EPBC 2010/5649
Millar Road Clearing Vegetation to Allow Quarrying

Annual Compliance Report
2022/2023

Introduction

On the 14 February 2022 transfer of EPBC Approval 2010/5649 from WA Limestone Group of Companies (WAL) to City of Rockingham was approved by the Department of Agriculture, Water and Environment. Following approval of the transfer, the City gained responsibility for the ongoing implementation of the conditions of the EPBC approval, including the implementation of the Tamworth Hill Swamp Reserve Revegetation Plan (THSRRP) as per Condition 2.

During the preparation of the City's Tamworth Hill Swamp Management Plan in 2019, City's Officers identified that the revegetation works undertaken in accordance with the THSRRP had not met the EPBC approval requirements. The non-compliance was reported to the Department of Environment and Energy (DEE) in 2018. To assist in addressing the non-compliance of the EPBC approval requirements, a revised THSRRP was prepared by the City and subsequently approved by DEE in 2019. The THSRRP Addendum outlines additional planting requirements under an implementation schedule from 2020 to 2024.

Following the transfer of EPBC Approval 2010/5649 from WAL to the City, The City will now be wholly responsible for implementing all conditions on the approval. It is noted a number of the conditions have been previously completed and are no longer applicable. Table 1 summarises the 12 conditions detailed in the EPBC approval report.

Table 1: Compliance Audit of EPBC Approval 2010/5649 Conditions 2022/2023

Condition	Details	Status	Comment
1	The person taking the action must ensure that the vegetation clearing does not exceed 22 hectares and is contained within the area specified in the map at Figure 1 of Appendix A: project area.	Completed	Clearing was completed within the approved area prior to this reporting period as detailed by WA Limestone's EPBC 2010/5649 Millar Road Annual Compliance Report 2021 EPBC-2010-5649-Millar-Road-Annual-Compliance-Report-2021.pdf (walimestone.com)
2	To mitigate potential impacts to Black Cockatoos, within six (6) months of the commencement of construction, the person taking the action must prepare and submit a Tamworth Hill Swamp Reserve Revegetation Plan (THSRRP) for the Minister's approval that identifies the measures to minimise the impacts of the action on Black Cockatoos. The THSRRP must detail the following: i. .measures to establish the equivalent of at least 12ha of habitat known to be primary feeding plants for Black Cockatoos within the Tamworth HillSwamp Reserve (THSR), through landscape planting; ii. the revegetation methods to be undertaken within revegetation zones defined in Appendix A Figure2; iii. measures to ensure that seedlings being planted are free of Dieback, (Phytophthora cinnamomi); iv. timeframes and survival targets proposed for plantings; v. feral animal and weed controls measures to be implemented; vi. fencing to be undertaken; vii. contingency measures if targets are not met; viii. the monitoring and survey measures to be utilised, including timing schedules and reporting requirements; ix. roles and responsibilities of contractors, staff and the person taking the action, prior to, during and following any rehabilitation and revegetation works undertaken within the THSR area, and; x. how the WA DEC, CoR, or other conservation organisation(s), have been consulted in the preparation of the THSRRP. If the Minister approves the THSRRP then the THSRRP must be implemented.	Completed	Tamworth Hill Swamp Reserve Revegetation Plan – Addendum 1 was submitted to the Minister for approval in September 2019. Compliance with the approved Plan can be seen in Attachment 1 – Tamworth Hill Swamp Revegetation Report 2022/2023

3	Prior to commencement of construction the person taking the action must provide the department with written agreement from the CoR that the Tamworth Hill Swamp Reserve (THSR) revegetation areas shown at Appendix A Figure 2 will be retained in perpetuity under its existing conservation reserve status	Completed	No further update since WA Limestone's EPBC 2010/5649 Millar Road Annual Compliance Report 2021 EPBC-2010-5649-Millar-Road-Annual-Compliance-Report-2021.pdf (walimestone.com)
4	To offset the loss of 22ha of Black Cockatoo foraging habitat and the loss of 93 potential breeding trees, the person taking the action must within 12 months of the commencement of construction, provide funding of $65,000 to WA DEC for the acquisition, and to assist in the ongoing maintenance of, a 65ha area of freehold land in the Gingin area (offset area). The land being ceded to WA DEC, under irrevocable long term protection must contain Banksia woodland that is in equivalent or better condition than the Banksia woodland that is in 'average' condition within the project area. Within 4 weeks of the funding being provided to WA DEC, the person taking the action must provide written evidence to the department of the payment.	Completed by WA Limestone	No further update since WA Limestone's EPBC 2010/5649 Millar Road Annual Compliance Report 2021 EPBC-2010-5649-Millar-Road-Annual-Compliance-Report-2021.pdf (walimestone.com)
5	Within 12 months of the commencement of construction, the person taking the action must provide to the department a description and map clearly defining the location and boundaries of the offset area, as specified in Condition 4, which must be accompanied with the offset attributes.	Completed by WA Limestone	No further update since WA Limestone's EPBC 2010/5649 Millar Road Annual Compliance Report 2021 EPBC-2010-5649-Millar-Road-Annual-Compliance-Report-2021.pdf (walimestone.com)
6	To mitigate potential impacts to Black Cockatoo habitat adjacent to the Project Area, the person taking the action must ensure that the following measures is carried out to limit the occurrence of Dieback *(Phytophthora cinnamomi)* on site. i. All vehicles being used during construction of the quarry that have come from a Dieback affected area must be washed down prior to entering the project area in accordance with WA DEC management of Dieback in extractive industries guidelines.	Completed by WA Limestone	No further update since WA Limestone's EPBC 2010/5649 Millar Road Annual Compliance Report 2021 EPBC-2010-5649-Millar-Road-Annual-Compliance-Report-2021.pdf (walimestone.com)
7	Within 30 days after the commencement of construction, the person taking the action must advise the department in writing of the actual date of commencement.	Completed by WA Limestone	No further update since WA Limestone's EPBC 2010/5649 Millar Road Annual Compliance Report 2021 EPBC-2010-5649-Millar-Road-Annual-Compliance-Report-2021.pdf (walimestone.com)

8	Within three months of every 12 month anniversary of the commencement of construction, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of any management plans as specified in the conditions. The reports must remain on the website for at least five (5) years. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the department at the same time as the compliance report is published.	Completed	This Annual Compliance Report can be found of the City of Rockingham website
9	If the person taking the action wishes to carry out any activity otherwise than in accordance with the Tamworth Hill Swamp Reserve Revegetation Plan (THSRRP) as specified in the conditions, the person taking the action must submit to the department for the Minister's written approval a revised version of that THSRRP. The varied activity shall not commence until the Minister has approved the varied THSRRP in writing. The Minister will not approve a varied THSRRP unless the revised THSRRP would result in an equivalent or improved environmental outcome over time. If the Minister approves the revised THSRRP that THSRRP must be implemented in place of the THSRRP originally approved.	Not Applicable	Not Applicable
10	If the Minister believes that it is necessary or convenient for the better protection of Listed Threatened Species and Communities to do so, the Minister may request that the person taking the action make specified revisions to the Tamworth Hill Swamp Reserve Revegetation Plan (THSRRP) specified in the conditions and submit the revised THSRRP for the Ministers written approval. The person taking the action must comply with any such request. The revised approved THSRRP must be implemented. Unless the Minister has approved the revised THSRRP then the person taking the action must continue to implement the THSRRP originally approved, as specified in the conditions.	Not Applicable	Not Applicable
11	If, at any time after five years from the date of this approval, the person taking the action has not substantially commenced the action, then the person taking the action must not substantially commence the action without the written agreement of the Minister.	Completed by WA Limestone	No further update since WA Limestone's EPBC 2010/5649 Millar Road Annual Compliance Report 2021 EPBC-2010-5649-Millar-Road-Annual-Compliance-Report-2021.pdf (walimestone.com)

12	Unless otherwise agreed to in writing by the Minister, the person taking the action must publish the Tamworth Hill Swamp Reserve Revegetation Plan (THSRRP) referred to in these conditions of approval on their website. The THSRRP must be published on the website within 1 month of being approved.	Completed	The Tamworth Hill Swamp Reserve Revegetation Plan has been uploaded to the City of Rockingham's website

Appendix 1

Tamworth Hill Swamp Revegetation Project Report 2022/2023

Background

Revegetation strategies for this project are directed by the approved Tamworth Hill Swamp Reserve Revegetation Plan (THSRRP), developed by Coterra Environment in 2013, and Addendum 1 (2019). THSRRP identified the following performance targets for the revegetation program to establish 12 ha of habitat known to be primary feeding plants for Black Cockatoos within Tamworth Hill Swamp.

Characteristic	Minimum Target / KPI
Plant density	1 plant / m^2
Species composition	75% of revegetation species list
Weed cover	<20%

The following sections detail the measures that have been taken to address the management requirements as outlined in the THSRRP.

