED MONITORING REPORTS (APRIL 2022 – FEBRUARY 2023)

Date	1/06/2023
To	[redacted]
From	
Copy to	
Subject	MPE operational facility – Weed monitoring report April 2023

Introduction

Arcadis has been commissioned to conduct bi-monthly weed monitoring surveys within Moorebank Precinct East (MPE) operational facility at Moorebank Logistics Park. 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 undertaken in Spring 2020. Routine weed remediation works have commenced as of December 2022 along the rail link corridor, with future remediation works planned.

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. A number of weed remediation events have occurred since the inception of weed monitoring, detailed below:

- In early spring 2020, Spray Grass solutions commenced a rehabilitation project to remove weeds from the batters and revegetate with native species commensurate with the Urban Design and Landscaping Plan (UDLP) for MPE. Spray Grass solutions procured Cumberland Plain Seeds to provide technical oversight of the revegetation effort with native seed.
- In December 2021, a meeting was held that discussed the progress of the rehabilitation project and how the areas included were to be managed going forward. As a result of this meeting, the monitoring methodology for the Rail Link was differentiated from the rest of the MPE operational facility to consider the revegetation methodology and management recommendations proposed by Spray Grass Solutions and Cumberland Valley Seeds. Instead of reporting on the cover of all exotic species within the Rail Link, the focus be shifted to monitoring the covers of 'priority 'and key weeds specific to this project. Similarly, recommendations for the Rail Link will align with the decided-upon management actions. The monitoring methodology for the Rail Link has been included below.
- In December 2022, weed remediation works were initiated throughout the Rail Link, with plans to continue these and other ongoing works into 2023. The aims of these works were to target key and priority weeds within the rail corridor for removal and bring down the biomass of exotic species to

promote the continued growth of native seedings within the area. Remediation works have continued into April 2023.

Methodology

Arcadis ecologist Kate Mauger attended the MPE operational facility on 27 April 2023. 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 2.

The weather on the survey day was partly cloudy, with a maximum temperature of 24.3 °C recorded at Holsworthy Aerodrome (station 066161) (BOM 2021).

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 1.

Table 1. Categories to describe percent cover of weeds

Categories	Percentage cover of weeds within a patch (%)
Low	5 – 25
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 2.

Table 2. Priority and key weed species subject to control within the Rail Link

Priority weed species	Key weed species
Senecio madagascariensis (Fireweed)	*Chloris gayana* (Rhodes Grass)
Alternanthera philoxeroides (Alligator weed)	*Eragrostis curvula* (African Lovegrass)
Asparagus asparagoides (Bridal Creeper)	*Themeda quadrivalvis* (Grader Grass)
Olea europaea subsp. *cuspidata* (African Olive)	*Hyparrhenia hirta* (Coolatai Grass)

Priority weed species	Key weed species
Lantana camara (Lantana) *Ludwigia peruviana* (Ludwigia)	*Echium plantagineum* (Paterson's Curse)

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

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 27 April 2023.

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) as the ecologists were not under the supervision of an Australian Rail Track Corporation (ARTC) Protection Officer (PO). Future surveys along the Southern Sydney Freight Line (SSFL) will require the attendance of a PO.

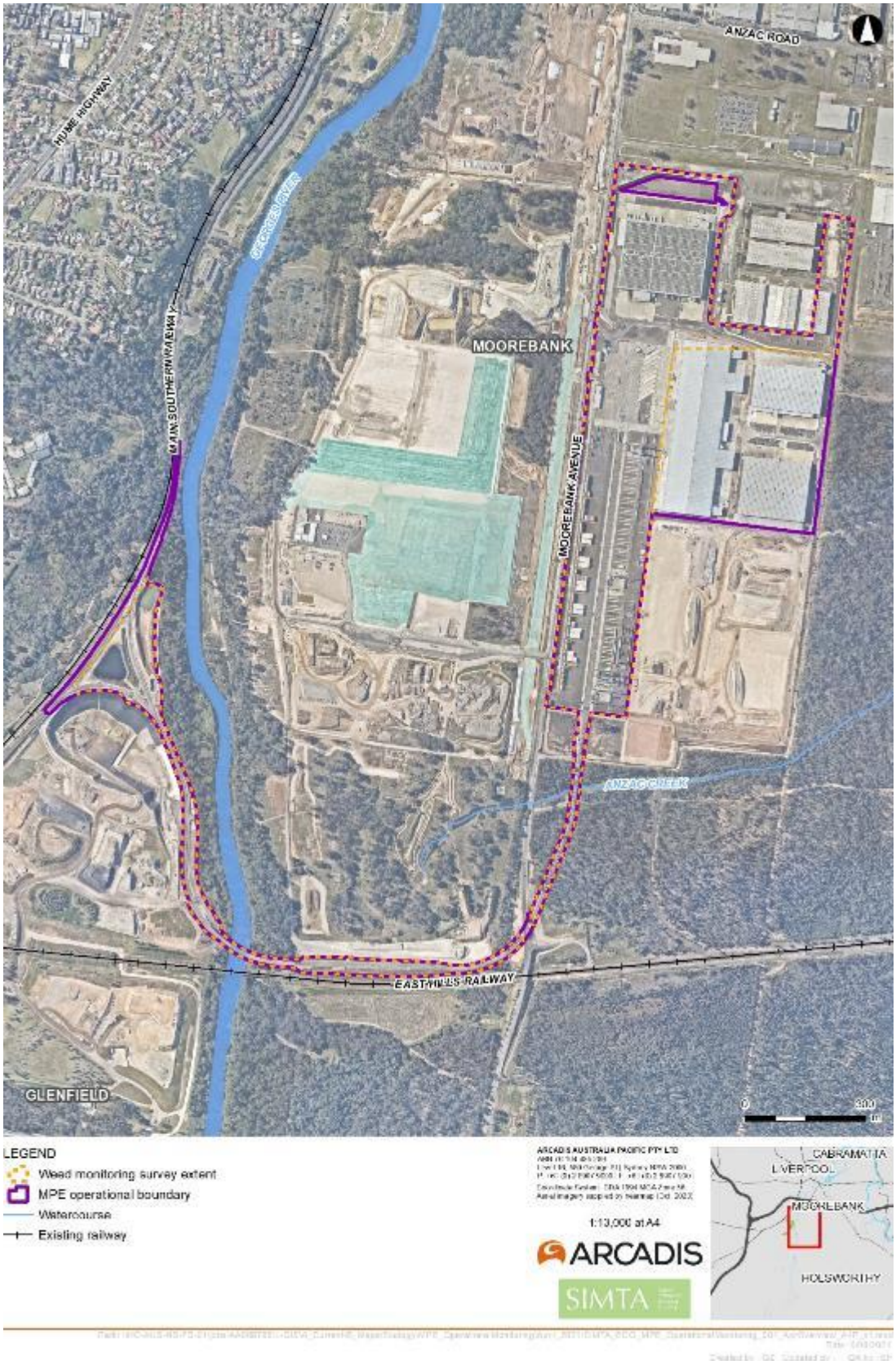

Figure 1. Survey extent within the MPE operational facility

Results

Observations made by the attending ecologists during the April 2023 weed monitoring survey are summarised below.

IMEX, warehouses and drainage infrastructure

Weed cover is similar to what was recorded in the February 2023 surveys across the developed areas and the associated truck drainage systems. While overall weed cover remains low, the current survey identified new instances of priority weed *Senecio madagascariensis* (Fireweed) occurring in the drainage basins (Plate 1). It was noted in the February report that fireweed was seeding and that it would spread, and this appears to have occurred as multiple new individuals were spotted.

No signs of weed remediation works (chipping or herbicide spraying of weeds) were observed at the north-eastern extent of the facility surrounding drainage basins and swales.

Instances of erosion within drainage basins and truck drainage systems have been rectified and restabilised since the February 2023 survey using geo-mesh fabric and stone boulders (Plate 2). Several native species are present and continue to grow on soft batters and in the drainage swale which will continue to aid in stabilising soft batters. Commonly observed species include *Acacia falcata* (Hickory Wattle)*, Chloris truncata (*Windmill Grass), *Typha orientalis* (Bulrush)*, Persicaria decipiens* (Slender Knotweed)*, Ficinia nodosa* (Knotted Club-rush) and *Lomandra longifolia* (Mat Rush)*.*

Plate 1. New observations of fireweed in drainage basins

Plate 2. Rectification measures for instances of erosion in the drainage basin (left), and around the stormwater outlet (right).

The soft batters of the trunk drainage system along Moorebank Avenue have a low cover of exotic grasses, which are currently stabilising the soil, with some native species, such as Hickory Wattle, persisting. Generally, the area with the stormwater basins requires thicker and more consistent vegetation cover to mitigation erosion from rainfall.

Similar levels of fireweed recorded in the February 2023 survey were observed in April (Plate 3). Fleabane (*Conyza* spp.) was observed along the footpaths adjacent to the IMEX building and has potential to spread into the trunk drainage system (Plate 3).

Plate 3 Fireweed, Grader Grass and Rhodes Grass growing on soft batters of the northeast trunk drainage system (left), Fleabane growing along footpath adjacent to IMEX building (right).

A small amount of plant growth was observed in the trunk drainage systems at the northernmost point of MPE. Recent rain events over the last 12 months have increased the amount of silt and organic matter in the drainage systems, which may have resulted in vegetation growth. The remainder of the trunk drainage system remains vegetation free.

Rail Access Land Package (RALP)

No weed control works have occurred within the RALP corridor since the February surveys. Moderate growth of exotic species has been observed in soft landscaped areas around patches of mature native grasses and shrubs (Figure 6). Exotic biomass has increased but was not observed impacting occurrences of native species or impeding growth. The larger areas of native species flagged by ecologists which have been avoided from slashing works has seen increased growth and seeding

events from species like *Themeda traiandra* (Kangaroo Grass), *Cymbopogon refractus* (Barbed-wire Grass) and *Dichanthium sericeum* (Queensland Bluegrass) (Plate 4).

Plate 4 Pink flagging tape marking the location of native species to be retained during the remediation works.

Plate 5. Exotic species continue to colonise remediated soft batters amongst native species

The status of weeds and weed remediation works observed during the April 2023 monitoring survey has been compared against a series of recommended actions developed during the baseline monitoring survey (Table 3).

Table 3 Weed remediation works tracking

Priority	Action	Action description	April '23 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 is present within the Rail Link: *Senecio madagascariensis* (Fireweed) (Figure 3 - Figure 10). This species requires ongoing management to reduce occurrence of this weed, with the final objective being to eradicate it. Three other priority weed species have been eradicated from the Rail ink since December 2022, including *Asparagus asparagoides* (Bridal Creeper), *Olea europaea subsp. cuspidata* (African Olive) and *Lantana camara* (Lantana). Continued management must be undertaken to suppress regeneration of priority weeds 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, Fleabane, and Grader Grass, are colonising soft batters in the Rail Link. These weeds should be removed. Scattered individuals of Golden Wreath Wattle and Castor Oil Plant have been removed from Rail Link since December 2022. 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 increasing on soft batters adjacent to the biobank site and ecologically sensitive areas. In some instances, exotic species are encroaching into these ecologically sensitive areas. Manual removal, including routine slashing, has recently been adopted 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

Priority	Action	Action description	April '23 performance assessment
			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. As native grasses become established, care must be taken, and indiscriminate slashing must be avoided. The Project Ecologist has demarcated native species using pink survey flags to assist the contractors when slashing to avoid off target impacts.
Native 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). Areas outlined by coloured polygons in Figure 3 - Figure 10 should be prioritised.	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. Weed remediation works have commenced as of December 2022 in gravel and ballast areas and have continued in February 2023, and are expected to recommence in June 2023. 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

Priority	Action	Action description	April '23 performance assessment
			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 MPE operational facility. No signs of weed remediation works were observed during the recent survey in these areas.

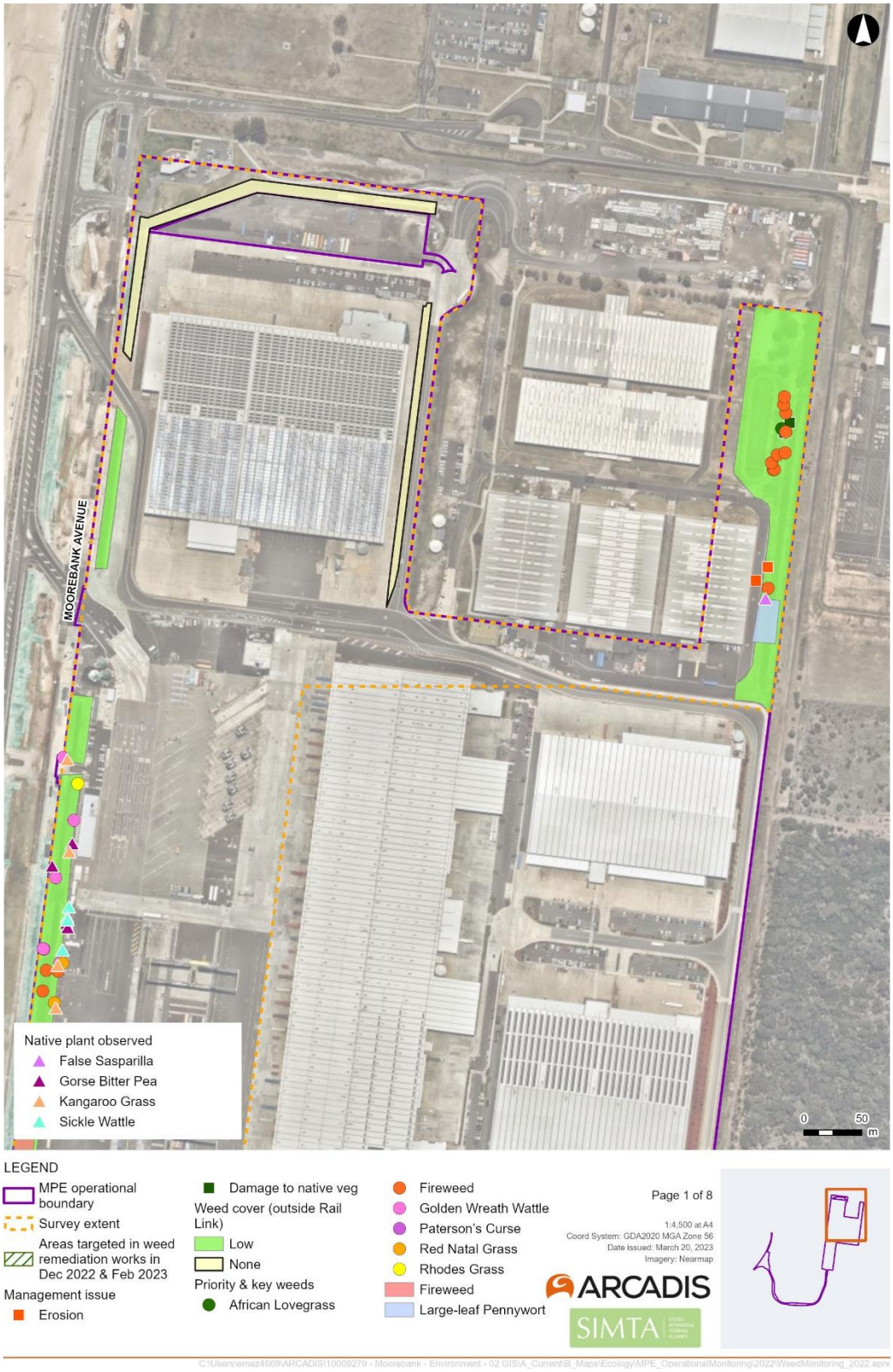

Figure 2 Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 1 of 8)