Revegetation Works

The focus of the revegetation strategy is to protect and enhance areas of existing native vegetation and to rehabilitate 12 ha of degraded areas around Tamworth Hill Swamp (areas marked “Part of EPBC Act offset” in Figure 1). Revegetation works have been carried out at the reserve since 2015 in quantities shown below in Table 1. Species used in revegetation are plants known to be primary feeding plants for Black Cockatoos or recommended in the THSRRP and Emerge Associates’ Tamworth Hill Swamp Environmental Assessment (2018).

The THSRRP Addendum includes a revised implementation schedule for infill planting from 2020 to 2024. Most recently, infill planting of 11,836 tubestock seedlings was undertaken in winter 2022 to address the shortfall in plant density and diversity across the site.

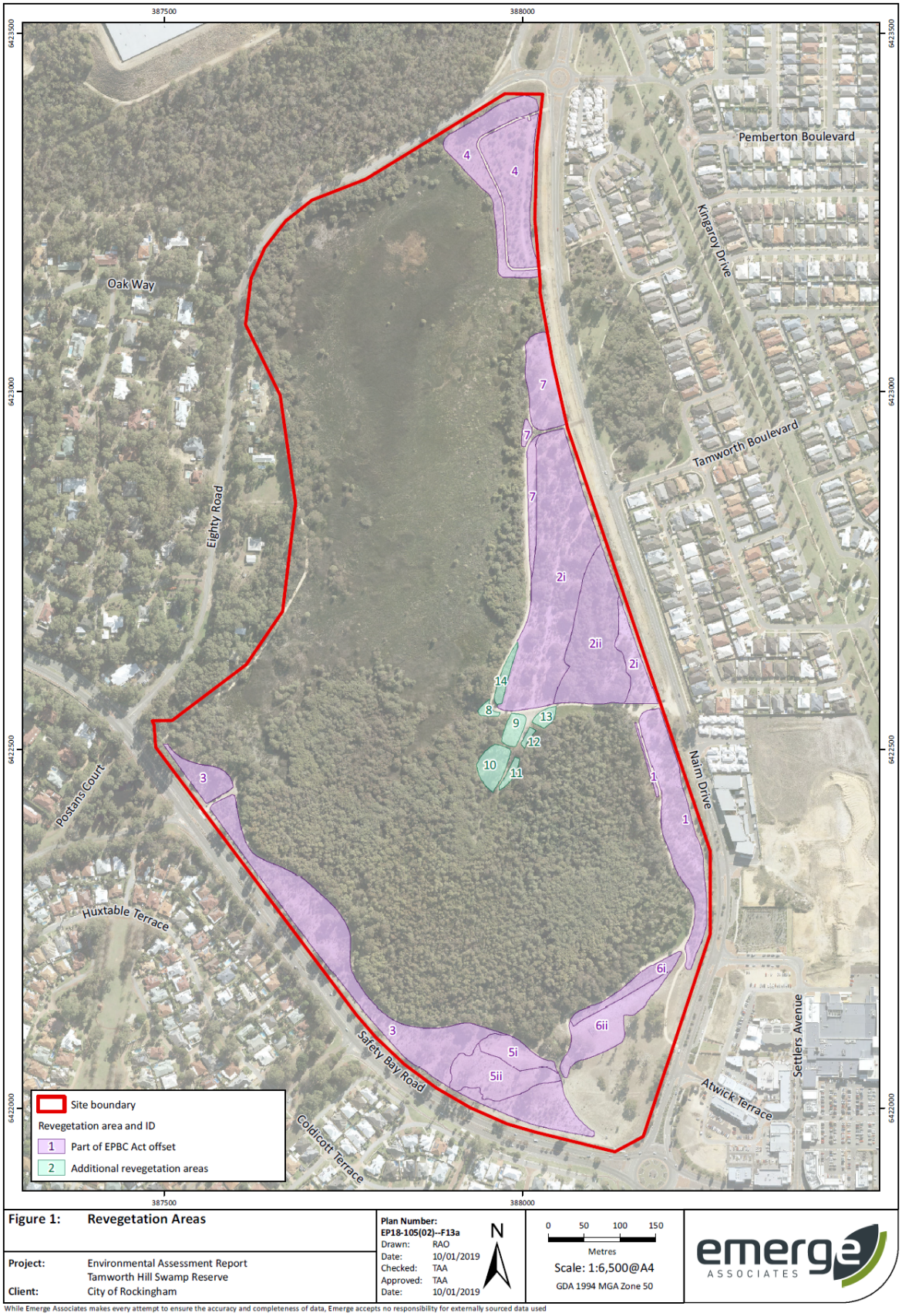

Figure 1: Revegetation areas at Tamworth Hill Swamp, numbered in relation to the order in which they were planted.

Table 1 – Yearly quantity of seedlings planted per revegetation area at the reserve

Area	2015	2016	2017	2018	2019	2020	2021	2022	**Total**
RA1	8103				434		7130	1876	**15667**
RA2	20000				788	9636	5090	625	**35514**
RA3		22000					12590	3010	**34590**
RA4		4720					5050	1450	**9770**
RA5			5000		560		3950	1255	**9510**
RA6			5000				1910	680	**6910**
RA7			4960				2850	940	**7810**
RA8			100		60				**160**
RA9			100		60				**160**
RA10			100		60				**160**
RA11					118				**118**
RA12					100				**100**
RA13					100				**100**
Additional randomised planting throughout								2000	**2000**
Total	**28103**	**26720**	**15260**	**0**	**2280**	**9636**	**38570**	**11836**	**132405**

Dieback Hygiene

Dieback hygiene protocols are in place for cleaning machinery and footwear with a methylated spirits or bleach solution. Seedlings used in the revegetation program are sourced from Nursery Industry Accreditation Scheme Australia (NIASA) accredited nurseries to ensure they are certified dieback free. No additional soil has been imported into the reserve.

Feral animal control

The City's feral animal control program continued this reporting period. The program is focused on the integrated control of feral rabbits, cats and foxes, in accordance with control measures recommended for use in urban environments by the Department of Agriculture and Food and the Department of Biodiversity, Conservation and Attractions. The program is coordinated by the City of Rockingham and is undertaken by a licenced feral animal control contractor.

An assessment was carried out throughout the reserve in early 2022 to check for signs of feral animal activity. One fox was detected at the reserve but was unable to be trapped during the program. No signs of cats or rabbits were observed.

Weed control

Weekly maintenance is undertaken at the reserve which predominantly comprises weed control (chemical, manual and mechanical) to maintain the weed density below the 20% maximum allowance, however for the majority of the site, actual density is significantly lower. Results from the assessment of weed coverage at the reserve in spring 2022 can be seen in Table 2, and detailed further in the full consultant's report at the end of this document.

Fencing

Fences with pedestrian gates are maintained to rationalise access and recreation within the reserve. Clear pathways are designated to assist in avoiding trampling of vegetation. The perimeter fences also assists in preventing unauthorised vehicle access.

The perimeter fence is inspected during routine weekly maintenance of the reserve by environmental maintenance contractors. Any damage to the fence is repaired upon discovery or arranged through specialist fencing contractors.

The original THSRRP recommended temporary fencing to be constructed around revegetation areas. Kangaroo exclusion fencing was constructed around RA2 in 2015, and removed in 2017 after plant establishment. Since that time no further fencing has been installed around other revegetation zones. The Addendum to the THSRRP recommends use of compostable tree guards as the minimum treatment with fencing as the alternative measure to be considered. Compostable tree guards have been used to exclude predation by both rabbits and kangaroos with good success.

Monitoring

Results of the monitoring are included Section 4 – Monitoring below and in the attached Vegetation Survey Report 2022

Monitoring quadrats have been established across the revegetation areas and marked by GPS. Locations of 21 quadrats were nominated at random by Emerge Associates in their 2018 assessment on a 10m x 10m overlay grid across the reserve (Figure 2). Each revegetation zone contains three quadrats marked at their northwest corner by a steel fence picket.

Figure 2: Location of monitoring quadrats installed by Emerge Associates in 2018

Quadrats were resurveyed by Natural Area Holdings (NAH) consultants in spring 2022 for native species stem density, native coverage and weed coverage. A summary of the survey results against the THSRRP performance targets is shown in Table 2 below. The full report is attached to the end of this document.

The 2022 survey found the mean native species density across the Site was 0.29 stems per m^2. This is lower than the 2021 survey which recorded a mean native density of 1.3 stems per m^2. NAH have found that the 2021 data included the native *Crassula colorata* which was a result of natural self-seeding recruitment. Consequently, NAH did not include it in their assessment of revegetation survival resulting in lower native density in areas.

Ongoing planting works were scheduled for winter 2023 across the reserve to increase plant density and diversity throughout.