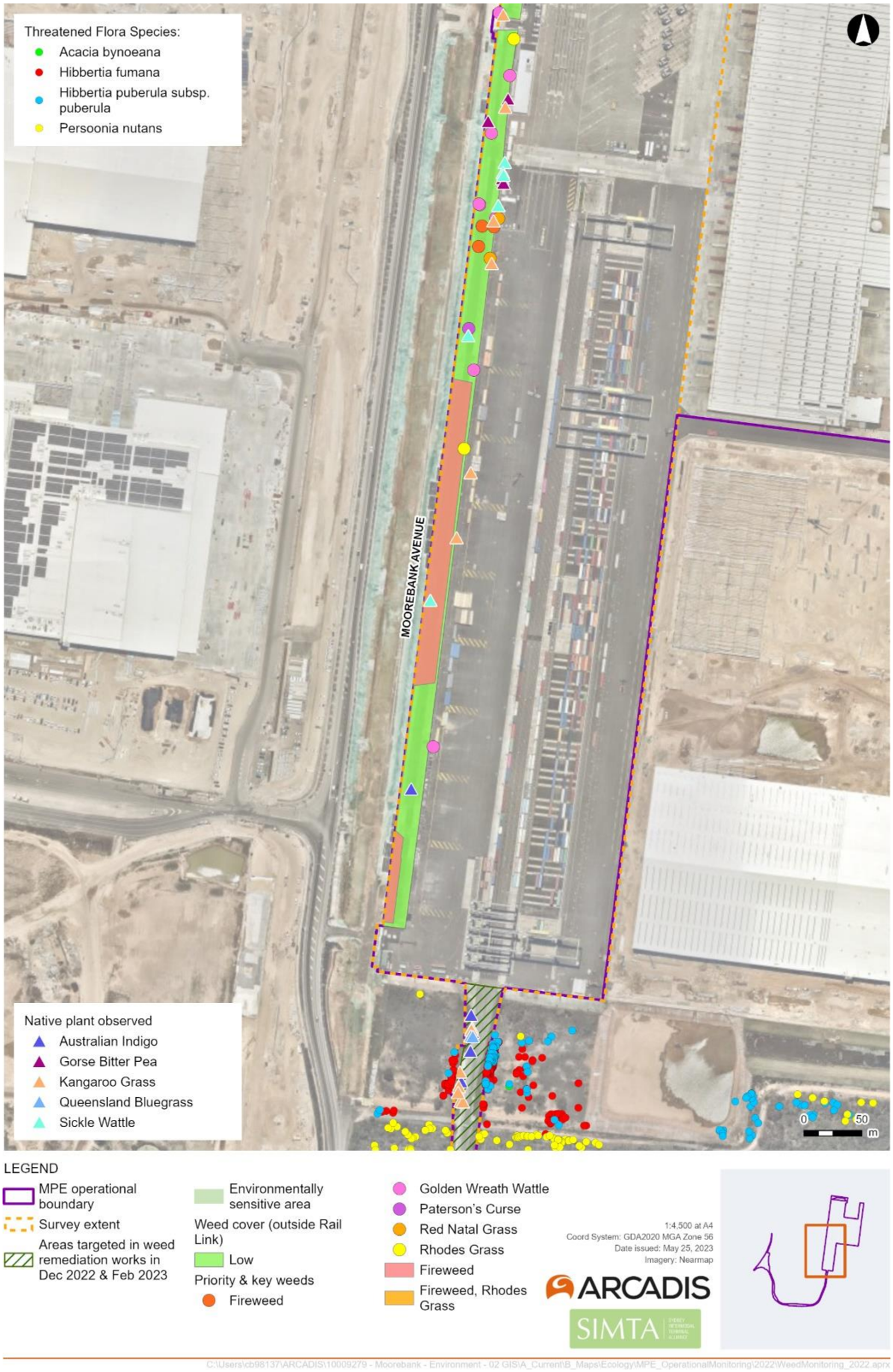

Figure 3. Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 2 of 8)

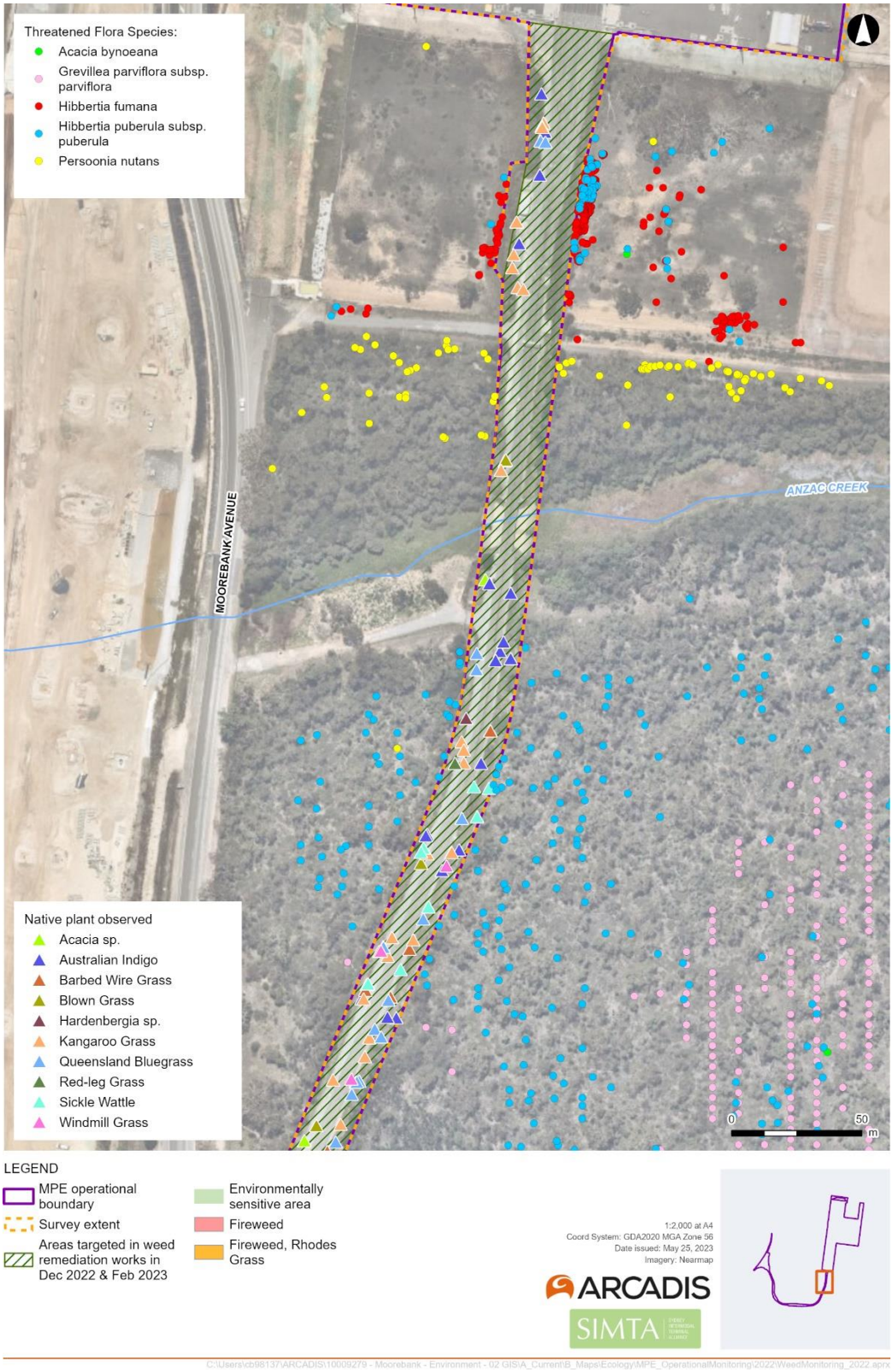

Figure 4. Native species, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 3 of 8)

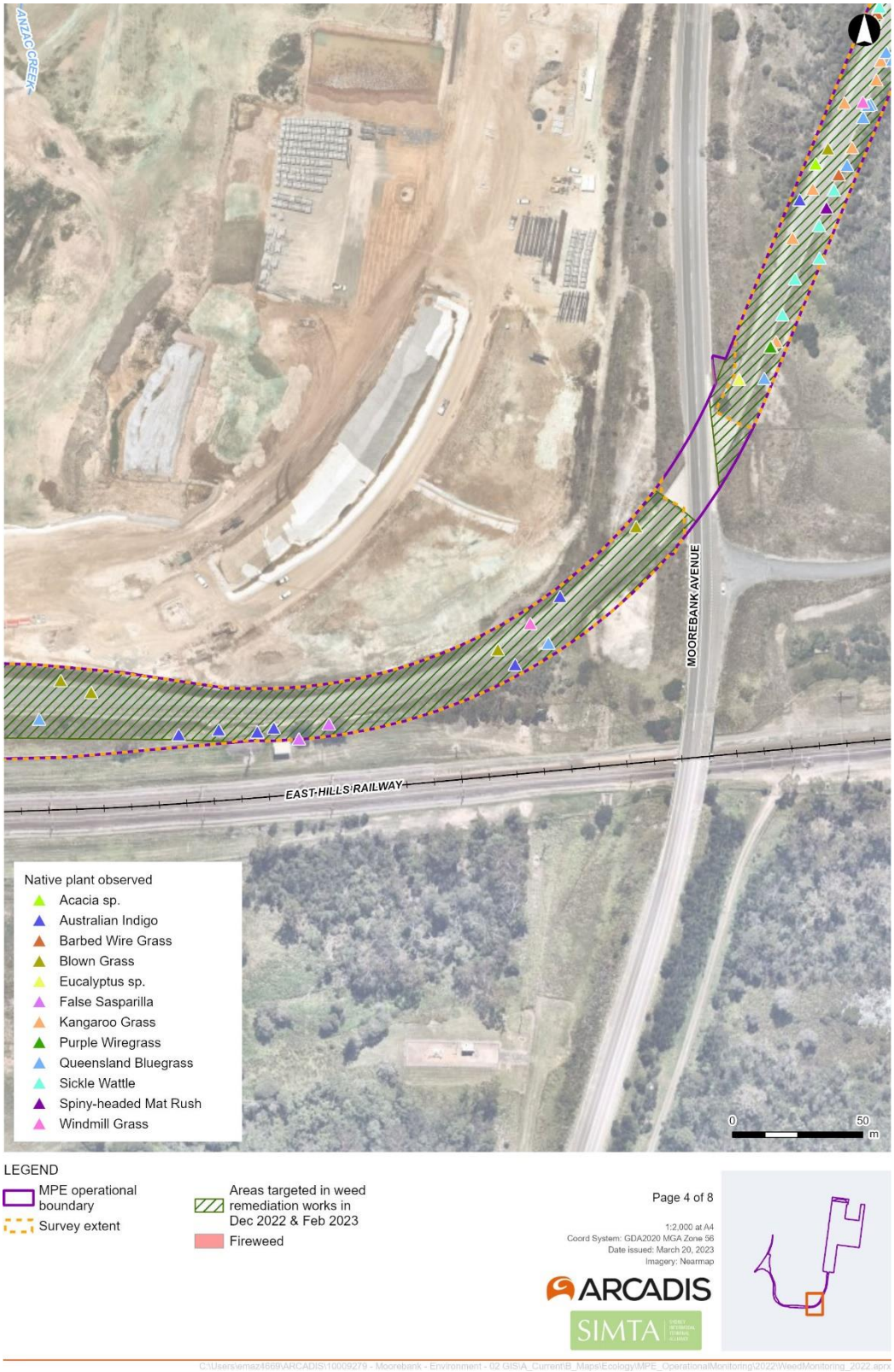

Figure 5 Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 4 of 8)

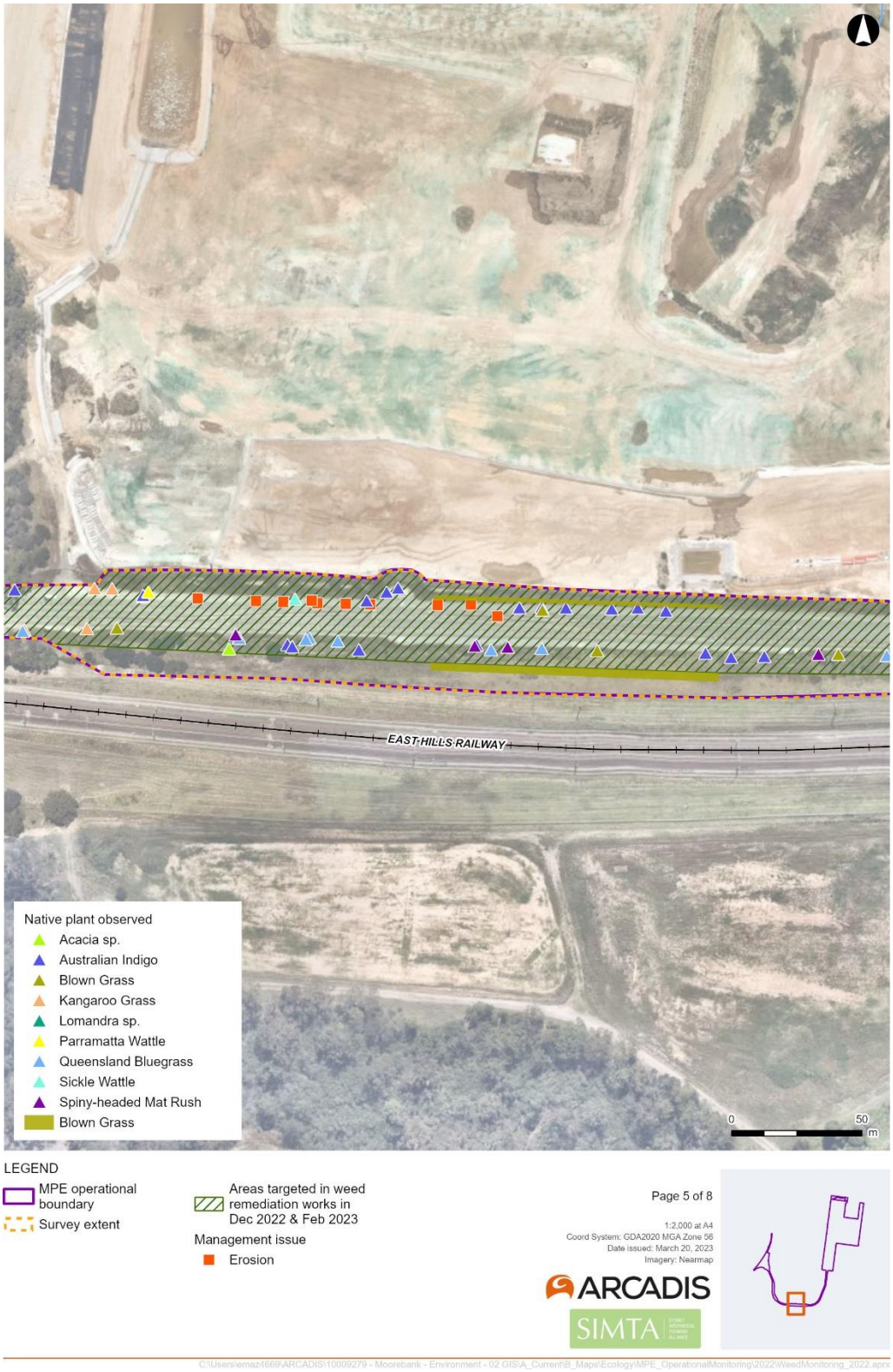

Figure 6. Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 5 of 8)