Table 2 – Summary of revegetation performance targets

Quadrat	**Minimum 1 native plant / m2**		**Minimum 75% of revegetation species list represented**		**Maximum 20% weed coverage**	
		Target met		**Target met**		**Target met**
Revegetation area (all quadrats)	0.29	✘	68.3%	✘	2.7%	✓

R1a	0.24	✗		1.0	✓
R1b	0.46	✗		0.3	✓
R1c	0.15	✗		0.2	✓
R2a	0.24	✗		0.3	✓
R2b	0.90	✗		6.3	✓
R2c	0.17	✗		0.9	✓
R3a	0.37	✗		0.2	✓
R3b	0.29	✗		0.4	✓
R3c	0.37	✗		0.1	✓
R4a	0.22	✗		4.6	✓
R4b	0.16	✗		1.0	✓
R4c	0.15	✗		18.4	✓
R5a	0.25	✗		0.7	✓
R5b	0.34	✗		0.2	✓
R5c	0.14	✗		3.0	✓
R6a	0.23	✗		12.4	✓
R6b	0.3	✗		0.3	✓
R6c	0.47	✗		0.7	✓
R7a	0.18	✗		0.9	✓
R7b	0.18	✗		3.2	✓
R7c	0.36	✗		1.5	✓

Natural Area Holdings Pty Ltd
Whadjuk Country
57 Boulder Road
Malaga WA 6090

28 November 2022

Nathan Leslie
Environmental Supervisor
City of Rockingham

Dear Nathan Leslie

RE: TAMWORTH HILL SWAMP BASIC FLORA AND VEGETATION SURVEY

Natural Area Consulting Management Services (Natural Area) was contracted by the City of Rockingham (the City) to undertake a basic flora and vegetation survey within areas of revegetation at Tamworth Hill Swamp. The objective of this survey was to assess the revegetation against the following performance targets:

1. minimum density of one native plant per m^2
2. minimum species richness across all sites of 75% of the revegetation species list
3. maximum of 20% weed coverage.

A total of 21 monitoring quadrats (10m x 10m) were surveyed, with the following data being recorded:

- all native and introduced species present
- total count of individuals (both alive and dead) for each native species
- foliar cover for each species, both native and introduced
- vegetation condition
- general comments and potential management issues.

The survey identified a total of 102 species from 33 families, including 68 native species and 35 introduced species. Of the three performance targets, currently only target 3 is being met, with average weed coverage across all quadrats being 2.7%. Current average native plant density is 0.29 plants per m^2, which requires the further installation of approximately 71 individuals per quadrat. Current species richness is at 68.3% of the revegetation list, requiring a further six species to meet this performance target.

Regards

Shelley Hill
Environmental Consultant

1.0 Introduction

Natural Area Consulting Management Services (Natural Area) was contracted by the City of Rockingham (the City) to undertake a basic flora and vegetation survey within areas of revegetation at Tamworth Hill Swamp. The objective of this survey was to assess the revegetation against the predetermined performance targets for the revegetation site.

2.0 Methodology

The flora and vegetation survey was conducted in accordance with *Technical Guidance-Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority, 2016). Samples were collected, or photographs taken of unfamiliar species to enable later identification.

Natural Area botanist Shelley Hill with field assistant Georgia Goodwine undertook the monitoring event between 24 and 25 October 2022, with key data recorded using Mappt software on a handheld tablet. Monitoring activities included:

- setting out a total of 21 monitoring quadrats (10 x 10 m) in established locations within the seven revegetation areas (Figure 1)
- photographing each quadrat in the north-west corner
- recording landscape characteristics including soil types/colour, aspect, slope, surface rock, topography and drainage using a modified recording sheets based on the NAIA templates developed for the Perth Biodiversity Project
- determining leaf litter depth, percentage cover, and percentage of bare ground
- recording a species list for both native and introduced species, including percentage cover and height of each species
- recording number alive/dead stems each native flora species
- recording revegetation condition and evidence of disturbance, such as fire.

The data obtained from the flora and vegetation survey was used to assess the revegetation against the following performance targets:

1. minimum density of one native plant per m^2
2. minimum species richness across all sites of 75% of the revegetation species list
3. maximum of 20% weed coverage.

2.1 Limitations

The potential limitations encountered whilst conducting the basic flora and vegetation monitoring event are listed in Table 1 below, including an assessment of the mitigation and impact of each on the results.

Table 1: Flora survey limitations

Potential Limitation	Comments
Availability of contextual information	Regional and local contextual information were readily available for the site.
Competency/experience of team	The revegetation monitoring was conducted by a team with extensive experience carrying out detailed flora and vegetation surveys and revegetation monitoring in the Swan Coastal Plain.
Proportion of flora recorded/collected, any identification issues	A total of 102 flora species (taxa) were recorded from 33 families during the field survey, including 35 introduced (weeds) and 67 native species. Of these, three native species (2.9%) were unable to be identified due to a lack of diagnostic features; Myrtaceae sp., *Lomandra* sp. and *Thelymitra* sp. None of these species have features consistent with those within the revegetation species list, and therefore are not likely to impact the results or the achievement of performance target 2. The number of dead stems recorded is not a reliable reflection of mortality rates for revegetation. Recording the number of dead stems for each species is strongly impacted by the persistence of vegetative material remaining intact following mortality to allow observation and identification. Additionally, not all dead stems were able to be identified to species level due to the lack of diagnostic characteristics.
Survey effort and extent	All quadrats and photo points were assessed over a period of two days.
Access restrictions	No access restrictions were encountered.
Survey timing	The basic flora and vegetation survey was conducted within Spring, which is the optimal timing for surveys conducted within the Swan Coastal Plain bioregion.
Disturbances	No recent disturbances which may have had an effect on the results, such as fires, clearing and floods, were noted.

Figure 1:
Quadrat Locations
Tamworth Hill Swamp

3.0 Flora Survey Results

The results of monitoring activities are provided in this section of the report. A quadrat photos compile is provided in Appendix 2 and quadrat data in Appendix 3. It was noted that photos provided in the previous monitoring report in Spring 2021 for Quadrat 2b and 3a are the same photo and as such they do not align with the photos taken in Spring 2022.

3.1 Vegetation Condition

The condition of the revegetation ranged from Good to Poor, with lower conditions reflecting quadrats displaying high rates of revegetation mortality and/or high weed cover (Table 2). The revegetation in seven quadrats was recorded to be in fair condition in 2022, in comparison to good condition in 2021. This is likely a result of factors including plant condition and mortality being accounted for in 2022 but not 2021. Over half (52.4%) of the quadrats were observed to have recently undergone chemical weed treatment. One quadrat (R6c) was observed to contain mature revegetation from which tree guards were not removed and have now been outgrown (Figure 2). Additionally, the presence of paper wasp (*Polistes* sp.) nests were observed within a number of the quadrats. Some metal stakes in place to mark the corners of monitoring quadrats were unable to be located in two quadrats; R2c and R6b.

Figure 2: Tree guards observed surrounding mature revegetation in quadrat R4b.

Table 2: Condition of revegetation and quadrats

Quadrat	Vegetation Structure	Revegetation Condition	Comments
R1a	Mature overstorey over juvenile tubestock	Good	Fallen branch on SW stake. Previous weed spray.
R1b	Mature overstorey/midstorey over juvenile tubestock	Fair	
R1c	Mature overstorey/midstorey over juvenile tubestock	Fair	
R2a	Mature overstorey/midstorey over juvenile tubestock	Good	Previous weed spray.
R2b	Mature midstorey/understorey,	Good	

Quadrat	Vegetation Structure	Revegetation Condition	Comments
	no juvenile tubestock		
R2c	Mature overstorey/midstorey, no juvenile tubestock	Good	SE and SW stakes no longer present.
R3a	Mature overstorey/midstorey over juvenile tubestock	Fair	
R3b	Mature overstorey/midstorey over juvenile tubestock	Fair	Previous weed spray.
R3c	Mature overstorey/midstorey, no juvenile tubestock	Good	
R4a	Mature overstorey/midstorey over juvenile tubestock	Fair	Previous weed spray.
R4b	Mature midstorey over juvenile tubestock	Good	Previous weed spray.
R4c	Mature overstorey/midstorey over juvenile tubestock	Fair	Previous weed spray.
R5a	Mature overstorey/midstorey with juvenile tubestock	Good	
R5b	Juvenile tubestock	Poor	Previous weed spray. High density of dead **Crassula* sp. High tubestock mortality.
R5c	Mature overstorey/midstorey with juvenile tubestock	Good	Previous weed spray.
R6a	Mature overstorey/midstorey over juvenile tubestock	Good	Previous weed spray.
R6b	Mature overstorey/midstorey, no juvenile tubestock	Good	NW stake no longer present.
R6c	Mature overstorey/midstorey, no juvenile tubestock	Good	Plastic tree guards surrounding mature trees and shrubs.
R7a	Mature overstorey/midstorey over juvenile tubestock	Good	Only NW stake present.
R7b	Mature overstorey over juvenile tubestock	Fair	Previous weed spray.
R7c	Mature overstorey/midstorey over juvenile tubestock	Good	Previous weed spray.

3.2 Native Flora

A total of 67 native flora species (taxa) were recorded from 20 families during the field survey. A complete flora species list is provided in Appendix 1. The most commonly observed families were Fabaceae, Proteaceae and Myrtaceae, with a representation of 12 to 13 species each respectively. Examples of native flora species are shown in Figure 3. Vegetation within the survey quadrats included recently installed juvenile tubestock protected with tree guards, established revegetation from previous installations and remnant bushland vegetation.