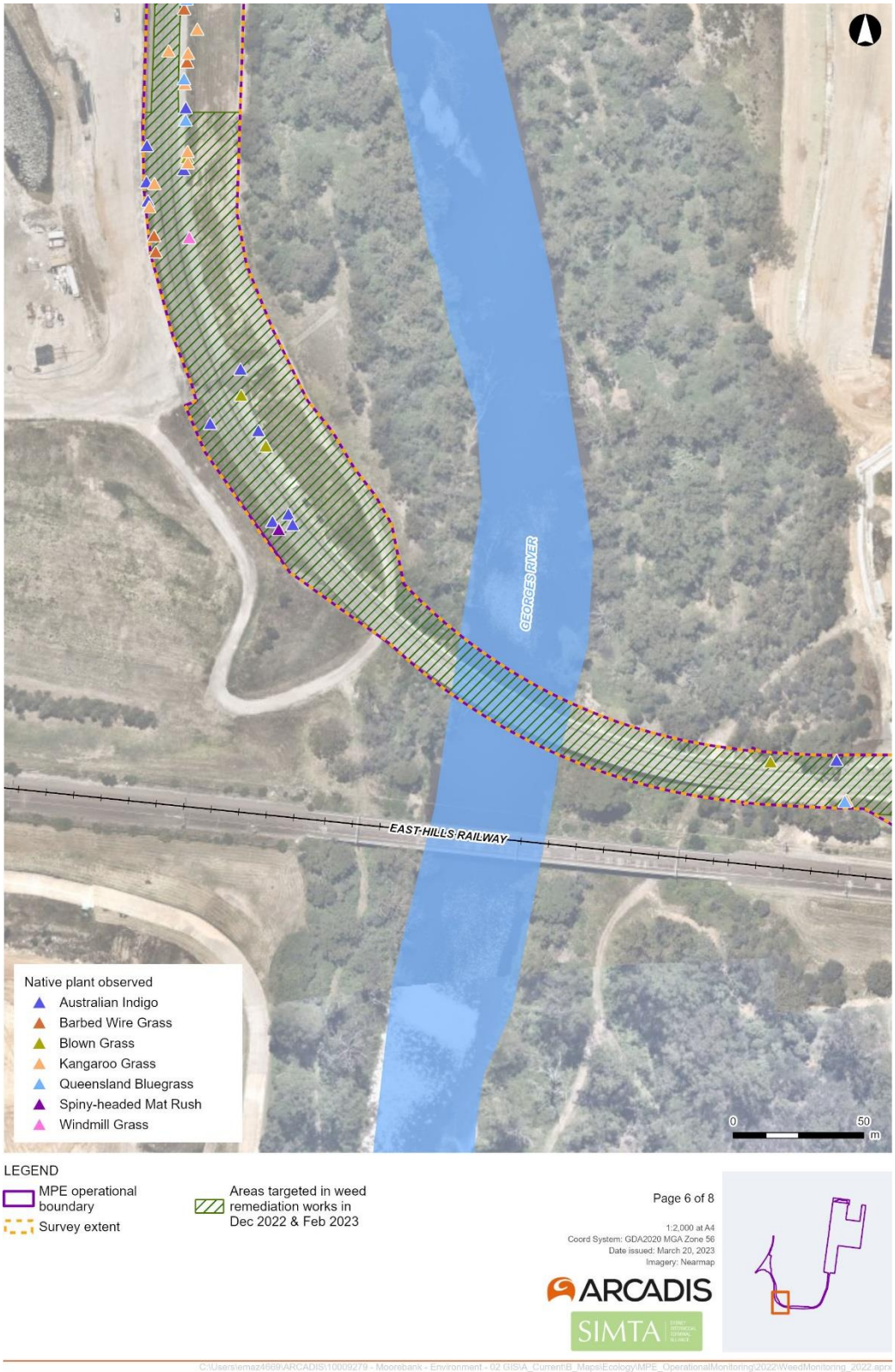

Figure 7. Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 6 of 8)

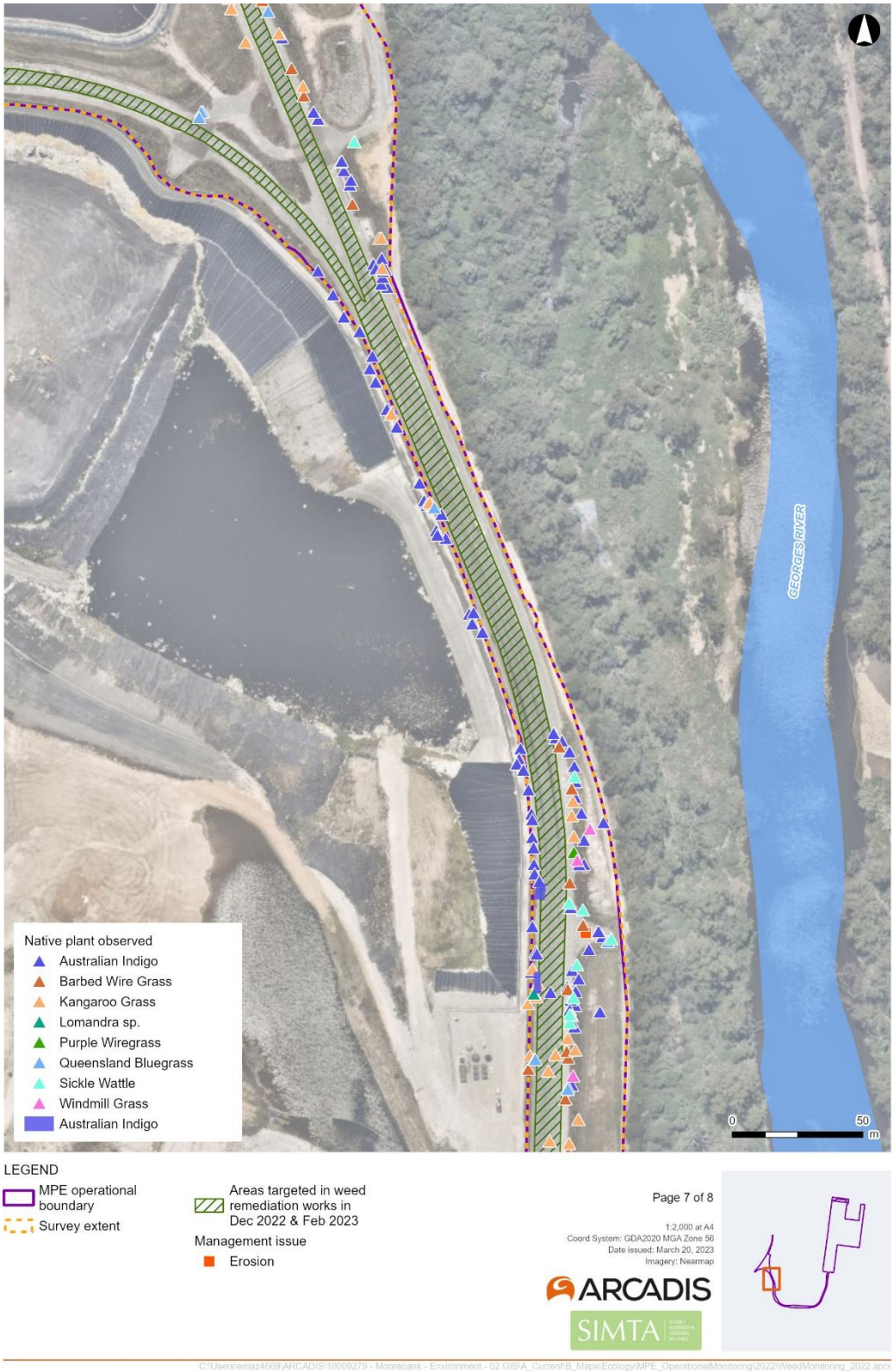

Figure 8. Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 7 of 8)

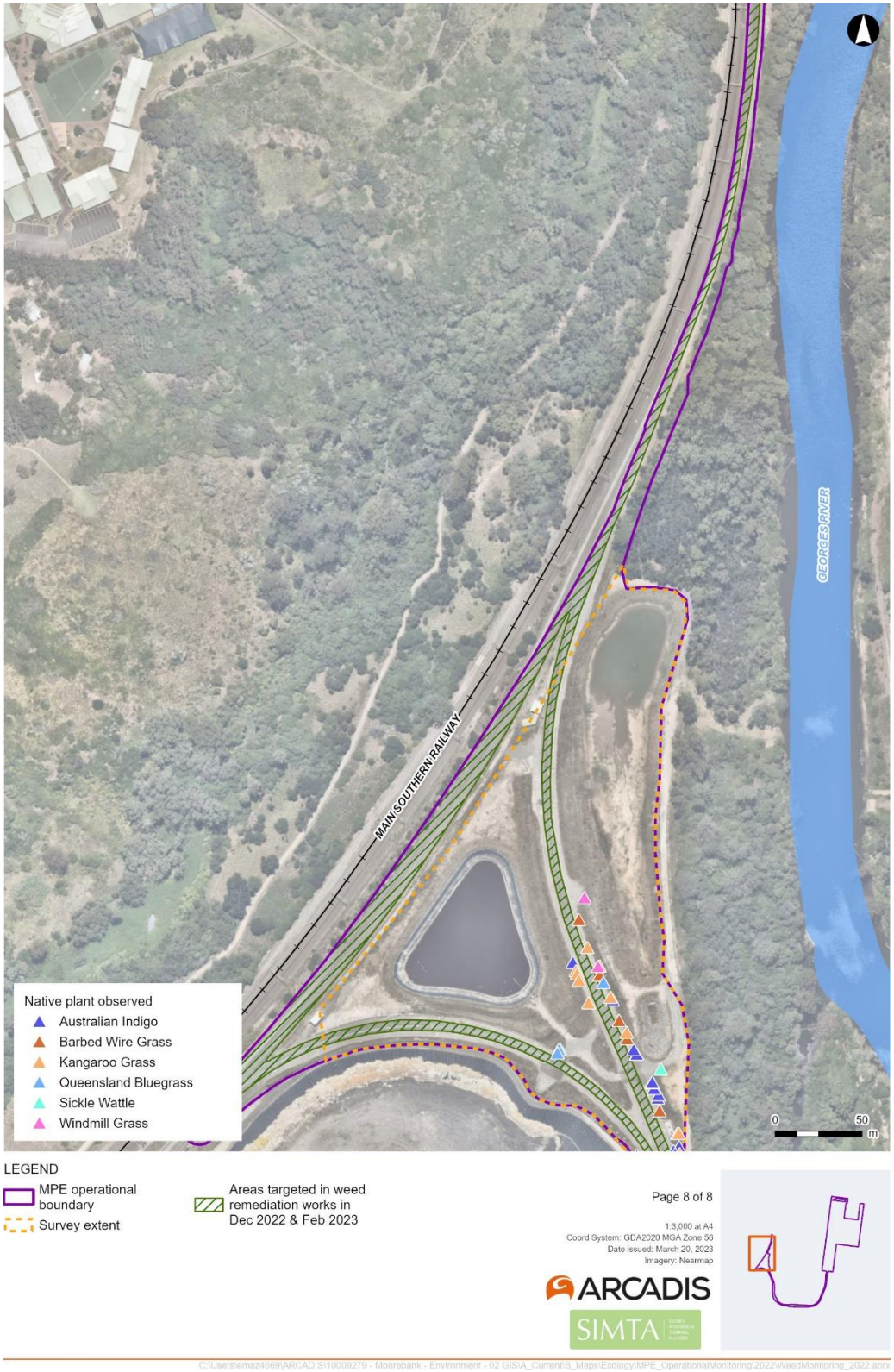

Figure 9. Native plants, weed covers and aggressive weeds identified across the MPE operational facility. The coloured areas under the "Priority & key weeds" legend area areas that have high-density weeds (Map 8 of 8)

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 undertaken since the February 2022 survey in consideration 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 February 2022 weed monitoring report are still applicable to the management of the site. These include:

- Targeted weed control to continue throughout the operational area
- Bush regeneration and weed control 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. 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 Grader Grass and 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 Fireweed and Peruvian Water Primrose.
- Large patches of African Lovegrass, Rhodes Grass and Grader Grass between the Rail Link and the East Hills train line should be slashed regularly to prevent seeding events (Figure 4, 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.
- Plants damaged due to high water flows following large rain events, and erosion should be assessed for management strategies to remedy the damage. If possible, measures should be put in place to assist the plant's recovery, such as providing structural support in the form of wooden stakes to prop up fallen plants.
- Weed control works are planned in early June to reduce the biomass of exotic species at the beginning of the winter season to provide space and resources for winter growing native species. It is anticipated that over the winter period routine slashing of the RALP corridor can be reduced as exotic plants will have a slower growth rate. It is hoped during this time that native species are able to grow and reach a size by which they can be identified prior to the next slashing event. Any newly identified individual will be demarcated with pink flags, avoided from slashing and encouraged to grow and colonise surrounding areas through bush regeneration techniques.

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 Rhodes grass and 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.

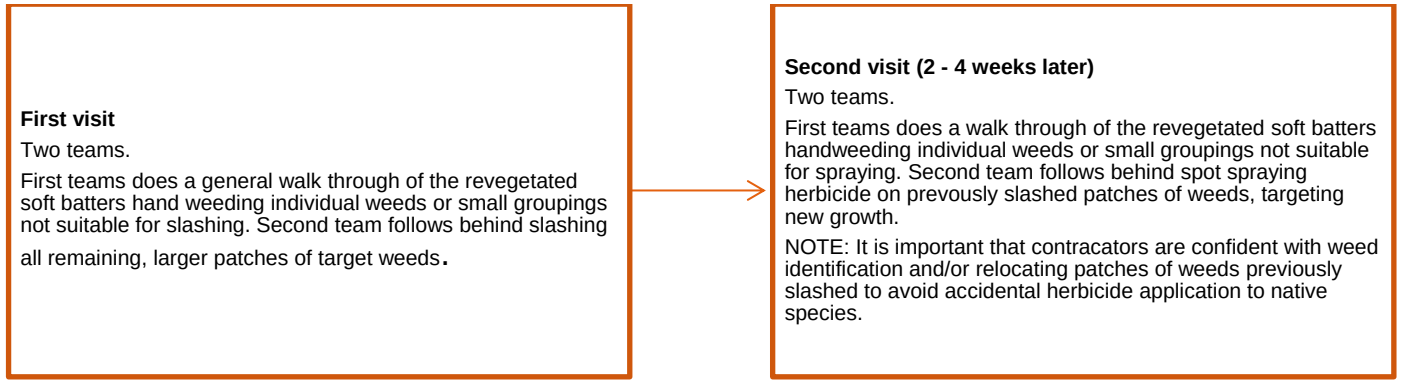

Figure 10. Suggested process to controlling target weeds on revegetated soft batters

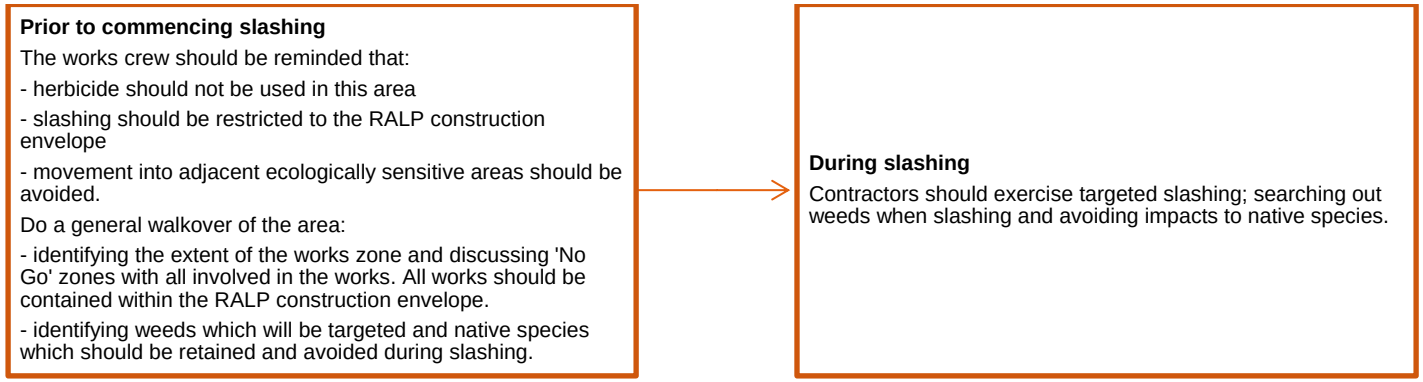

Figure 11. Slashing target weeds within the RALP construction envelope adjacent to ecologically sensitive areas

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 October 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
August 2020	Exotic species, specifically *Medicago polymorpha* (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.
August 2021	Collect litter scattered through the Rail Link corridor and in adjacent areas	Commenced	Litter remains in the Rail Link corridor and adjacent areas.
October 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.
August 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.	Not started	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.	Not started	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 2021

April 2023

April 2021

December 2021

April 2023

April 2021

December 2021

April 2023

April 2021

December 2021

April 2023

April 2021

December 2021

Missing

April 2023

April 2021

December 2021

April 2023

		
April 2021	**December 2021**	**April 2023**

APPENDIX B. RAIL LINK WEED REMEDIATION - SUMMARY OF WORKS

Memo

Date 2/06/2023
To [redacted]
From
Copy to
Subject MIP East Rail Link landscaping remediation: Summary of weed control works

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LOGOS Property engaged Arcadis ecologists to oversee weed control works being undertaken by the landscaping maintenance contractor P&E Services within the Moorebank Intermodal Precinct (MIP) East Rail Link corridor. These weed control works were commenced to build upon the remediation and revegetation project completed by Spray Grass Solutions for the MIP East Rail Link corridor between September 2021 – March 2022. There were two objectives for the remediation project:

1. There is sufficient vegetation cover on the rail embankment and other vegetated areas to control erosion, as required by Detailed Design

2. The quantity of any weed presence is not detrimental to the survival of native grasses and shrub species, and can be manged through ongoing and regular maintenance

This memorandum has been prepared to summarise the maintenance works undertaken by P&E Services within the Rail Link corridor as a continuation to achieving these objectives.