Species richness within quadrats ranged from a minimum of 6 species in R2b and R6a and a maximum of 23 species in R4a. Average native species density was 0.29 stems per m^2, with the highest revegetation success in quadrat R2b (0.90 per m^2). Natural recruitment of native species was observed in seven quadrats, including the germination of *Melaleuca lateritia*, *Isolepis marginata, Senecio pinnatifolius, Microtis media* and a *Thelymitra* species which was unable to be identified as it was not currently flowering. Additionally, species were identified which were likely to be present as a result of revegetation however were not within the revegetation species list. These were *Acacia drummondii, Lomandra caespitosa* and *Lomandra* sp. (all within tree guards), as well as *Acacia pulchella* var. *goadbyi* and *Eucalyptus todtiana*.

Acacia pulchella (Prickly Moses)

Kennedia prostrata (Scarlet Runner)

Calothamnus quadrifidus (One-sided Bottlebrush)

Melaleuca teretifolia (Banbar)

Figure 3: Examples of native flora species recorded

3.3 Introduced Flora

A total of 35 introduced flora species (taxa) were recorded from 17 families during the field survey. A complete flora species list is provided in Appendix 1. The most commonly observed families were Asteraceae (daisies), Fabaceae (peas) and Poaceae (grasses), with four to seven species each. Examples of introduced species observed are shown in Figure 4. No Declared Pests or Weeds of National Significance (WoNS) were identified within the survey site.

Average weed cover across all quadrats was 2.7%, with a maximum of 18.4% in R4c and a minimum of 0.1% in R3c. The average number of weed species across all quadrats was 4.6, with a maximum of 19 species in R4c and a minimum of one species in R1c, R3c and R4a.

Whiteflower Fumitory (**Fumaria capreolata*)

**Monopsis debilis*

**Lupinus cosentinii*

Common Fig (**Ficus carica*)

Figure 4: Examples of introduced flora species recorded

4.0 Performance Targets

4.1 Minimum density of one native plant per m2

Average native species density was 0.29 stems per m^2, with a minimum of 0.14 stems per m^2 in R5c and a maximum of 0.90 stems per m^2 in quadrat R2b (Table 3). As a result, none of the quadrats meet the density performance target of 1 plant per m^2. This is a reduction of ten quadrats which were found to meet the performance target in 2021, however a review of the 2021 data showed that count data for the native species *Crassula colorata* was included in the density calculations. This is an annual species, identified within the quadrats as a result of native recruitment and was not planted during revegetation. It was not identified in any quadrats in 2022, likely due to the survey being undertaken outside of the peak growth period for this species (August – October) and the recent chemical weed control. Additionally, no annual species present as a result of native recruitment and not revegetation were included in density calculations in 2022, as the inclusion of these species does not accurately reflect revegetation survival. Species density data for 2021 excluding *Crassula colorata* shows the successful achievement of the density performance target in only one quadrat (R2b) which also had the highest density in 2022.

On average, the installation of 71 tubestock is required per quadrat in order to meet this performance target.

Table 3: Assessment of performance target 1 for each revegetation quadrat

Quadrat	Native Plant Density (plants per m^2)	Completion Criterion Status
R1a	0.24	Not achieved
R1b	0.46	Not achieved
R1c	0.15	Not achieved
R2a	0.24	Not achieved
R2b	0.90	Not achieved
R2c	0.17	Not achieved
R3a	0.37	Not achieved
R3b	0.29	Not achieved
R3c	0.37	Not achieved
R4a	0.22	Not achieved
R4b	0.16	Not achieved
R4c	0.15	Not achieved
R5a	0.25	Not achieved
R5b	0.34	Not achieved
R5c	0.14	Not achieved
R6a	0.23	Not achieved

Quadrat	Native Plant Density (plants per m^2)	Completion Criterion Status
R6b	0.3	Not achieved
R6c	0.47	Not achieved
R7a	0.18	Not achieved
R7b	0.18	Not achieved
R7c	0.36	Not achieved

4.2 Minimum species richness of 75% of the revegetation species list

Of the 68 native species identified within the revegetation quadrats, a total of 56 species were within the revegetation species list. This list contains 82 species, therefore having a representation of 68.3% within the revegetation sites. As a result, the revegetation does not meet the performance target of 75% representation. The addition of a further six species is required to achieve this performance target.

4.3 Maximum of 20% weed coverage

The average weed cover across all quadrats was 2.7%, with the maximum weed coverage within a quadrat being 18.4% in R4c (Table 4). As a result, all quadrats meet this performance target.

Table 4: Assessment of performance target 3 for each revegetation quadrat

Quadrat	Weed Coverage (%)	Completion Criterion Status
R1a	1.0	Achieved
R1b	0.3	Achieved
R1c	0.2	Achieved
R2a	0.3	Achieved
R2b	6.3	Achieved
R2c	0.9	Achieved
R3a	0.2	Achieved
R3b	0.4	Achieved
R3c	0.1	Achieved
R4a	4.6	Achieved
R4b	1.0	Achieved
R4c	18.4	Achieved
R5a	0.7	Achieved
R5b	0.2	Achieved
R5c	3.0	Achieved
R6a	12.4	Achieved
R6b	0.3	Achieved
R6c	0.7	Achieved
R7a	0.9	Achieved
R7b	3.2	Achieved
R7c	1.5	Achieved

5.0 Recommendations

In order to maintain the condition of the vegetation quadrats, Natural Area recommends the upkeep of routine maintenance and weed control to prevent weed coverage exceeding the performance target. Additionally, it is recommended that the tree guards which have been outgrown by mature revegetation be removed to prevent adverse impacts on the growth and survival of the vegetation.

In order to meet the first two performance targets, Natural Area recommends that infill planting be undertaken in the coming Winter season. Successful achievement of the density performance target requires the installation of an average of 71 tubestock per quadrat, however infill planting should also account for natural rates of mortality. It should be noted, however, that the density performance target will be difficult to achieve in the long-term due to natural mortality, plant growth and competition, as well as factors such as leaf litter and dead wood coverage. Successful achievement of the species richness performance target requires the representation of a further six species within the revegetation quadrats. The species within the revegetation list which are currently not represented within the species present are:

- *Acacia sessilis*
- *Anigozanthos humilis*
- *Austrostipa compressa*
- *Casuarina obesa*
- *Daviesia physodes*
- *Gastrolobium capitatum*
- *Grevillea crithmifolia*
- *Hemiandra pungens*
- *Hovea trisperma*
- *Hypocalymma robustum*
- *Hypolaena exsulca*
- *Lepidosperma squamatum*
- *Leucopogon australis*
- *Machaerina articulata* (prev. *Baumea articulata*)
- *Machaerina juncea* (prev. *Baumea juncea*)
- *Melaleuca thymoides*
- *Melaleuca trichophylla*
- *Melaleuca viminea*
- *Mesomelaena pseudostygia*
- *Petrophile linearis*
- *Phlebocarya ciliata*
- *Pimelea rosea*
- *Rytidosperma occidentale*
- *Templetonia retusa*
- *Xanthorrhoea preissii*
- *Xanthosia huegelii.*

Appendix 1 – Species List

*Denotes introduced species

Family	Species	Common Name	Revegetation List
Aizoaceae	**Carpobrotus edulis*	Hottentot	-
Asteraceae	**Arctotheca calendula*	Cape Weed	-
Asteraceae	**Erigeron bonariensis*		-
Asteraceae	**Erigeron sumatrensis*		-
Asteraceae	**Hypochaeris radicata*	Flat Weed	-
Asteraceae	**Sonchus oleraceus*	Common Sowthistle	-
Asteraceae	**Symphyotrichum squamatum*	Bushy Starwort	-
Campanulaceae	**Monopsis debilis*		-
Caryophyllaceae	**Stellaria media*	Chickweed	-
Crassulaceae	**Crassula alata*		-
Crassulaceae	**Crassula glomerata*		-
Euphorbiaceae	**Euphorbia maculata*		-
Euphorbiaceae	**Euphorbia terracina*	Geraldton Carnation Weed	-
Fabaceae	**Lotus subbiflorus*		-
Fabaceae	**Lupinus cosentinii*		-
Fabaceae	**Ornithopus compressus*	Yellow Serradella	-
Fabaceae	**Trifolium campestre*	Hop Clover	-
Geraniaceae	**Erodium botrys*	Long Storksbill	-
Moraceae	**Ficus carica*	Common Fig	-
Onagraceae	**Epilobium ciliatum*		-
Onagraceae	**Oenothera drummondii*	Beach Evening Primrose	-
Onagraceae	**Oenothera stricta*	Common Evening Primrose	-
Papaveraceae	**Fumaria capreolata*	Whiteflower Fumitory	-
Poaceae	**Avena barbata*	Bearded Oat	-
Poaceae	**Bromus diandrus*	Great Brome	-
Poaceae	**Cenchrus clandestinus*	Kikuyu Grass	-
Poaceae	**Ehrharta calycina*	Perennial Veldt Grass	-
Poaceae	**Ehrharta longiflora*	Annual Veldt Grass	-
Poaceae	**Lolium rigidum*	Wimmera Ryegrass	-