Background

The MPE East Rail Link corridor has seen significant change and works over the time Arcadis has been monitoring the area since 1 April 2020. The soft batters on either side of the Rail Link have had varying levels of exotic cover. A number of weed remediation events/projects have occurred since the inception of weed monitoring, detailed below:

- In early spring 2020, Spray Grass solutions commenced a remediation project to remove weeds from the batters and revegetate with native species commensurate with the Urban Design and Landscaping Plan (UDLP) for MPE. Spray Grass solutions procured Cumberland Plain Seeds to provide technical oversight of the revegetation effort with native seed.
- In December 2021, a meeting was held which discussed the progress of the rehabilitation project and how the areas included were to be managed going forward. Goals anticipated to be observed over the coming months, communicated by Spray Grass Solutions and Cumberland Plain Seeds, included:
  - an increase in native seed striking
  - further growth of observed native shrubs, grasses and forbs
  - haying-off of cover crop species to make room for native species growth
  - present native species would not be outcompeted by common herbaceous weed species and cover crops
- During site inspections in January and March 2022 areas of the Rail Link were observed to be meeting the revegetation goals communicated by Spray Grass Solutions and Cumberland Valley Seeds.

- At project finalisation (March 2023) it was communicated that ongoing management was required to support the regeneration and colonisation of native species that had established within the Rail Link through this remediation project, including:
  - On-boarding of a trained bush regeneration contractor to conduct regular ongoing weed control work
  - Weed control works targeting exotic species listed as 'priority' for the Greater Sydney Local Land Services region and the exotic grass species: *Melinus repens* (Red Natal Grass), *Chloris gayana* (Rhodes Grass), *Eragrostis curvula* (African Love Grass), *Hyparrhenia hirta* (Coolatai Grass) and *Themeda quadrivalvis* (Grader Grass)
  - Monitoring of rehabilitated areas of the Rail Link to identify areas which may require additional support (i.e. seeding) or any novel exotic species which may be detrimental to the survival of natives.
- In December 2022, P&E Solution were engaged to undertake routine weed control works throughout the Rail Link. The aims of these works were to remove priority and exotic grass species as identified above from within the rail corridor and reduce the biomass of exotic species to promote the continued growth and colonisation of native seedings across soft batters.

The works undertaken by P&E Services post December 2022 are the subject of this memorandum.

Methods

The following process was undertaken during weed control/maintenance works:

- Prior to commencement of any weed control works Arcadis ecologists walked through the Rail Link corridor placing pink survey flags at the base of native species.
- A site walkover with P&E Services and a detailed toolbox talk from supervising Arcadis ecologist was undertaken:
  - explaining the objectives of the works (stabilisation; increasing cover of native species)
  - stepping out the pink survey flag demarcation process and works methodology: A one-metre buffer must be applied around each pink survey flag. Works within one metre of the survey flags should be restricted to hand weeding. No herbicide or slashing is to occur within the one-metre buffer.
  - pointing out native species that are growing in the corridor to be retained and protected throughout the course of the works including key diagnostic features of different species.
  - pointing out weed species that require removal and ongoing control including key diagnostic features of different species.
  - Identifying sensitive areas (i.e. BA341 biobank site) and explaining what works are permissible in close proximity to these areas to avoid any off-target impacts
  - explanation of how Daily Works Report are to be filled out, including what details are to be included regarding the works undertaken.
- P&E Services commenced manual weed control works using a combination of slashing (using an excavator with a slashing attachment and handheld brush cutters), and hand-weeding. Arcadis ecologists were present on-site at the commencement of works to supervise manual weed removal, provide additional direction, or answer any contractor questions. Once P&E Services were comfortable and showed that they were competent at implementing the prescribed methodology they were no longer supervised. Herbicide use was minimised as much as practical being restricted to cut and painting of woody weeds and targeted spot spraying on the rail ballast and gravels. Herbicide spraying was not conducted on soft batters.

To date, eleven days of weed control/maintenance works have been conducted by P&E Services within the Rail Link. Dates and a description of works have been included in Table 1.

Table 1 Weed control works completed by P&E Services as of 1/06/2023.

Date	Temp. (ºC)	Wind speed (km/hr)	Wind direction	Actions taken
5/12/2022	31.6	18.2	SE	Slashing all plants within the ballast and gravel areas
6/12/2022	20.4	17.5	SE	Slashing all plants within the ballast and gravel areas
7/12/2022	27.3	21.3	NE	Targeted herbicide spraying using a backpack sprayer for plants within the ballast and gravel areas
4/2/2023	21.1	44	WNW	Slashing of all weeds and hand weeding around marker flags
5/2/2023	21.3	35	E	Slashing of all weeds and hand weeding around marker flags
6/2/2023	24.7	35	E	Slashing of all weeds and hand weeding around marker flags
7/2/2023	24.4	33	SE	Slashing of all weeds and hand weeding around marker flags
8/2/2023	22.8	37	SSE	Slashing of all weeds and hand weeding around marker flags
23/2/2023	19.1	41	NE	Slashing of all weeds and hand weeding around marker flags
28/2/2023	24.8	20	E	Slashing of all weeds and hand weeding around marker flags
01/03/2023	26.8	12.5	S	Slashing of all weeds and hand weeding around marker flags

Completed works

Weed control works conducted by P&E Services between December 2022 and March 2023 have successfully reduced weed biomass within the Rail Link corridor. Weed removal on soft batters has reduced the competition for native species, providing more space and resources for natives to grow, set seed and colonise open areas. A summary of the works conducted by P&E Services across this period is give below and all Daily Task Reports have been included in Appendix A.

December 2022

Weed control works were conducted over three days on the 5, 6 and 7 of December 2022, focusing on removing all vegetation on gravelled and ballast areas within the Rail Link corridor. All plants growing on the gravel and ballast areas were slashed and had herbicide applied using a backpack sprayer. Targeted spot spraying was undertaken rather than broader sweep spraying to minimise off target impacts. Any trees regenerating in ballast or gravel areas were removed to improve sight lines for train operators to prevent a safety risk.

Site photograph 1. P&E Services employee applying herbicide to plants on gravel and ballast areas using a backpack sprayer.

February and March 2023

Weed control works were conducted over eight days in February and March 2023 focused on improving the condition of soft batters within the Rail Link by:

- removing priority and exotic grass species
- reducing the overall biomass of other herbaceous weeds
- retaining and protecting present native plant species demarcated by pink survey flags.
- promoting the growth and colonisation of native plant species by reducing competition from exotic species

P&E Services prioritised manual control of weeds through a combination of slashing and hand weeding, making sure to avoid impacts to native species. Hand weeding wase employed to target annual species such as *Themeda quadrivalvis* and (Grader Grass) and *Senecio madagascariensis* (Fireweed) due to their relatively small root system and to prevent spreading seed through slashing.

Larger herbaceous and woody weeds like *Verbena bonariensis* (Purple Top), *Conyza bonariensis* (Fleabnae) and *Senecio* spp. were hand weeded prior to slashing to reduce the amount of vegetation to be mulched through slashing. Additionally, all species listed as “priority” weeds for the Greater Sydney region were manually removed and taken off site.

Slashing using handheld brush cutters and excavator mounted mowing head was adopted for all other exotic species being mainly exotic grasses and low growing herbaceous weeds like *Trifolium michelianum* (Bolansa Clover), *Chloris gayana* (Rhodes Grass), *Eragrostic curvula* (African Lovegrass), *Melinus repens* (Red Natal Grass), *Bidens pilosa* (Cobbler's Pegs), *Medicago polymorpha* (Bur Medic), *Hypocharis radicata* (Catsear) and *Lactuca serriola* (Prickly Lettuce). Where large amounts of mulch was present following slashing, raking was conducted to remove excessive plant material. Excessive mulch was placed in bags and removed from site.

Before and after photographs of the Rail Link batters have been included in Site photograph 2 and Site photograph 3, respectively.

Site photograph 2. Soft baters in the Rail Link corridor prior to weed removal works by P&E Services. Note the high cover and biomass of weed species

Site photograph 3. Soft batters in the Rail Link corridor following weed removal works by P&E Services. Note the reduced cover of exotic species and retention of native species next to pink survey flags.

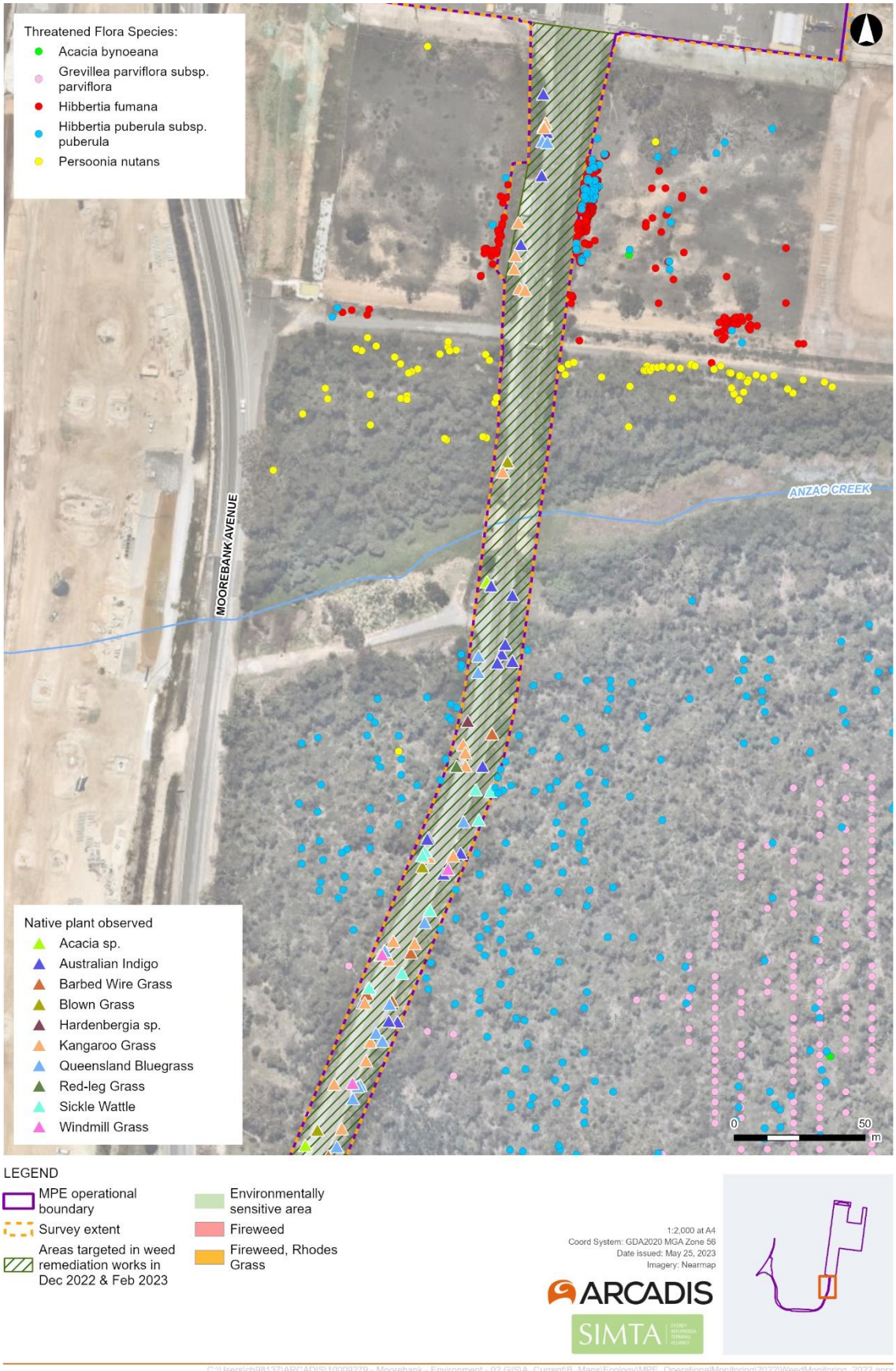

Figure 1. Extent of weed control/maintenance works in the Rail Link and occurrences of native plants (1 of 6)

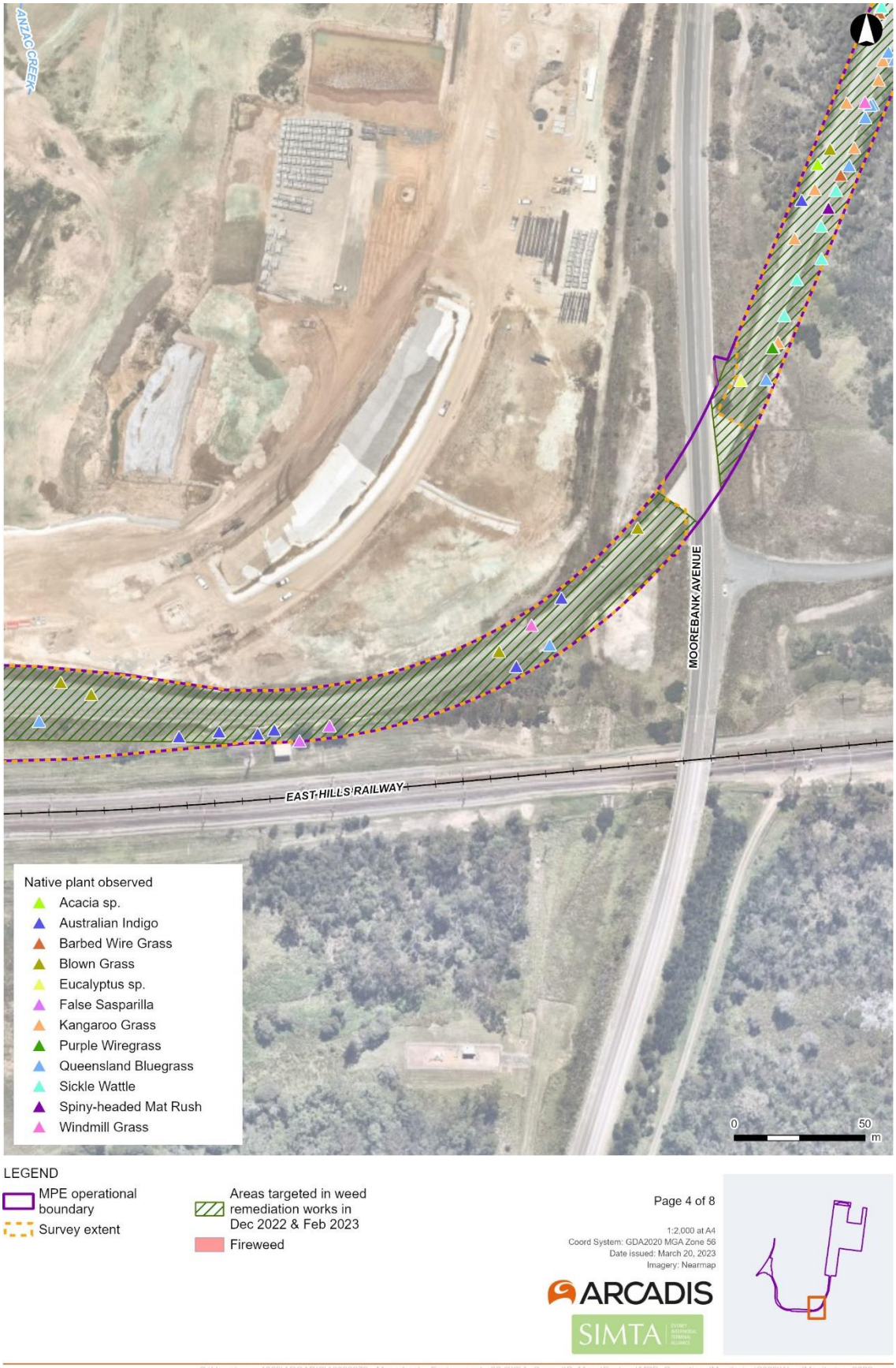

Figure 1. Extent of weed control/maintenance works in the Rail Link and occurrences of native plants (2 of 6)