Family	Species	Common Name	Revegetation List
Poaceae	**Vulpia myuros*	Rat's Tail Fescue	-
Polygonaceae	**Rumex acetosella*	Sorrel	-
Primulaceae	**Lysimachia arvensis*	Pimpernel	-
Rubiaceae	**Galium murale*	Small Goosegrass	-
Solanaceae	**Solanum nigrum*	Black Berry Nightshade	-
Verbenaceae	**Phyla nodiflora*		-
Apiaceae	*Centella asiatica*	Centella	Yes
Asparagaceae	*Lomandra caespitosa*		No
Asparagaceae	*Lomandra* sp.		No
Asparagaceae	*Sowerbaea laxiflora*	Purple Tassels	Yes
Asparagaceae	*Thysanotus multiflorus*	Many-flowered Fringe Lily	Yes
Asteraceae	*Senecio pinnatifolius*		No
Campanulaceae	*Lobelia anceps*	Angled Lobelia	Yes
Casuarinaceae	*Allocasuarina fraseriana*	Sheoak	Yes
Cyperaceae	*Ficinia nodosa*	Knotted Club Rush	Yes
Cyperaceae	*Gahnia trifida*	Coast Saw-sedge	Yes
Cyperaceae	*Isolepis marginata*	Coarse Club-rush	No
Cyperaceae	*Lepidosperma longitudinale*	Pithy Sword-sedge	Yes
Cyperaceae	*Machaerina preissii*		Yes
Dasypogonaceae	*Dasypogon bromeliifolius*	Pineapple Bush	Yes
Fabaceae	*Acacia drummondii*	Drummond's Wattle	No
Fabaceae	*Acacia huegelii*		Yes
Fabaceae	*Acacia lasiocarpa*	Panjang	Yes
Fabaceae	*Acacia pulchella*	Prickly Moses	Yes
Fabaceae	*Acacia pulchella* var. *goadbyi*		No
Fabaceae	*Acacia saligna*	Orange Wattle	Yes
Fabaceae	*Acacia stenoptera*	Narrow Winged Wattle	Yes
Fabaceae	*Bossiaea eriocarpa*	Common Brown Pea	Yes
Fabaceae	*Gompholobium tomentosum*	Hairy Yellow Pea	Yes
Fabaceae	*Hardenbergia comptoniana*	Native Wisteria	Yes
Fabaceae	*Jacksonia furcellata*	Grey Stinkwood	Yes

Family	Species	Common Name	Revegetation List
Fabaceae	*Jacksonia sternbergiana*	Stinkwood	Yes
Fabaceae	*Kennedia prostrata*	Scarlet Runner	Yes
Haemodoraceae	*Anigozanthos manglesii*	Mangles Kangaroo Paw	Yes
Haemodoraceae	*Conostylis aculeata*	Prickly Conostylis	Yes
Haemodoraceae	*Conostylis juncea*		Yes
Hemerocallidaceae	*Dianella revoluta*	Blueberry Lily	Yes
Hemerocallidaceae	*Tricoryne elatior*		Yes
Iridaceae	*Patersonia occidentalis*	Purple Flag	Yes
Juncaceae	*Juncus subsecundus*	Finger Rush	Yes
Myrtaceae	*Calothamnus quadrifidus*	One-sided Bottlebrush	Yes
Myrtaceae	*Corymbia calophylla*	Marri	Yes
Myrtaceae	*Eucalyptus gomphocephala*	Tuart	Yes
Myrtaceae	*Eucalyptus marginata*		Yes
Myrtaceae	*Eucalyptus rudis*	Flooded Gum	Yes
Myrtaceae	*Eucalyptus todtiana*	Pricklybark	No
Myrtaceae	*Kunzea glabrescens*	Spearwood	Yes
Myrtaceae	*Leptospermum erubescens*	Roadside Teatree	Yes
Myrtaceae	*Melaleuca lateritia*	Robin Redbreast Bush	Yes
Myrtaceae	*Melaleuca rhaphiophylla*	Swamp Paperbark	Yes
Myrtaceae	*Melaleuca teretifolia*	Banbar	Yes
Myrtaceae	*Myrtaceae* sp. (no diagnostic features due to young growth stage)		No
Orchidaceae	*Microtis media*	Tall Mignonette Orchid	No
Orchidaceae	*Thelymitra* sp.		No
Phyllanthaceae	*Lysiandra calycina*	False Boronia	Yes
Poaceae	*Austrostipa flavescens*		Yes
Poaceae	*Microlaena stipoides*	Weeping Grass	Yes
Proteaceae	*Banksia attenuata*	Slender Banksia	Yes
Proteaceae	*Banksia grandis*	Bull Banksia	Yes
Proteaceae	*Banksia ilicifolia*	Holly-leaved Banksia	Yes
Proteaceae	*Banksia littoralis*	Swamp Banksia	Yes
Proteaceae	*Banksia menziesii*	Firewood Banksia	Yes

Family	Species	Common Name	Revegetation List
Proteaceae	*Banksia sessilis*	Parrot Bush	Yes
Proteaceae	*Hakea lissocarpha*	Honey Bush	Yes
Proteaceae	*Hakea prostrata*	Harsh Hakea	Yes
Proteaceae	*Hakea ruscifolia*	Candle Hakea	Yes
Proteaceae	*Hakea trifurcata*	Two-leaf Hakea	Yes
Proteaceae	*Hakea varia*	Variable-leaved Hakea	Yes
Proteaceae	*Stirlingia latifolia*	Blueboy	Yes
Restionaceae	*Desmocladus flexuosus*		Yes
Rhamnaceae	*Spyridium globulosum*	Basket Bush	Yes
Scrophulariaceae	*Myoporum caprarioides*	Slender Myoporum	Yes

Appendix 2 – Quadrat Photo Compile

Quadrat		Photo 2021	Photo 2022
1	a		
	b		

Quadrat	Photo 2021	Photo 2022
c		
2 a		

Quadrat	Photo 2021	Photo 2022
b		
c		

Quadrat	Photo 2021	Photo 2022
3 a	 (Same photo as R3c)	
3 b		

Quadrat	Photo 2021	Photo 2022
c	 (Same photo as R3a)	
4 a		

Quadrat	Photo 2021	Photo 2022
b		
c		

Quadrat	Photo 2021	Photo 2022
5 a		
5 b		

Quadrat	Photo 2021	Photo 2022
c		
6 a		

Quadrat	Photo 2021	Photo 2022
b		
c		

Quadrat	Photo 2021	Photo 2022
7 a		
7 b		

Quadrat	Photo 2021	Photo 2022
C		

Appendix 3 – Quadrat Data

Quadrat No.:	R1a
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	388240
Northing:	6422250
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown sand
Gravel:	0
Rock:	0
Leaf Litter:	0
Bare Ground:	95%
Drainage:	Well draining
Condition:	Good

Notes: Fallen branch on SW stake

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Acacia huegelii	1		0.1	0.3	**Bromus diandrus*	0.1	0.2
Acacia stenoptera	2		0.1	0.3	**Crassula alata*	0.1	0.1
Austrostipa flavescens	3		0.5	0.3	**Erigeron sumatrensis*	0.1	0.2
Bossiaea eriocarpa		1	0.1	0.2	**Erodium botrys*	0.1	0.1
Calothamnus quadrifidus	6	1	0.5	0.2	**Oenothera stricta*	0.5	0.3
Corymbia calophylla		2	15.0	10.0	**Rumex acetosella*	0.1	0.2
Eucalyptus rudis	4		45.0	10.0			
Ficinia nodosa	3		0.5	0.4			
Hakea varia	1		0.1	0.5			
Jacksonia furcellata	2		1.0	0.5			
Lepidosperma longitudinale		5	0.5	0.2			
Leptospermum erubescens	1		0.1	0.2			
Microtis media	1		0.1	0.4			
Patersonia occidentalis	1		0.1	0.3			

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Senecio pinnatifolius			0.1	0.3			

Note: * denotes introduced species

Quadrat No.:	**R1b**
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	388220
Northing:	6422380
Location:	Tamworth Hill Swamp
Topography:	Mid slope
Aspect:	West
Slope:	0-1%
Soil:	Grey sand
Gravel:	0
Rock:	0
Leaf Litter:	40%
Bare Ground:	3%
Drainage:	Well draining
Condition:	Fair

Notes: Germination of *Melaleuca* spp. Evidence of grazing.

Native Species	**No. Alive**	**No. Dead**	**Cover (%)**	**Height (m)**	**Weed Species**	**Cover (%)**	**Height (m)**
Acacia pulchella	3		0.1	0.2	**Ehrharta calycina*	0.1	0.3
Acacia saligna	7		40.0	4.0	**Erodium botrys*	0.1	0.1
Anigozanthos manglesii	1		0.1	0.2	**Vulpia myuros*	0.1	0.2
Banksia sessilis	1	1	0.1	0.2			
Calothamnus quadrifidus		1	0.1	0.2			
Conostylis juncea	1		0.1	0.2			
Dasypogon bromeliifolius	1		0.1	0.1			
Eucalyptus marginata	4		7.0	3.0			
Ficinia nodosa	1		0.1	0.4			
Hakea prostrata	2		5.0	0.5			
Hakea varia	3		5.0	1.0			
Kunzea glabrescens	3		10.0	3.0			
Lepidosperma longitudinale		4	0.1	0.2			
Melaleuca lateritia	20		0.1	0.1			
Microlaena stipoides	1		0.1	0.2			

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Sowerbaea laxiflora	1		0.1	0.2			

Note: * denotes introduced species

Quadrat No.:	**R1c**
Survey Date:	24/10/2022
Personnel:	SNH GG
Easting:	388190
Northing:	6422510
Location:	Tamworth Hill Swamp
Topography:	Mid slope
Aspect:	West
Slope:	1-3%
Soil:	Grey sand
Gravel:	0
Rock:	0
Leaf Litter:	95%
Bare Ground:	0
Drainage:	Well draining
Condition:	Fair

Native Species	**No. Alive**	**No. Dead**	**Cover (%)**	**Height (m)**	**Weed Species**	**Cover (%)**	**Height (m)**
Acacia pulchella		2	0.1	0.1	**Ehrharta calycina*	0.2	0.4
Acacia saligna	3		70.0	4.0			
Allocasuarina fraseriana		2	0.1	0.2			
Banksia sessilis		1	0.1	0.2			
Conostylis aculeata		4	0.1	0.2			
Corymbia calophylla	4		15.0	5.0			
Hakea prostrata	1		2.0	0.5			
Hakea varia	3		10.0	3.0			
Lomandra caespitosa	3		0.1	0.3			
Microtis media	1		0.1	0.1			
Tricoryne elatior	1		0.1	0.3			

Note: * denotes introduced species

Quadrat No.:	R2a
Survey Date:	24/10/2022
Personnel:	SNH GG
Easting:	387990
Northing:	6422600
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown loamy sand
Gravel:	0
Rock:	0
Leaf Litter:	60%
Bare Ground:	2%
Drainage:	Well draining
Condition:	Good

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Banksia menziesii	2		3.0	0.5	**Erigeron sumatrensis*	0.1	0.2
Calothamnus quadrifidus	2		2.0	1.0	**Oenothera drummondii*	0.1	0.2
Corymbia calophylla	1		15.0	8.0	**Rumex acetosella*	0.1	0.2
Eucalyptus marginata		3	2.0	4.0			
Eucalyptus rudis	3		15.0	7.0			
Ficinia nodosa	1		0.1	0.3			
Hakea prostrata	5	1	30.0	2.0			
Hakea varia	2		1.0	1.0			
Lepidosperma longitudinale	3	1	0.1	0.3			
Leptospermum erubescens	1		0.1	0.2			
Lysiandra calycina	1		0.5	0.5			
Patersonia occidentalis	1		0.1	0.1			
Spyridium globulosum	1		0.1	0.1			
Thysanotus multiflorus	1		0.1	0.2			

Note: * denotes introduced species

Quadrat No.:	**R2b**
Survey Date:	24/10/2022
Personnel:	SNH GG
Easting:	388080
Northing:	6422660
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Black/brown loam
Gravel:	0
Rock:	0
Leaf Litter:	95%
Bare Ground:	0
Drainage:	Well draining
Condition:	Good

Native Species	**No. Alive**	**No. Dead**	**Cover (%)**	**Height (m)**	**Weed Species**	**Cover (%)**	**Height (m)**
Centella asiatica	50		3.0	0.1	**Cenchrus clandestinus*	0.1	0.2
Eucalyptus rudis	12		100.0	15.0	**Erigeron sumatrensis*	0.1	0.2
Gahnia trifida	3		5.0	1.5	**Ficus carica*	6.0	3.0
Lobelia anceps	2		0.5	0.1	**Phyla nodiflora*	0.1	0.2
Melaleuca lateritia	5		20.0	2.5			
Melaleuca teretifolia	18	4	30.0	2.5			

Note: * denotes introduced species

Quadrat No.:	**R2c**
Survey Date:	24/10/2022
Personnel:	SNH GG
Easting:	388050
Northing:	6422830
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown sand
Gravel:	0
Rock:	0
Leaf Litter:	50%
Bare Ground:	5%
Drainage:	Well draining
Condition:	Good

Notes: All mature plants with no guards, SE and SW stakes not present

Native Species	**No. Alive**	**No. Dead**	**Cover (%)**	**Height (m)**	**Weed Species**	**Cover (%)**	**Height (m)**
Allocasuarina fraseriana	3		2.0	3.0	**Bromus diandrus*	0.1	0.3
Banksia attenuata	1		1.0	3.0	**Erigeron sumatrensis*	0.1	0.1
Banksia sessilis	1		2.0	3.0	**Rumex acetosella*	0.5	0.2
Corymbia calophylla			20.0	9.0	**Stellaria media*	0.1	0.1
Hakea prostrata	3		7.0	0.5	**Vulpia myuros*	0.1	0.2
Hakea ruscifolia	2		7.0	3.0			
Hakea trifurcata	1	1	20.0	4.0			
Hardenbergia comptoniana	6		2.0	2.0			
Isolepis marginata			0.1	0.1			
Microtis media	1		0.1	0.2			

Note: * denotes introduced species

Quadrat No.:	**R3a**
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	387550
Northing:	6422460
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown sand
Gravel:	0
Rock:	0
Leaf Litter:	99%
Bare Ground:	0
Drainage:	Well draining
Condition:	Fair

Native Species	**No. Alive**	**No. Dead**	**Cover (%)**	**Height (m)**	**Weed Species**	**Cover (%)**	**Height (m)**
Acacia huegelii		1	0.1		**Ehrharta longiflora*	0.1	0.2
Acacia pulchella		1	0.1		**Trifolium campestre*	0.1	0.1
Acacia saligna	6	1	80.0	8.0			
Acacia stenoptera		1	0.1				
Banksia grandis	5		1.0	2.0			
Banksia menziesii	1		0.1	0.3			
Banksia sessilis		1	0.5				
Calothamnus quadrifidus	1		0.1	0.2			
Dianella revoluta	3		0.1	0.3			
Eucalyptus gomphocephala	1		7.0	8.0			
Eucalyptus rudis	1		2.0	7.0			
Eucalyptus todtiana	1		2.0	6.0			
Hakea prostrata	1	1	1.0	0.5			
Hakea ruscifolia	2	2	0.1	3.0			
Hakea trifurcata		3	0.1				

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Hakea varia	5	3	2.0	1.0			
Jacksonia furcellata	1	3	1.0	3.0			
Kennedia prostrata	2	2	0.1	0.2			
Leptospermum erubescens	1		0.1	0.2			
Melaleuca rhaphiophylla	1		2.0	2.0			
Melaleuca teretifolia	1		1.0	1.5			
Microlaena stipoides		1	0.1				
Patersonia occidentalis	11	4	0.5	3.0			
Spyridium globulosum	3		5.0	3.0			

Note: * denotes introduced species

Quadrat No.:	**R3b**
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	387700
Northing:	6422270
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown sand
Gravel:	0
Rock:	0
Leaf Litter:	50%
Bare Ground:	1%
Drainage:	Well draining
Condition:	Fair

Notes: Recent chemical weed control

Native Species	**No. Alive**	**No. Dead**	**Cover (%)**	**Height (m)**	**Weed Species**	**Cover (%)**	**Height (m)**
Acacia pulchella var. *goadbyi*	1		0.1	0.3	*Ehrharta calycina	0.1	0.2
Banksia grandis	4		3.0	2.0	*Ehrharta longiflora	0.1	0.2
Banksia sessilis		1	0.1		*Erigeron bonariensis	0.1	0.1
Calothamnus quadrifidus	4		0.5	0.2	*Sonchus oleraceus	0.1	0.1
Corymbia calophylla	1		2.0	3.0			
Eucalyptus gomphocephala	2		10.0	6.0			
Eucalyptus rudis	2		7.0	6.0			
Eucalyptus todtiana	1		2.0	4.0			
Hakea trifurcata	4	1	7.0	1.5			
Jacksonia furcellata	3		3.0	2.5			
Lomandra caespitosa	1	2	0.1	0.2			
Melaleuca teretifolia	2		2.0	1.0			
Microlaena stipoides	1		0.1	0.3			
Patersonia occidentalis		1	0.1				
Spyridium globulosum	3	1	3.0	2.0			

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Stirlingia latifolia		1	0.1				

Note: * denotes introduced species

Quadrat No.:	R3c
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	388040
Northing:	6422000
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Grey/brown sand
Gravel:	0
Rock:	0
Leaf Litter:	95%
Bare Ground:	1%
Drainage:	Well draining
Condition:	Good

Notes: All mature revegetation, no tree guards

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Acacia pulchella	1	4	1.0	1.0	**Ehrharta calycina*	0.1	0.3
Acacia saligna	1		2.0	2.5			
Allocasuarina fraseriana	1		0.1	0.3			
Banksia grandis	2		1.0	2.0			
Banksia littoralis	1		1.0	1.0			
Banksia menziesii	1		1.0	1.0			
Banksia sessilis	1		0.1	0.3			
Corymbia calophylla	7		25.0	6.0			
Gahnia trifida	5	1	2.0	1.0			
Hakea prostrata	8		20.0	3.0			
Jacksonia furcellata	5		15.0	3.0			
Melaleuca rhaphiophylla	1		1.0	1.0			
Melaleuca teretifolia	2		2.0	1.5			
Spyridium globulosum	1		1.0	1.0			