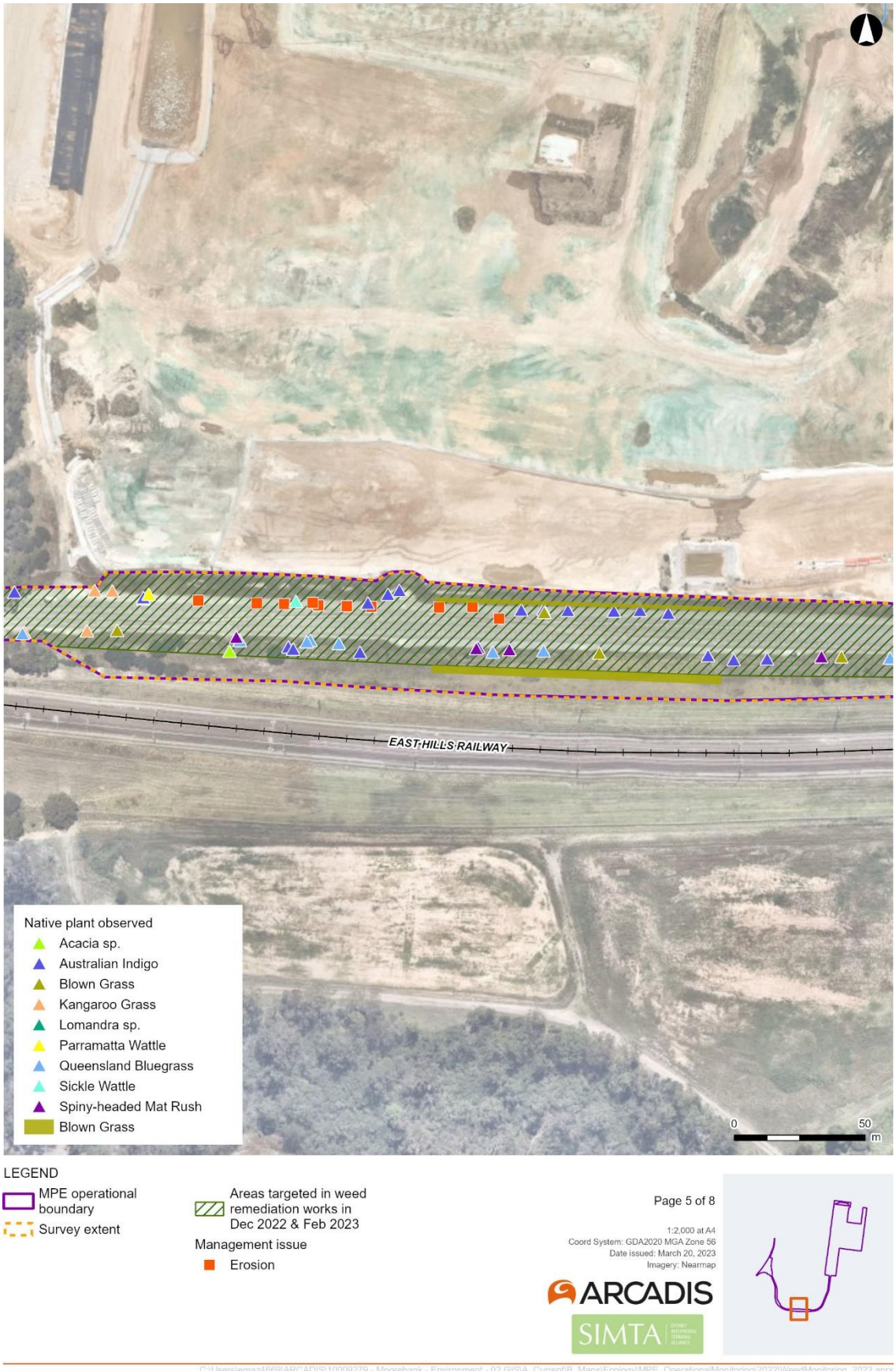

Figure 1. Extent of weed control/maintenance works in the Rail Link and occurrences of native plants (3 of 6)

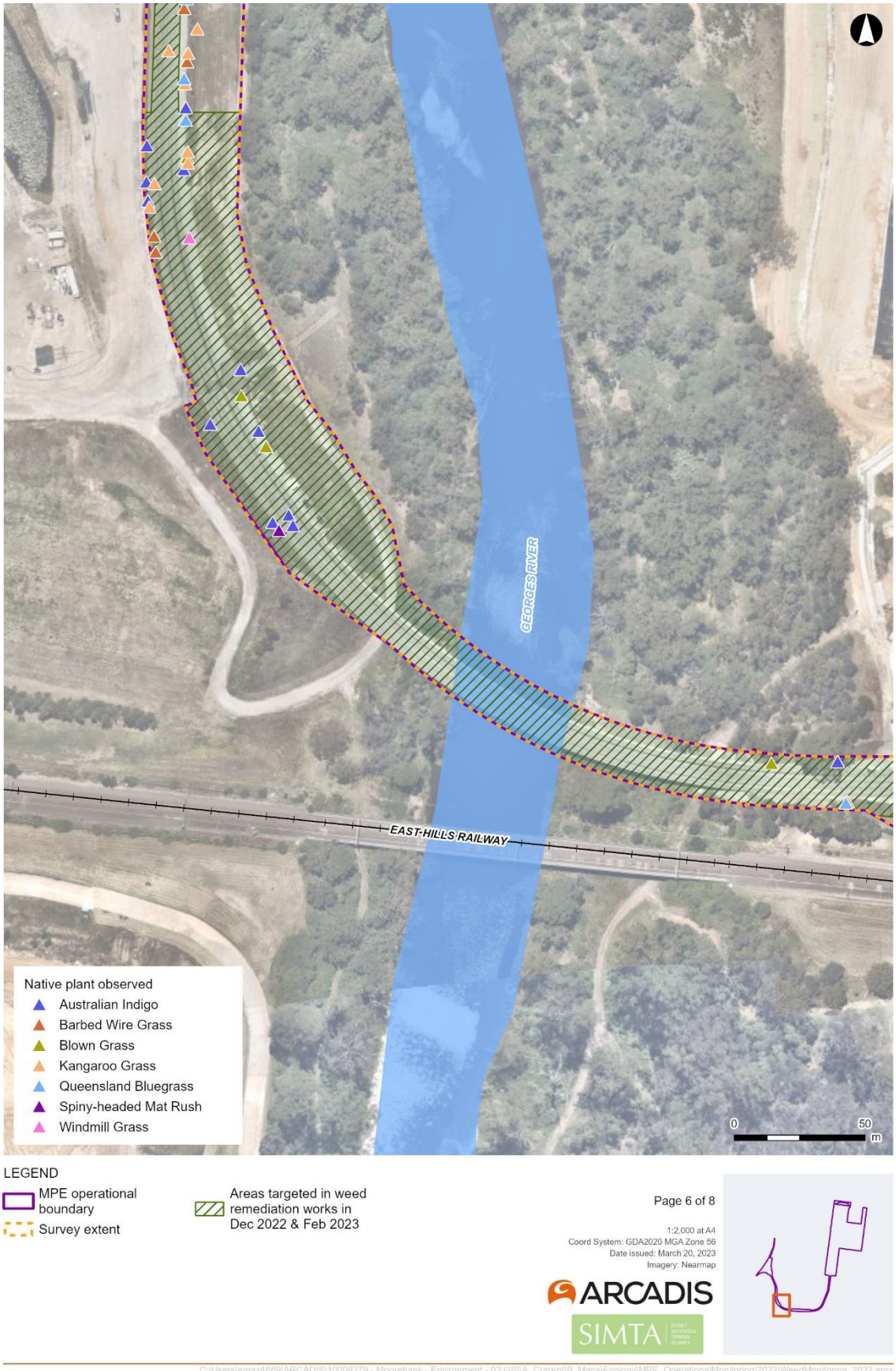

Figure 1. Extent of weed control/maintenance works in the Rail Link and occurrences of native plants (4 of 6)

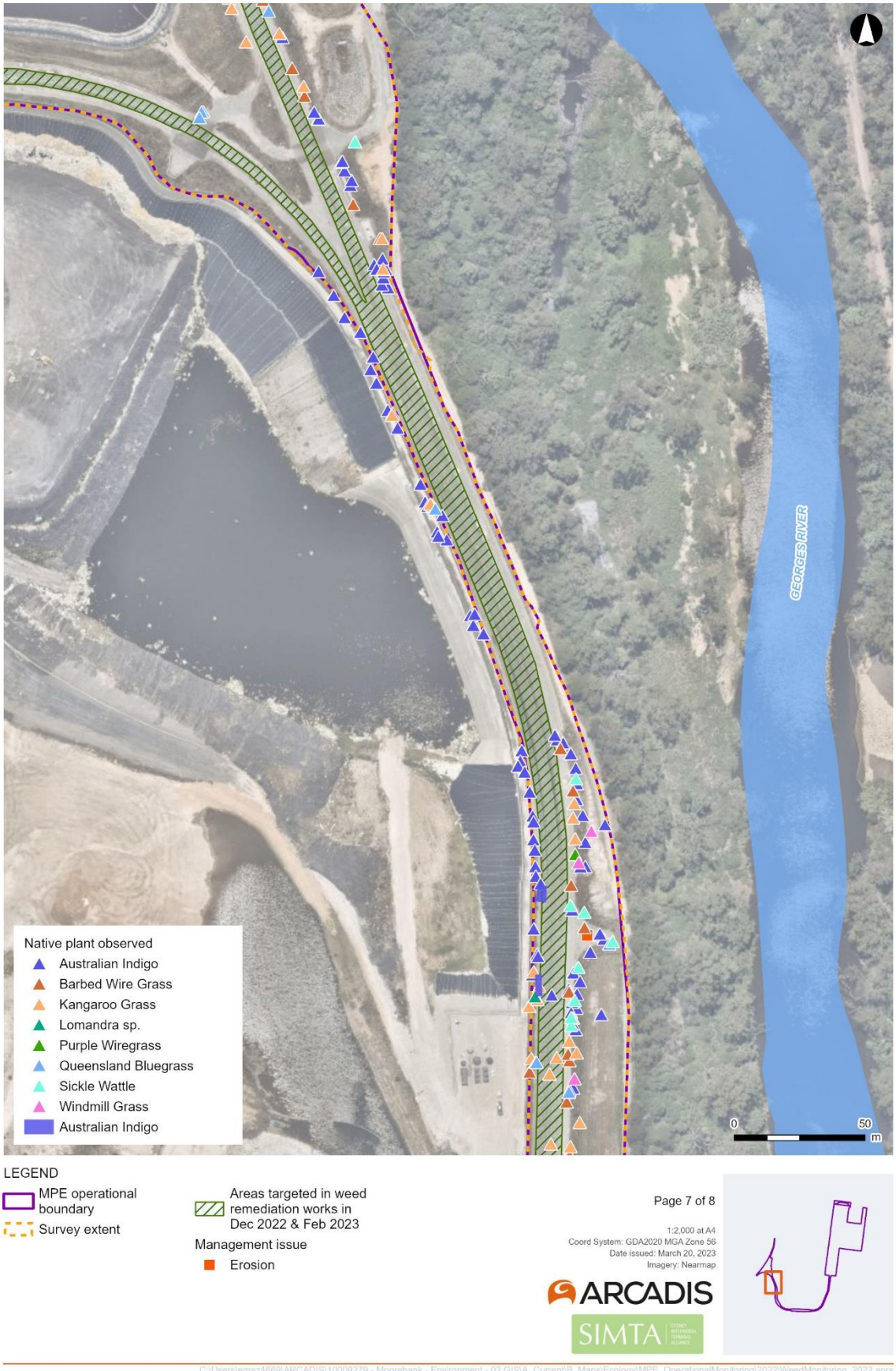

Figure 1. Extent of weed control/maintenance works in the Rail Link and occurrences of native plants (5 of 6)

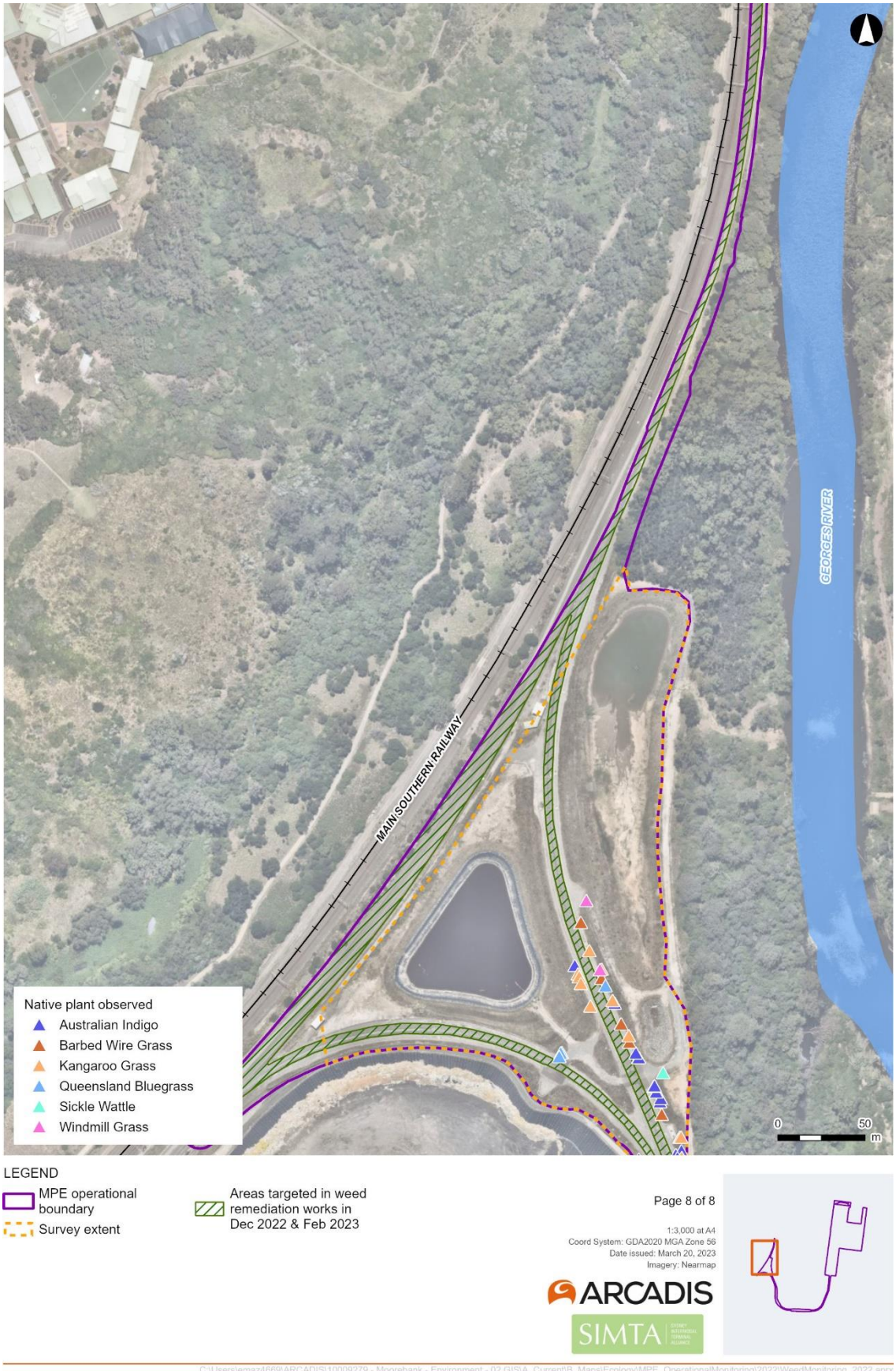

Figure 1. Extent of weed control/maintenance works in the Rail Link and occurrences of native plants (6 of 6)

Evaluation and ongoing recommendations

Works completed between December 2022 – March 2023 have returned the condition of soft batters to a more manageable state. Removal of priority and aggressive weed species and suppression of herbaceous weeds has provided more space for mature native species to grow and increase cover across the soft batters. In turn the increase in native cover has increased the resilience of these soft batters to erosion. It is important to continue this regime of weed control/maintenance to continue to promote the growth, recruitment, and colonisation of native plant species.

The following maintenance regime is recommended over the next 6 – 12 months:

- Weed control/maintenance works should continue in the Rail Link corridor every month during months where weeds are actively growing (mid-September – mid-June) and every two months in months where weed growth is limited by colder temperatures (mid-June – mid-September). The regularity of these works may vary depending on the level of growth observed. The Project Ecologist should be consulted if the maintenance routine is to be changed.
- During cooler months the weed control/maintenance contractor should limit slashing and focus on hand-weeding exotic species from around native plants.
- Project Ecologist should inspect the site on a bi-monthly basis to identify any novel weeds or weed infestations that require immediate management to reduce risk to native species or sensitive areas. The attending ecologist should demarcate any additional occurrences of native species using pink survey flags during inspections.

Date	21/07/2022
To	[redacted]
From	
Copy to	
Subject	MPE operational facility – Weed monitoring report July 2022

Introduction

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

- 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 have been monitoring the MPE operational facility for weed occurrence since April 2020. Soft landscaped areas surrounding the IMEX, warehouses and freight village and within drainage infrastructure have maintained low weed cover since the initial weed survey. Routine weed control works have been observed across these areas which have maintained the low weed cover. Overall, the change in weed cover across these areas has been minor since monitoring began and is considered acceptable against the operational requirements of the precinct.

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 either side of the Rail Link have had varying levels of exotic cover. In early spring 2020 Spray Grass solutions commenced a rehabilitation project to remove weeds from the batters and revegetate with native species commensurate with the Urban Design and Landscaping Plan (UDLP) for MPE. Spray Grass solutions procured Cumberland Plain Seeds to provide technical oversight of the revegetation effort with native seed.

A meeting was held on 7 December 2021 which discussed the progress of the rehabilitation project and how the areas included were to be managed going forward. As a result of this meeting, the monitoring methodology for the Rail Link was differentiated from the rest of the MPE operational facility to consider the revegetation methodology and management recommendations proposed by Spray Grass Solutions and Cumberland Valley Seeds.

Instead of reporting on the cover of all exotic species within the Rail Link the focus be shifted to monitoring the covers of 'priority 'and key weeds, specific to this project. Similarly, recommendations made for the Rail Link will align with the decided upon management actions. The monitoring methodology for the Rail Link has been included below.

Methodology

Arcadis ecologists Thea Kane and Jed Brown attended the MPE operational facility on Tuesday 12 July 2022. 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 day of survey was sunny with a maximum temperature of 16.3°C recorded at Holsworthy Aerodrome (station 066161) (BOM 2021).

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 control 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 1

Table 1. Categories to describe percent cover of weeds

Categories	Percentage cover of weeds within a patch (%)
Low	5 – 25
Moderate	25 – 75
High	75 – 100

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

Rail Link

Following the meeting held in December 2022 regarding revegetating of 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 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 2.

Table 2. Priority and key weed species subject to control within the Rail Link

Priority weed species	Key weed species
Senecio madagascariensis (Fireweed)	*Chloris gayana* (Rhodes Grass)
Alternanthera philoxeroides (Alligator weed)	*Eragrostis curvula* (African Lovegrass)
Asparagus asparagoides (Bridal Creeper)	*Themeda quadrivalvis* (Grader Grass)
Olea europaea subsp. *cuspidata* (African Olive)	*Hyparrhenia hirta* (Coolatai Grass)

Priority weed species	Key weed species
Lantana camara (Lantana) *Ludwigia peruviana* (Ludwigia)	*Echium plantagineum* (Paterson's Curse)

The location of key and priority weed species and observed weed control works were recorded on an Arc-GIS enabled iPad.

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 the 12 July 2022.

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) as the ecologists were not under the supervision of an Australian Rail Track Corporation (ARTC) Protection Officer (PO). Future surveys along the Southern Sydney Freight Line (SSFL) will require the attendance of a PO.

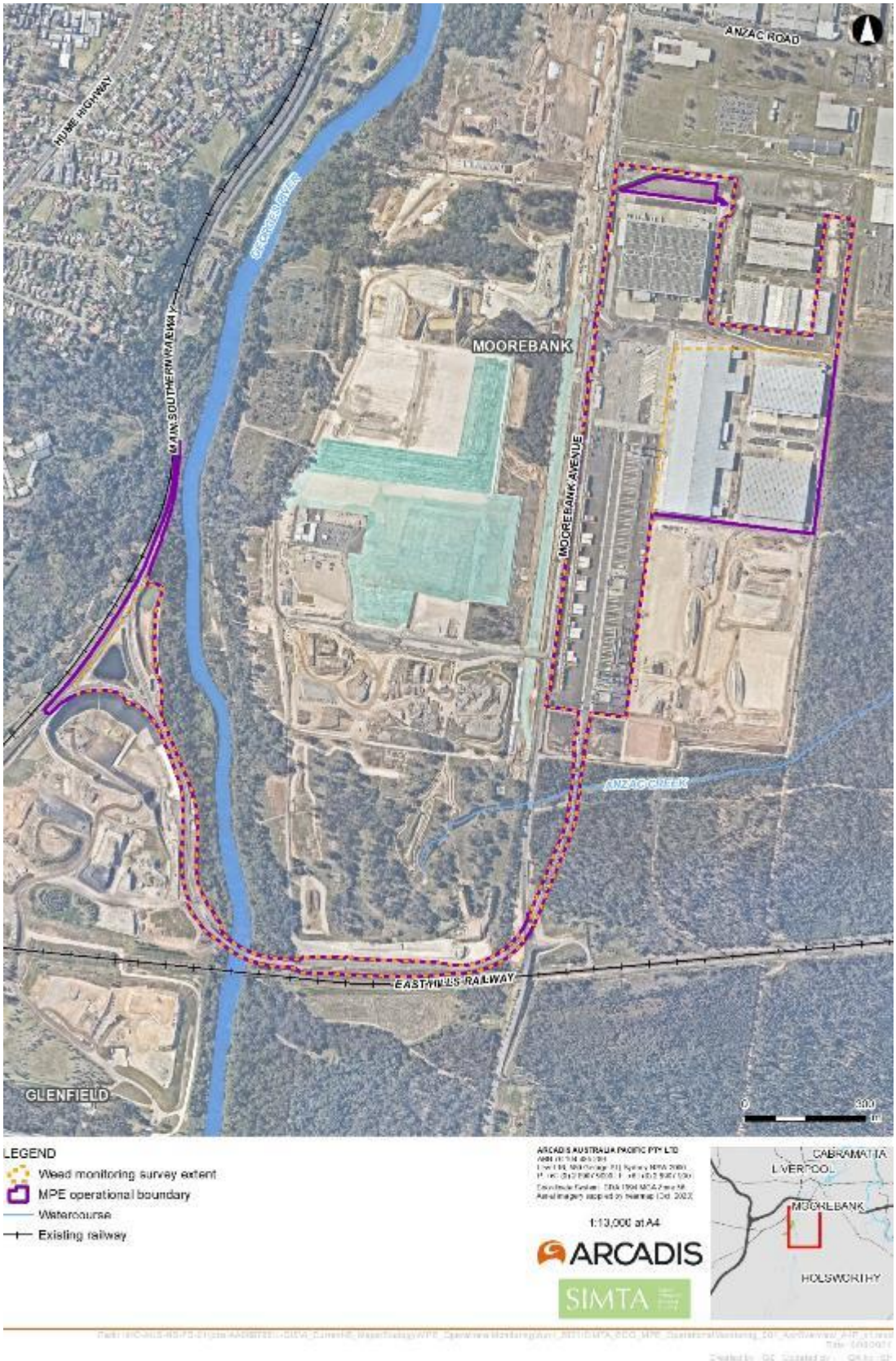

Figure 1. Survey extent within the MPE operational facility

Results

Observations made by the attending ecologists during the July 2022 weed monitoring survey are summarised below.

IMEX, warehouses and drainage infrastructure

Weed cover has slightly increased within the MPE operational facility to what was recorded during the April 2022 surveys. No weed control works (chipping or herbicide spraying of weeds) were observed at the north-eastern extent of the facility surrounding drainage basins and swales. While weed cover remains low, the current survey identified new instances of priority weed *Senecio madagascariensis* (Fireweed) (Plate 1).

Due to recent high rainfall across the Sydney region, new instances of erosion and damage to native species *Acacia falcata* (Sickle Wattle) was observed (Plate 2). Several native species are present and continue to grow on soft batters and in the drainage swale, including Sickle Wattle*, Typha orientalis* (Bulrush)*, Persicaria decipiens* (Slender Knotweed)*, Ficinia nodosa* (Knotted Club-rush) and *Lomandra longifolia* (Mat Rush)*.*

Plate 1. New observations of Fireweed in drainage basins

Plate 2. New observation of native plant damage and erosion in drainage basins

The soft batters of the northeast trunk drainage system have a low cover of exotic grasses which are currently acting to stabilise the soil, with some native species such as Sickle Wattle persisting. Instances of Fireweed observed in the April 2022 survey persists in the current survey.

No plant growth was observed in the trunk drainage systems at the northern most point of MPE (Plate 3). Absence of soil or other form of growing substrate will likely mean continued lack of vegetation for this area.

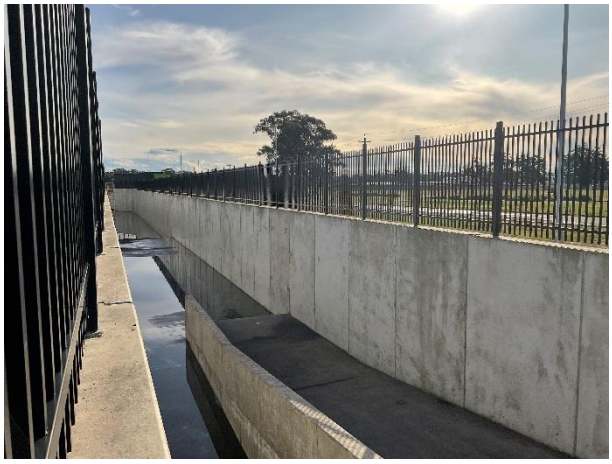

Plate 3 Northern drainage area of MPE with lack of any plant growth

Weed cover remains along soft batters in the drainage line running along the western extent of MPE. Generally, these soft batters have a low vegetation cover, with sparse occurrences of native species such as Sickle Wattle and *Davesia ulicifolia* (Gorse Bitter-pea).

Rail Access Land Package (RALP)

No evidence of recent targeted weed control works was observed along the extent of the Rail Link since targeted slashing of herbaceous weeds (Fleabane) was undertaken between the December 2021 and April 2022 inspection. Fleabane was not recorded to have regrown in these areas.

Most areas of soft batter either side of the rail link displayed increases in exotic biomass since the previous inspection during April 2022. An increase in Fireweed, *Chloris gayana* (Rhodes Grass) and *Themeda quadrivalvis* (Grader Grass) was observed along the Rail Link, with most occurrences located on the eastern side. It is likely that recent climactic variables, including the combination of high rainfall and sunny days, in addition to the lack of weed management have created favourable conditions for herbaceous and grass weeds to thrive.

No weed control works or browning off of other herbaceous weeds were observed during current surveys.

Plate 4. Exotic species, Rhodes Grass and Fireweed, continue colonising remediated soft batters within the Rail Link corridor

New instances of native grasses were observed along the rail link corridor including *Themeda triandra* (Kangaroo Grass), *Chloris truncata* (Windmill Grass) and *Cymbopogon refractus* (Barbed Wire Grass) (Plate 5).

Plate 5. Kangaroo grass growing among weeds along the rail link corridor

Some hardier native seedlings, such as Sickle Wattle and *Indigofera australis* (Australia Indigo), were observed to be growing unimpeded by increasing weed cover (Plate 6). The juvenile vine like growth form of Australia Indigo allows for growth in the spaces between weed biomass (Plate 6).

Plate 6 Australia indigo (left) and Sickle Wattle (right) observed to be growing despite increase in exotic biomass

An isolated area containing priority and key weeds remains to be untreated on the eastern side of the Rail Link bridge. Aggressive weed species present include *Asparagus asparagoides* (Bridal Creeper), *Lantana camara* (Lantana), *Olea europaea* subsp. *cuspidata* (African Olive), Fireweed, Rhodes Grass and Grader Grass. The location of priority weeds and areas with high weed cover is included in Figure 2 - Figure 9.

The status of weeds and weed control works observed during the July 2022 monitoring survey has been compared against a series of recommended actions developed during the baseline monitoring survey (Table 3).

Table 3. Weed control works tracking

Priority	Action	Action description	July '22 performance assessment
1	Eradicate 'priority' weeds	Target 'priority' weed species through a combination of manual removal and herbicide treatment. Herbicide application should be considerate of timing (i.e., applying herbicide when weeds are actively growing) and best practice methodologies.	Four priority weed species are present within the Rail Link: *Asparagus asparagoides* (Bridal Creeper), *Olea europaea* subsp. *cuspidata* (African Olive), *Lantana camara* (Lantana) and *Senecio madagascariensis* (Fireweed) (Figure 2 - Figure 9). These should be removed.
2	Removal of key an aggressive weed species	Key weed species including African Lovegrass, Rhodes Grass, Paterson's Curse. Coolatai Grass and Grader Grass should be removed revegetated areas of soft batter. Aggressive weed species including Moth Vine, Castor Oil Plant should be removed from all operational areas using a combination of manual and herbicide control.	Key weed species including Rhodes Grass, African Lovegrass, Coolatai Grass, Paterson's Curse and Grader Grass are increasingly colonising soft batters in the Rail Link. These weeds should be prioritised for removal. Scattered individuals of Golden Wreath Wattle, Moth Vine and Castor Oil Plant remain within the Rail Link, however are likely outside of the operational boundary (Figure 2 - Figure 9). Despite this, these weeds should be removed to avoid encroachment into revegetated areas.
3	Supress 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.	Weed growth is increasing on soft batters adjacent to the biobank site and ecologically sensitive areas. In some instances, exotic species are encroaching into these ecologically sensitive areas. Manual removal including routine slashing has been adopted to prevent present weeds from reaching seeding maturity and further encroaching on adjacent high value areas (biobanks site and ecologically sensitive areas containing threatened plant species). All works should be restricted to the operational area and should 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.

Priority	Action	Action description	July ’22 performance assessment
			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.	Slashing has not been adopted to managed regrowth of invasive grasses (African Lovegrass, Grader Grass) within the Rail Link. Slashing should be used to manage large expanses of exotic grassland to prevent seeding events.
5	Reduce cover of weeds within the Rail Link	Reduction weed cover by applying control methods commensurate with the Operational Flora and Fauna Management Plan (Arcadis 2019)	Targeted slashing has been previously employed to control weed colonisation on soft batters, however, needs to be continued to limit re-colonisation of weeds within the Rail Link. Works should involve targeted slashing of mature plants, removing flowering and seed heads to minimise seeding. No works have been conducted to reduce the cover of weeds within the Rail Link since the April 2022 monitoring event. Future weed control actions will focus on removing and reducing the cover of priority and key weed species and supressing 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 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 MPE operational facility. No signs of weed control works were observed during the recent survey.

Litter

A small amount of litter was again observed within the rail corridor and in adjacent areas at the western extent of the Qube Rail Link nearest Glenfield waste facility. Litter was observed within areas of native and exotic vegetation, blocking drainage infrastructure within the rail corridor, and in the Georges River (Plate 7).

Plate 7. Litter observed within the rail corridor during the July inspection

Erosion

High rainfall events during the period between the previous and current surveys has resulted in slipping of a number of sections of remediated soft batters within the Rail Link corridor (Plate 8). The location of the areas where batter slipping was observed is presented in Figure 6.