Note: * denotes introduced species

Quadrat No.:	R4a
Survey Date:	24/10/2022
Personnel:	SNH GG
Easting:	387990
Northing:	6423210
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown loamy sand
Gravel:	0
Rock:	0
Leaf Litter:	40%
Bare Ground:	10%
Drainage:	Well draining
Condition:	Fair

Notes: Recent chemical weed control

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Acacia huegelii	2		0.1	0.3	**Avena barbata*	0.1	0.5
Acacia lasiocarpa		1	0.1		**Bromus diandrus*	0.5	0.3
Acacia pulchella		1	0.1		**Crassula alata*	2.0	0.1
Acacia saligna	1		0.5	1.0	**Crassula glomerata*	0.1	0.1
Acacia stenoptera		1	0.1		**Ehrharta longiflora*	0.1	0.3
Anigozanthos manglesii	2		0.1	0.2	**Epilobium ciliatum*	0.5	0.2
Calothamnus quadrifidus	1		0.1	0.2	**Erigeron bonariensis*	0.1	0.3
Conostylis aculeata	2		0.1	0.2	**Erodium botrys*	0.1	0.1
Corymbia calophylla			60.0	9.0	**Euphorbia maculata*	0.1	0.1
Dasypogon bromeliifolius		2	0.1		**Hypochaeris radicata*	0.1	0.1
Hakea lissocarpha	2		0.1	0.3	**Lolium rigidum*	0.1	0.3
Hakea prostrata	1		0.1	0.2	**Lotus subbiflorus*	0.5	0.1
Jacksonia furcellata	1		0.5	1.0	**Lupinus cosentinii*	0.1	0.1
Kennedia prostrata	2		0.1		**Oenothera drummondii*	0.1	0.1

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Lomandra sp.	1		0.1	0.4	**Solanum nigrum*	0.1	0.2
Lysiandra calycina	2		0.5	0.3			
Melaleuca lateritia	1		0.1	0.2			
Melaleuca rhaphiophylla			2.0	1.5			
Melaleuca teretifolia	1		1.0	0.8			
Microlaena stipoides	1		0.1	0.2			
Patersonia occidentalis		4	0.1				
Spyridium globulosum	1	2	0.1	0.3			
Stirlingia latifolia	1	1	0.1	0.2			

Note: * denotes introduced species

Quadrat No.:	R4b
Survey Date:	24/10/2022
Personnel:	SNH GG
Easting:	387980
Northing:	6423300
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown sandy loam
Gravel:	0
Rock:	0
Leaf Litter:	90%
Bare Ground:	1%
Drainage:	Well draining
Condition:	Good

Notes: Recent chemical weed control

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Acacia lasiocarpa	2		0.1	0.4	**Epilobium ciliatum*	0.1	0.2
Acacia saligna			70.0	7.0	**Erodium botrys*	0.1	0.2
Acacia stenoptera		1	0.1		**Lolium rigidum*	0.1	0.3
Anigozanthos manglesii		1	0.1		**Lotus subbiflorus*	0.1	0.2
Banksia sessilis		1	0.1		**Oenothera drummondii*	0.5	0.2
Calothamnus quadrifidus	1	1	0.1	0.2	**Rumex acetosella*	0.1	0.1
Dasypogon bromeliifolius		2	0.1				
Ficinia nodosa	1		0.1	0.2			
Gahnia trifida			0.1	0.4			
Hakea varia			2.0	1.0			
Jacksonia furcellata	1		0.5	0.5			
Juncus subsecundus	1		0.1	0.5			
Kunzea glabrescens			2.0	4.0			
Lepidosperma longitudinale	1		0.1	0.3			

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Machaerina preissii	1		0.1	0.5			
Melaleuca lateritia			1.0	1.0			
Melaleuca rhaphiophylla			2.0	1.5			
Microlaena stipoides	1		0.1	0.3			
Patersonia occidentalis		2	0.1				
Spyridium globulosum		2	0.1				
Thysanotus multiflorus	7	1	0.1	0.2			

Note: * denotes introduced species

Quadrat No.:	R4c
Survey Date:	24/10/2022
Personnel:	SNH GG
Easting:	387920
Northing:	6423330
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown loamy sand
Gravel:	0
Rock:	0
Leaf Litter:	20%
Bare Ground:	10%
Drainage:	Well draining
Condition:	Fair

Notes: Recent chemical weed control, NW stake covered by fallen branch

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Acacia pulchella	1		0.1	0.3	**Arctotheca calendula*	0.1	0.1
Acacia saligna			7.0	5.0	**Bromus diandrus*	0.1	0.3
Banksia attenuata			0.1	1.0	**Crassula glomerata*	0.1	0.1
Banksia grandis			1.0	2.5	**Ehrharta calycina*	0.1	0.3
Banksia ilicifolia			0.1	0.5	**Ehrharta longiflora*	0.0	0.1
Conostylis juncea	1		0.1	1.0	**Epilobium ciliatum*	0.1	0.2
Corymbia calophylla			10.0	8.0	**Fumaria capreolata*	15.0	1.5
Desmocladus flexuosus	1		0.1	0.1	**Galium murale*	0.1	0.1
Ficinia nodosa	1		0.1	3.0	**Hypochaeris radicata*	0.1	0.1
Hakea prostrata	1		0.1	0.2	**Lolium rigidum*	0.1	0.2
Hakea ruscifolia			2.0	1.0	**Lotus subbiflorus*	0.5	0.1
Jacksonia furcellata	2	1	0.1	0.5	**Monopsis debilis*	0.1	0.1
Jacksonia sternbergiana			30.0	1.5	**Oenothera drummondii*	1.0	0.2
Kunzea glabrescens			5.0	4.0	**Ornithopus compressus*	0.1	0.3

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Melaleuca lateritia	6		3.0	0.2	**Rumex acetosella*	0.5	0.1
Melaleuca rhaphiophylla			1.0	1.0	**Solanum nigrum*	0.1	0.1
Patersonia occidentalis	2		0.1	0.2	**Sonchus oleraceus*	0.1	0.1
Senecio pinnatifolius			0.1	0.1	**Symphyotrichum squamatum*	0.1	0.4
Thelymitra sp.			0.1	0.1	**Vulpia myuros*	0.1	0.2

Note: * denotes introduced species

Quadrat No.:	**R5a**
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	387920
Northing:	6422050
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown sand
Gravel:	0
Rock:	0
Leaf Litter:	60%
Bare Ground:	2%
Drainage:	Well draining
Condition:	Good

Notes: Mostly mature revegetation with some recent tubestock with guards

Native Species	**No. Alive**	**No. Dead**	**Cover (%)**	**Height (m)**	**Weed Species**	**Cover (%)**	**Height (m)**
Acacia saligna	2		15.0	4.0	**Ehrharta calycina*	0.5	0.3
Banksia menziesii	2		1.0	1.5	**Erigeron bonariensis*	0.1	0.3
Corymbia calophylla	7		30.0	6.0	**Lolium rigidum*	0.1	0.3
Hakea lissocarpha	1		0.5	0.3			
Hakea prostrata	3		2.0	1.5			
Hakea trifurcata	8		7.0	2.0			
Jacksonia furcellata	3	1	5.0	2.0			
Patersonia occidentalis		1	0.1				
Spyridium globulosum		1	0.1				
Stirlingia latifolia		1	0.1				

Note: * denotes introduced species

Quadrat No.:	**R5b**
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	387960
Northing:	6422080
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown sand
Gravel:	0
Rock:	0
Leaf Litter:	0
Bare Ground:	10%
Drainage:	Well draining
Condition:	Poor

Notes: Recent chemical weed control, mostly dead *Crassula* sp.