Plate 8. Batter slumping observed within the Rail Link

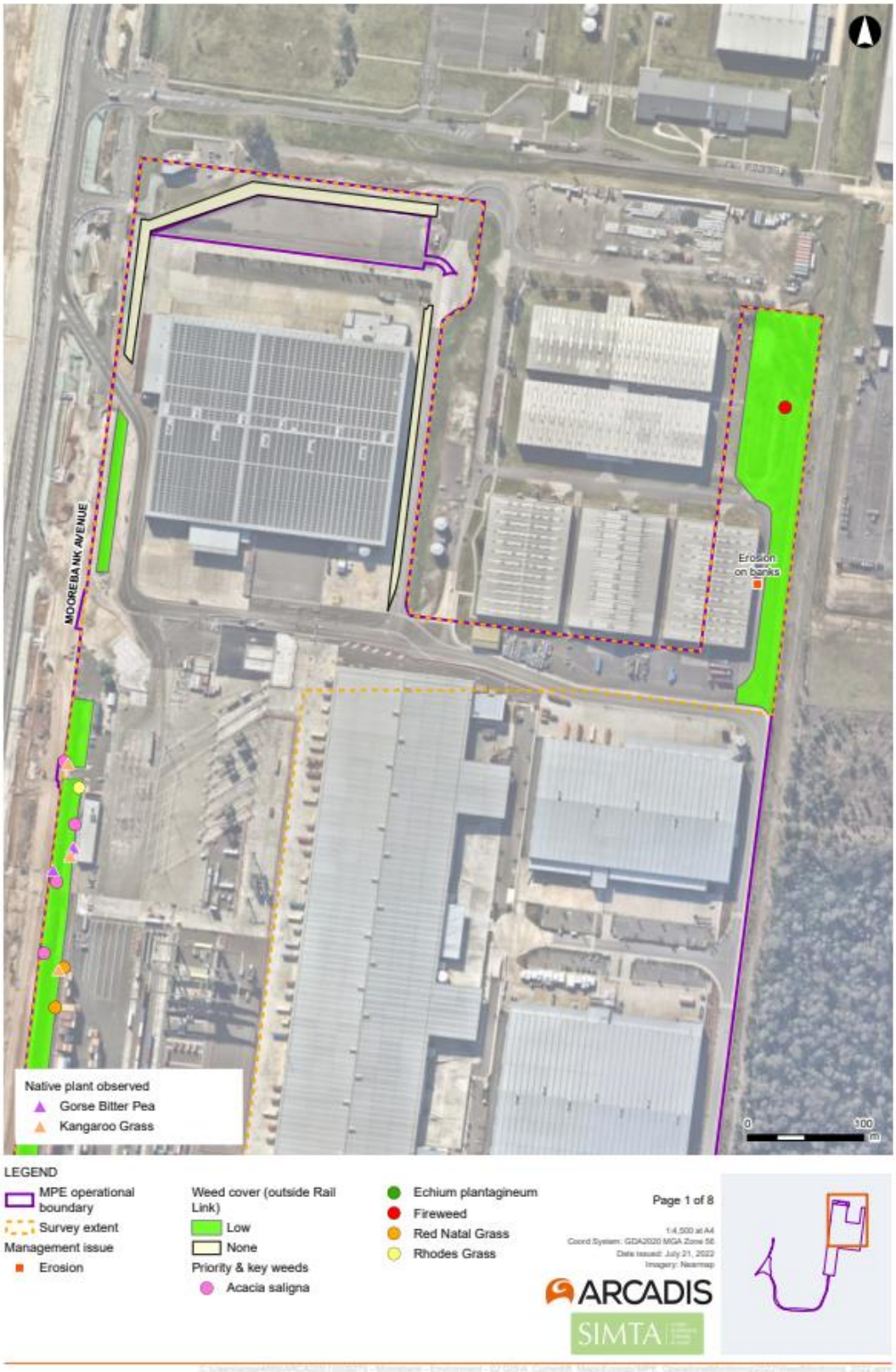

Figure 2 Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 1 of 8)

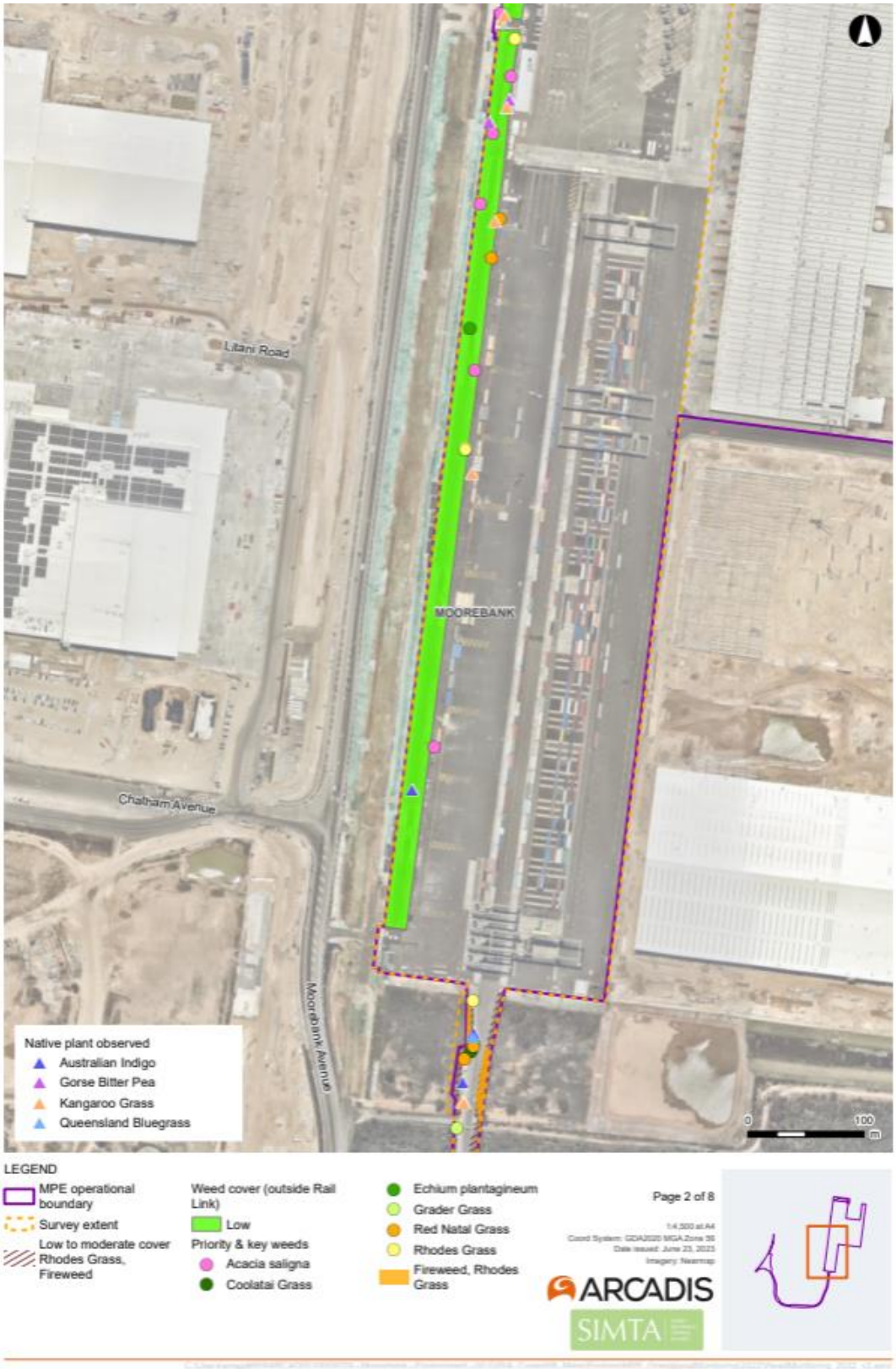

Figure 3. Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 2 of 8)

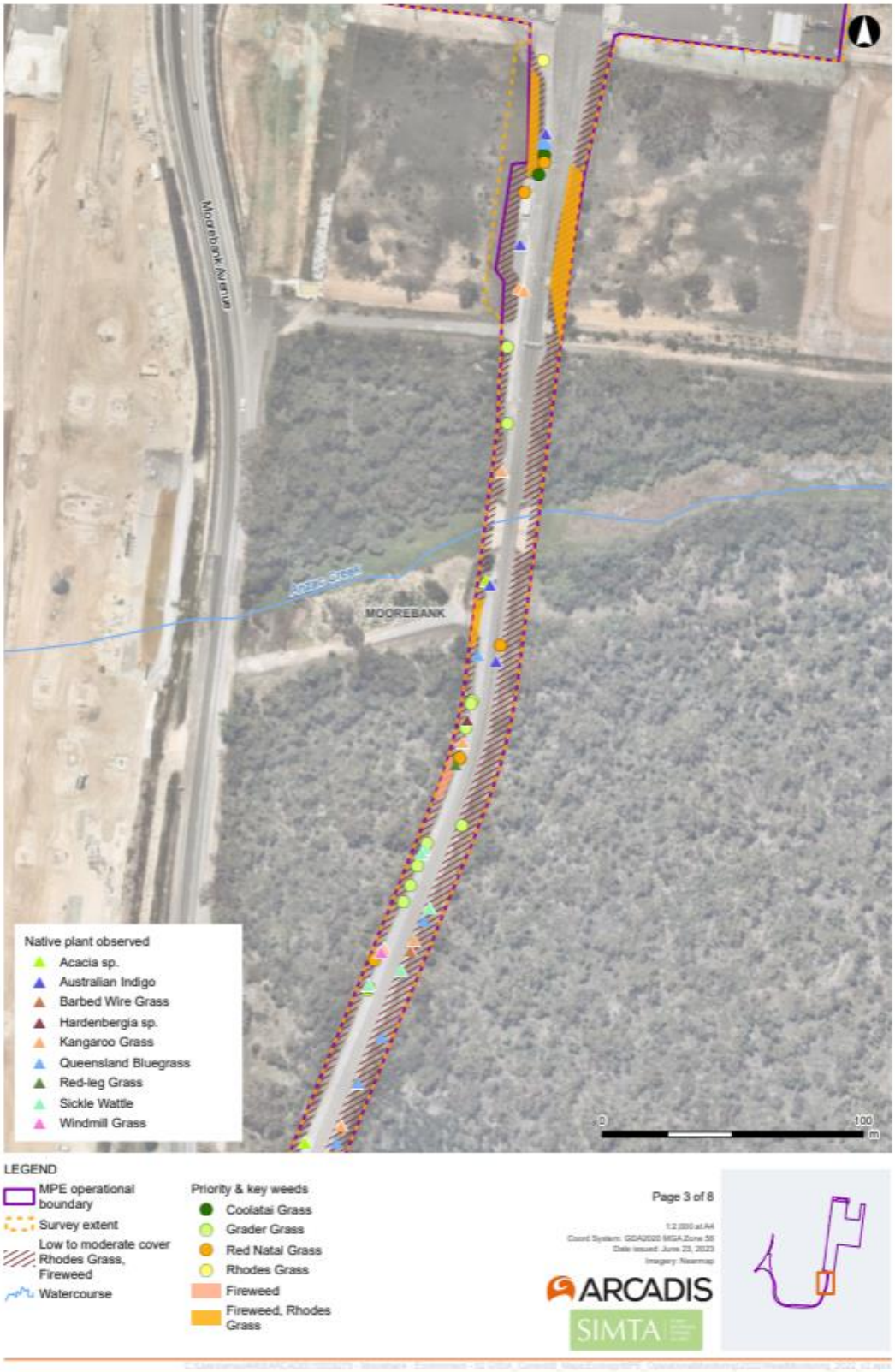

Figure 4. Native species, weed covers and aggressive weeds identified across the MPE operational facility (Map 3 of 8)

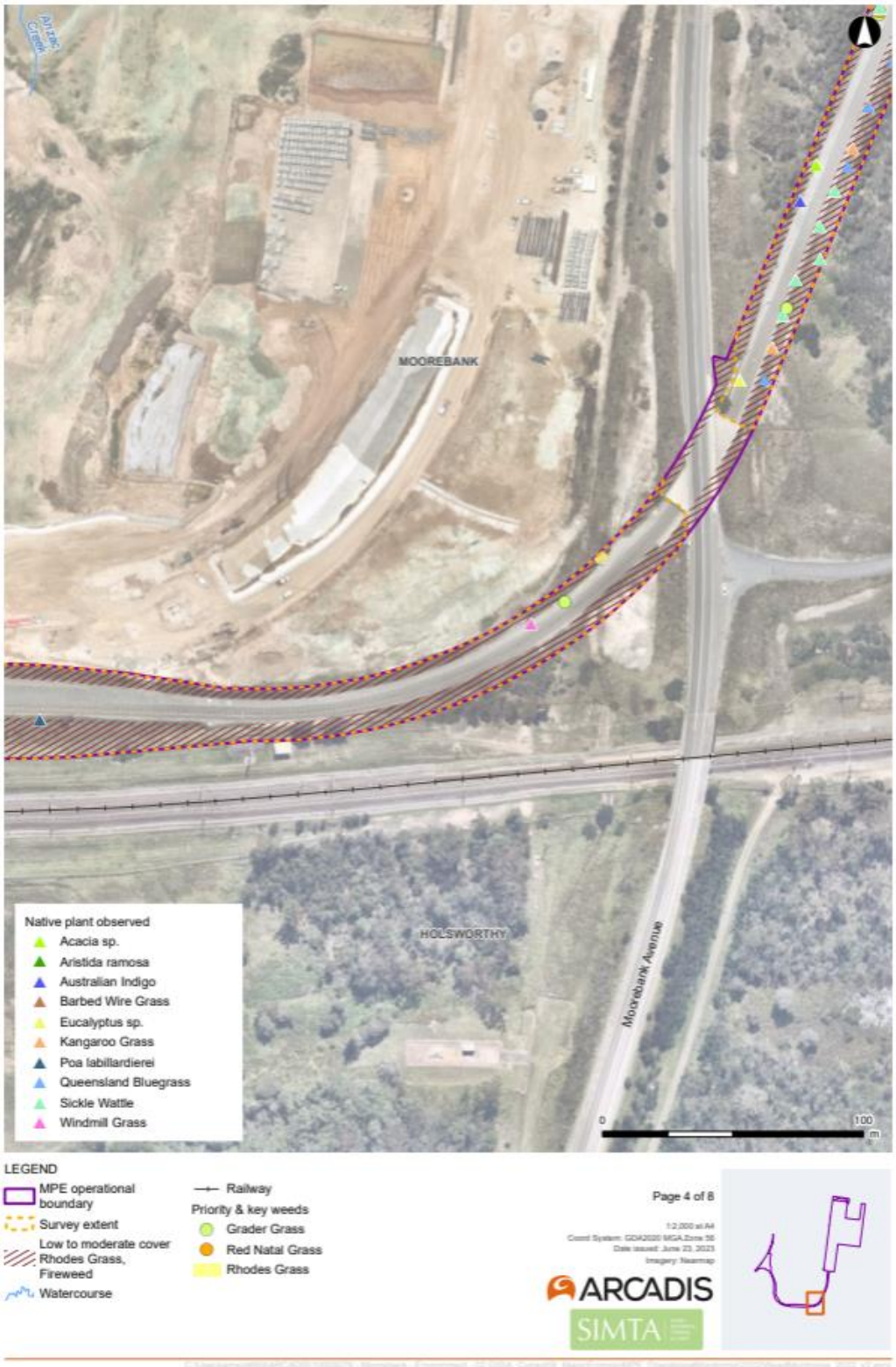

Figure 5 Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 4 of 8)

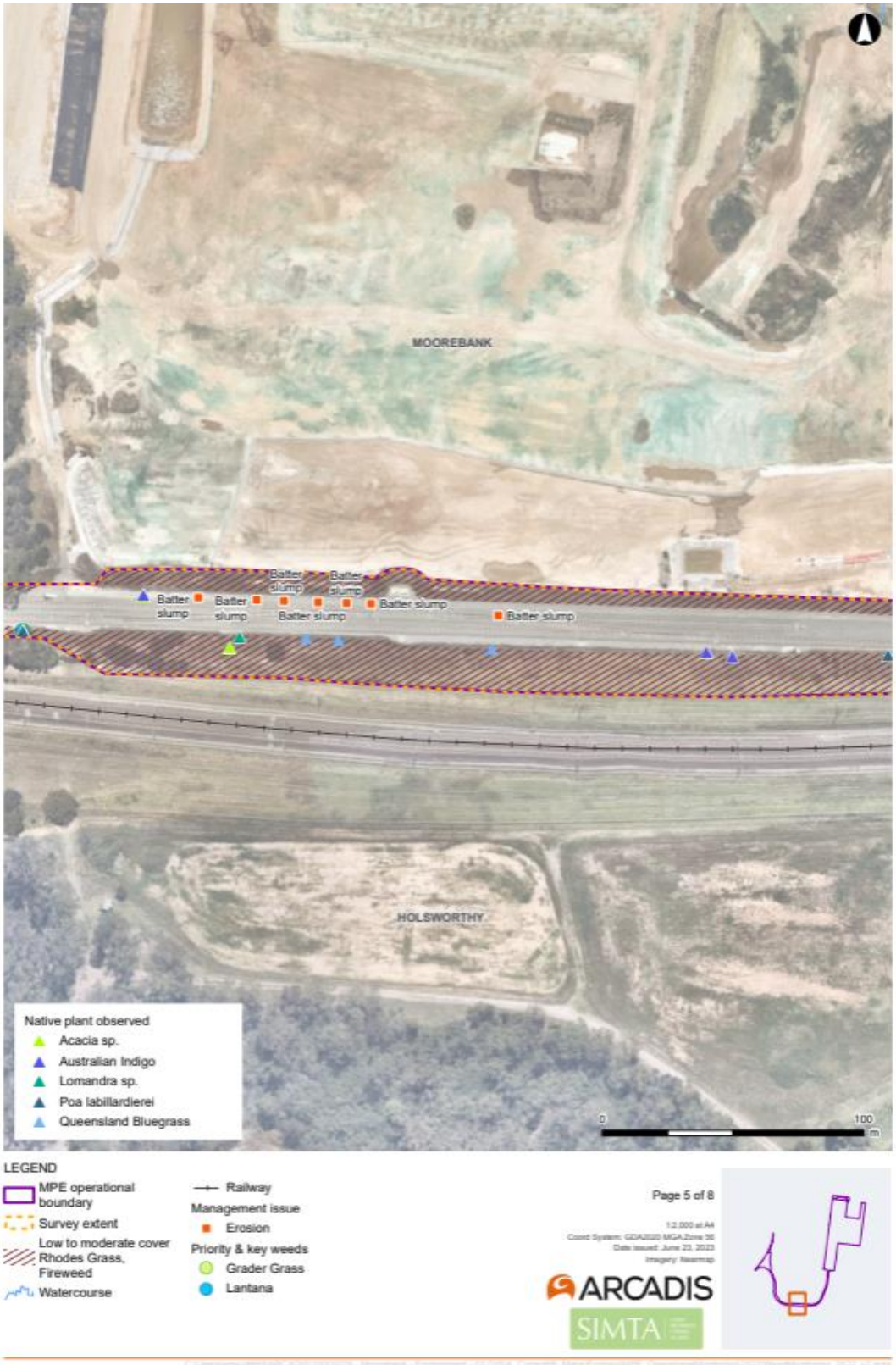

Figure 6. Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 5 of 8)

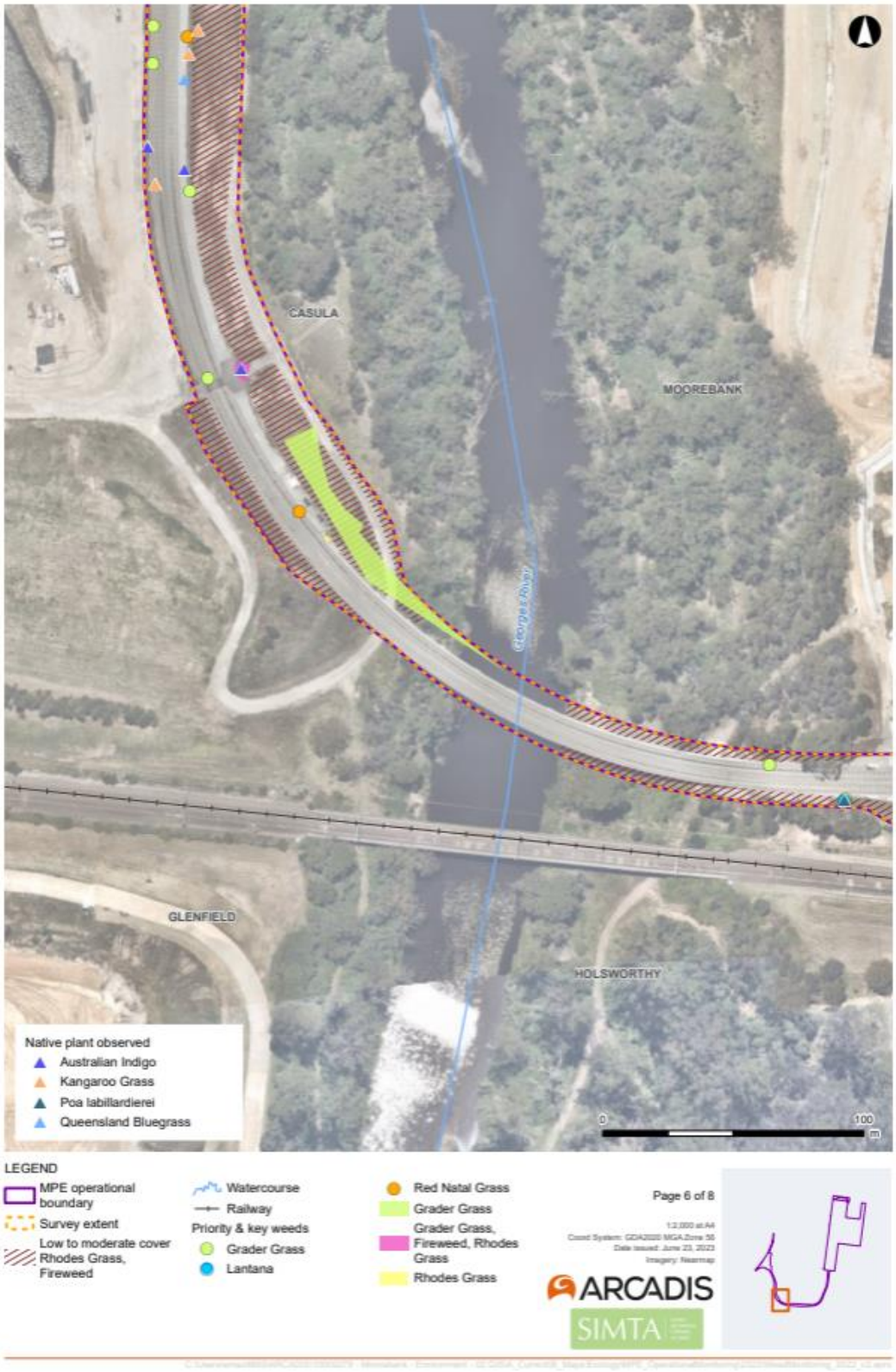

Figure 7. Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 6 of 8)

Figure 8. Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 7 of 8)

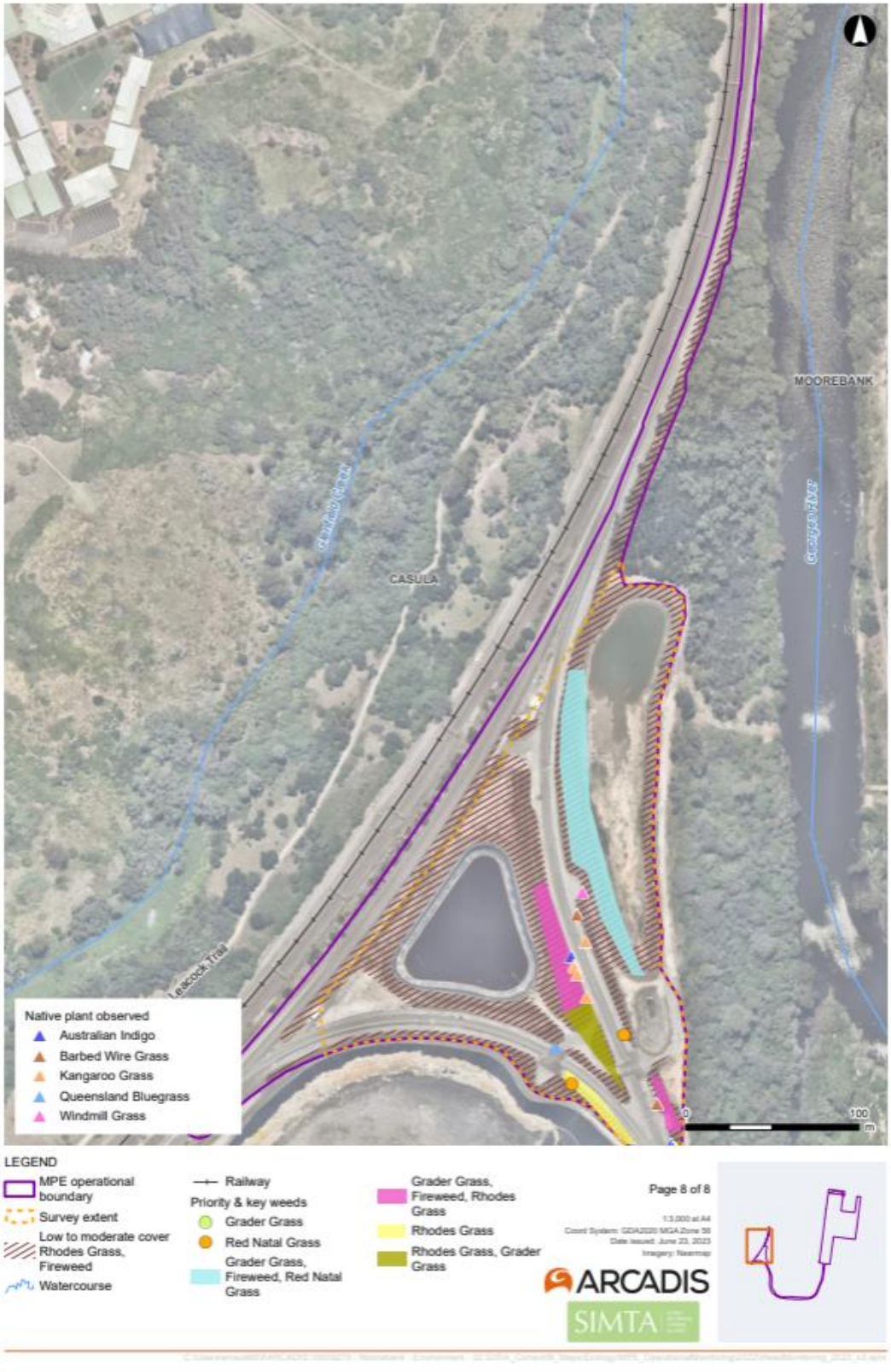

Figure 9. Native plant, weed covers and aggressive weeds identified across the MPE operational facility (Map 8 of 8)

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 undertaken since the April 2022 survey and the revegetation methodology proposed by Spray Grass Solutions and Cumberland Plain Seeds.

Majority of weed control and management actions recommendations documented in the April 2022 weed monitoring report are still applicable to management of the site. These include:

- Targeted weed control works along revegetated soft batters. Weed control works will focus on controlling priority and key weed species. Hand weeding should be conducted for individuals whereas a combination of slashing and herbicide spraying should be adopted to target larger patches of weeds. A suggested process to target weeds along revegetated soft batters is presented in Figure 10. Hand weeding is only feasible on annual species such as Grader Grass and Fireweed.
- Priority and aggressive weed species outside of revegetated areas within the Rail Link should be removed. Weeds which should be targeted include Lantana, African Olive, Bridal Creeper, Moth Vine, Castor Oil, Alligator Weed and Fireweed.
- Large patches of African Lovegrass, Rhodes Grass and Grader Grass between the Rail Link and the East Hills train line should be slashed on a regular basis to prevent seeding events when seed heads are absent (Figure 4, Figure 8). This will reduce colonisation of these grasses into revegetation areas.
- Exotic understory vegetation in the two locations outside of the Rail Link fence at the southern extent of the MPE operational facility (Figure 3) should be slashed regularly to prevent seeding events. Slashing should be targeted to avoid impacts to naturally regenerating shrubs including Acacias. No herbicide should be used in these locations and all works should be contained within the construction envelope of the RALP. Qualified bush regenerators should be procured to conduct these works to reduce off-target impacts to native species. A suggested process to target weeds within these areas is presented in Figure 11.
- Continue to collect litter from with 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 continue to be supressed through a combination of herbicide application, slashing and hand weeding. Weed control 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 in a way which prevents overspray (off target poisoning). If herbicide application occurs recommended herbicides for tussock grass, such as Rhodes grass and African Lovegrass include glyphosate or flupropanate while plants are actively growing, during summer and spring. Native vegetation outside of the Rail Link fence should not be affected by herbicide during weed control works.

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

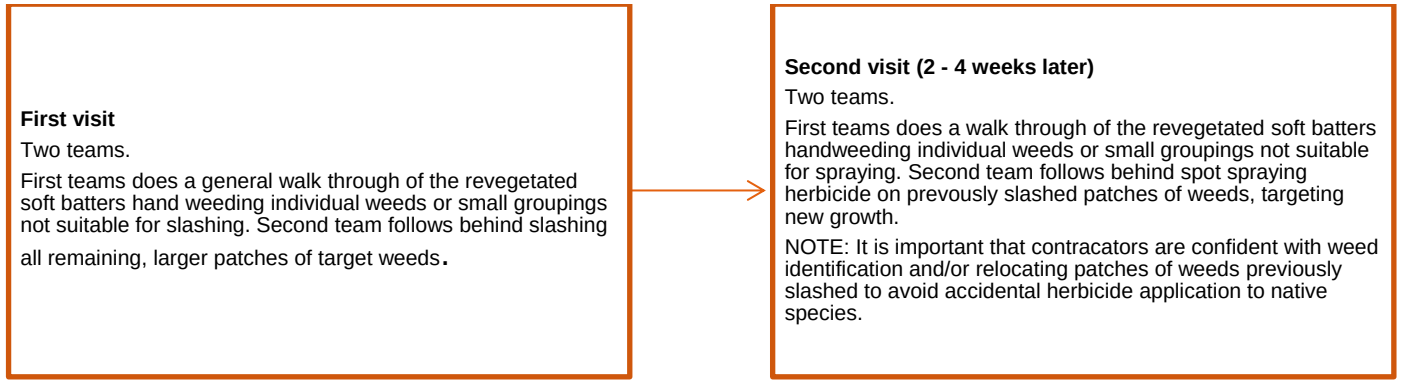

Figure 10. Suggested process to controlling target weeds on revegetated soft batters

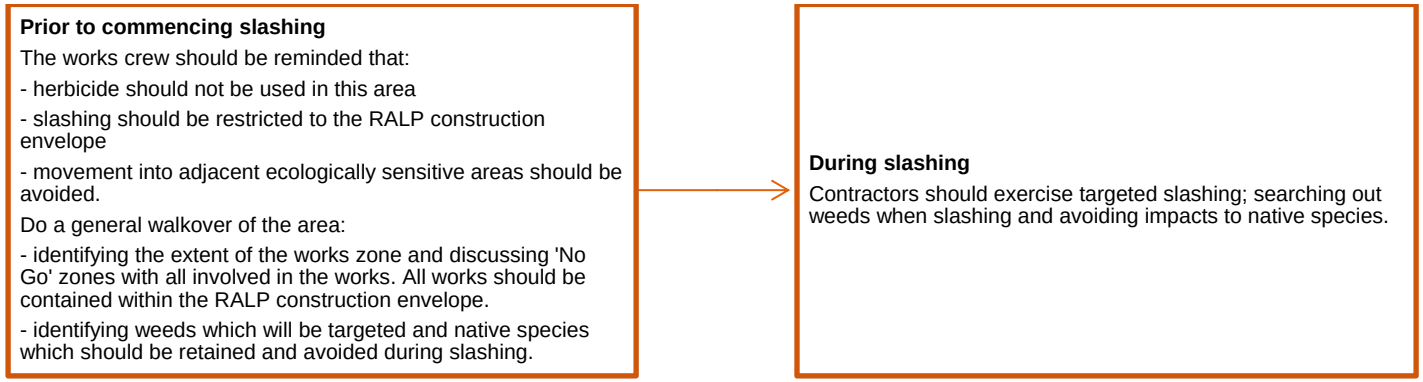

Figure 11. Slashing target weeds within the RALP construction envelope adjacent to ecologically sensitive areas

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 October 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 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.
August 2020	Exotic species, specifically *Medicago polymorpha* (Burr medic) should be removed from grassland 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 of the Rail Link corridor fencing. A qualified bush

Month of logging	Recommended action	Status (Not started, Commenced, Complete)	Comments
			regeneration contractor should be used to avoid impacts to 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.
August 2021	Collect litter scattered through the Rail Link corridor and in adjacent areas	Not started	Litter remains in Rail Link corridor and adjacent areas.
October 2021	Control aggressive weed species Coolatai Grass and Paterson's Curse within the Rail Link	Not started	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 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.
July 2022	Prioritise weed control works for priority and key weed species which have experienced accelerated growth in recent months.	Not started	Areas of particularly high biomass of priority and key weeds species should be prioritised for weed control 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.

APPENDIX B. REMEDIATION PROGRESS PHOTOGRAPHS

April 2021

December 2021

July 2022

April 2021

December 2021

July 2022

April 2021

December 2021

July 2022

April 2021

December 2021

July 2022

April 2021

December 2021

July 2022

April 2021

December 2021

July 2022

		
April 2021	**December 2021**	**July 2022**