Native Species	**No. Alive**	**No. Dead**	**Cover (%)**	**Height (m)**	**Weed Species**	**Cover (%)**	**Height (m)**
Acacia drummondii	3		0.1	0.2	**Erigeron bonariensis*	0.1	0.1
Acacia huegelii	1		0.1	0.2	**Oenothera drummondii*	0.1	0.1
Acacia pulchella		1	0.1	0.2			
Anigozanthos manglesii	2		0.1	0.3			
Austrostipa flavescens		1	0.1	0.2			
Banksia sessilis	4		0.5	0.3			
Bossiaea eriocarpa	2		0.1	0.3			
Calothamnus quadrifidus	4		0.5	0.2			
Conostylis aculeata	4		0.5	0.3			
Conostylis juncea	1		0.1	0.2			
Gompholobium tomentosum	1		0.1	0.2			
Hakea lissocarpha	2	1	0.1	0.3			
Hakea varia	1		0.1	0.3			
Jacksonia furcellata	2		0.1	0.3			
Lomandra caespitosa	4		0.5	0.2			

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Microlaena stipoides	1		0.1	0.3			
Myoporum caprarioides	2		0.2	0.3			
Patersonia occidentalis		16	0.5	0.2			
Spyridium globulosum		1	0.1	0.2			
Stirlingia latifolia		5	0.1	0.1			

Note: * denotes introduced species

Quadrat No.:	**R5c**
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	387990
Northing:	6422050
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown sand
Gravel:	0
Rock:	0
Leaf Litter:	7%
Bare Ground:	2%
Drainage:	Well draining
Condition:	Good

Notes: Recent chemical weed control

Native Species	**No. Alive**	**No. Dead**	**Cover (%)**	**Height (m)**	**Weed Species**	**Cover (%)**	**Height (m)**
Acacia lasiocarpa	1		0.1	0.3	**Ehrharta calycina*	2.0	0.5
Acacia stenoptera		2	0.1		**Erigeron bonariensis*	0.5	0.1
Allocasuarina fraseriana	1		0.1	0.2	**Oenothera drummondii*	0.5	0.1
Banksia ilicifolia	2		2.0	1.5			
Corymbia calophylla			2.0	2.0			
Hakea prostrata	5		10.0	2.0			
Jacksonia furcellata	3	5	10.0	3.0			
Patersonia occidentalis		1	0.1				
Spyridium globulosum	2	1	0.5	0.3			
Tricoryne elatior		1	0.1				

Note: * denotes introduced species

Quadrat No.:	**R6a**
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	388100
Northing:	6422090
Location:	Tamworth Hill Swamp
Topography:	Mid slope
Aspect:	West
Slope:	0-1%
Soil:	Grey/brown sand
Gravel:	0
Rock:	0
Leaf Litter:	40%
Bare Ground:	1%
Drainage:	Well draining
Condition:	Good

Notes: Recent chemical weed control.

Native Species	**No. Alive**	**No. Dead**	**Cover (%)**	**Height (m)**	**Weed Species**	**Cover (%)**	**Height (m)**
Corymbia calophylla	1		3.0	5.0	**Ehrharta calycina*	10.0	1.0
Hakea prostrata	10		20.0	1.5	**Erodium botrys*	0.1	0.1
Hakea ruscifolia	7		5.0	0.5	**Lolium rigidum*	0.1	0.2
Hakea trifurcata	1		1.0	0.5	**Lupinus cosentinii*	0.1	0.3
Leptospermum erubescens	2		0.1	0.2	**Oenothera drummondii*	2.0	0.2
Patersonia occidentalis	2		0.1	0.2	**Oenothera stricta*	0.1	0.2

Note: * denotes introduced species

Quadrat No.:	R6b
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	388130
Northing:	6422150
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Grey/brown sand
Gravel:	0
Rock:	0
Leaf Litter:	50%
Bare Ground:	10%
Drainage:	Well draining
Condition:	Good

Notes: Only mature revegetation. NW not present.

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Acacia saligna	1		2.0	2.5	**Avena barbata*	0.1	0.4
Banksia grandis	1		2.0	1.0	**Ehrharta calycina*	0.1	0.3
Banksia littoralis	1		1.0	1.5	**Lolium rigidum*	0.1	0.2
Banksia sessilis	2		5.0	0.5			
Corymbia calophylla	4		10.0	4.0			
Eucalyptus rudis	6		30.0	5.0			
Hakea prostrata	1		10.0	0.5			
Hakea ruscifolia	3		2.0	2.0			
Hakea trifurcata	2		0.5	0.5			
Hakea varia	8		50.0	3.0			
Jacksonia furcellata	1		1.0	0.5			

Note: * denotes introduced species

Quadrat No.:	R6c
Survey Date:	25/10/2022
Personnel:	SNH GG
Easting:	388170
Northing:	6422190
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown loamy sand
Gravel:	0
Rock:	0
Leaf Litter:	95%
Bare Ground:	0
Drainage:	Well draining
Condition:	Good

Notes: Only mature revegetation. Plastic guards still surrounding trees and shrubs.

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Banksia grandis	1		0.5	1.0	**Bromus diandrus*	0.1	0.3
Banksia littoralis	5		3.0	2.0	**Fumaria capreolata*	0.5	0.5
Corymbia calophylla	3	1	5.0	4.0	**Lolium rigidum*	0.1	0.3
Eucalyptus rudis	21		80.0	7.0			
Hakea prostrata	5	3	10.0	2.5			
Hakea trifurcata	7	1	10.0	2.0			
Hakea varia	4		2.0	1.5			
Jacksonia furcellata	1	5	1.0	1.5			

Note: * denotes introduced species

Quadrat No.:	R7a
Survey Date:	24/10/2022
Personnel:	SNH GG
Easting:	388010
Northing:	6422870
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown sand
Gravel:	0
Rock:	0
Leaf Litter:	30%
Bare Ground:	30%
Drainage:	Well draining
Condition:	Good

Notes: Only NW stake present.

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Acacia pulchella		1	0.1		**Crassula alata*	0.1	0.1
Allocasuarina fraseriana		1	0.1		**Erigeron sumatrensis*	0.1	0.3
Banksia menziesii	2		2.0	2.0	**Oenothera drummondii*	0.5	0.2
Banksia sessilis	2		5.0	1.0	**Trifolium campestre*	0.1	0.1
Corymbia calophylla	6		7.0	5.0	**Vulpia myuros*	0.1	0.3
Eucalyptus rudis	1		5.0	5.0			
Hakea prostrata	2		8.0	2.0			
Hakea ruscifolia		1	0.1				
Jacksonia furcellata	1	1	2.0	2.0			
Melaleuca rhaphiophylla	4		1.0	1.0			
Patersonia occidentalis		4	0.1				
Spyridium globulosum		1	0.1				

Note: * denotes introduced species

Quadrat No.:	R7b
Survey Date:	24/10/2022
Personnel:	SNH GG
Easting:	388020
Northing:	6423000
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown loamy sand
Gravel:	0
Rock:	0
Leaf Litter:	95%
Bare Ground:	0.5%
Drainage:	Well draining
Condition:	Fair

Notes: Recent chemical weed control.

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Acacia pulchella	2	1	0.1	0.3	**Crassula alata*	0.1	0.1
Banksia sessilis		2	0.1		**Ehrharta calycina*	0.1	0.2
Calothamnus quadrifidus		1	0.1		**Epilobium ciliatum*	0.1	0.2
Dasypogon bromeliifolius	1	1	0.1	0.2	**Erigeron bonariensis*	0.1	0.2
Desmocladus flexuosus		1	0.1		**Euphorbia terracina*	0.1	0.2
Dianella revoluta	1		0.1	0.2	**Lolium rigidum*	0.1	0.2
Eucalyptus rudis			70.0	15.0	**Lysimachia arvensis*	0.5	0.1
Ficinia nodosa	2		0.1	0.3	**Solanum nigrum*	2.0	0.5
Hakea prostrata	2		5.0	2.0	**Trifolium campestre*	0.1	0.1
Hakea varia	1		0.1	0.2			
Isolepis marginata			0.1	0.1			
Jacksonia furcellata	3		1.0	1.0			
Microlaena stipoides	1		0.1	0.2			
Myoporum caprarioides	1		0.1	0.3			
Myrtaceae sp. (no diagnostic			0.1	0.3			

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
features due to young growth stage)							
Patersonia occidentalis	2	2	0.1	0.3			
Spyridium globulosum	1		0.1	0.4			
Stirlingia latifolia		2	0.1				
Thysanotus multiflorus	1		0.1	0.2			

Note: * denotes introduced species

Quadrat No.:	R7c
Survey Date:	24/10/2022
Personnel:	SNH GG
Easting:	388030
Northing:	6423050
Location:	Tamworth Hill Swamp
Topography:	Flat
Aspect:	-
Slope:	-
Soil:	Brown sand
Gravel:	0
Rock:	0
Leaf Litter:	30%
Bare Ground:	5%
Drainage:	Well draining
Condition:	Good

Notes: Recent chemical weed control.

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Acacia huegelii	1	2	0.1	0.2	**Avena barbata*	0.1	0.3
Acacia pulchella	1	1	0.1	0.2	**Carpobrotus edulis*	0.1	0.2
Acacia saligna	1		15.0	4.0	**Ehrharta longiflora*	0.1	0.2
Acacia stenoptera		1	0.1		**Lotus subbiflorus*	0.1	0.1
Banksia menziesii	3		5.0	1.5	**Oenothera drummondii*	0.5	0.1
Banksia sessilis	2	1	0.1	0.2	**Stellaria media*	0.5	0.1
Calothamnus quadrifidus	1	1	0.1	0.2	**Trifolium campestre*	0.1	0.1
Conostylis aculeata	2		0.1	3.0			
Corymbia calophylla	1		7.0	6.0			
Dasypogon bromeliifolius	2	1	0.1	0.2			
Desmocladus flexuosus		1	0.1				
Ficinia nodosa	6		0.5	0.4			
Hakea prostrata	2		0.1	0.3			
Hakea trifurcata	1		5.0	3.0			
Isolepis marginata			0.1	0.1			

Native Species	No. Alive	No. Dead	Cover (%)	Height (m)	Weed Species	Cover (%)	Height (m)
Jacksonia furcellata	4	1	3.0	1.5			
Microlaena stipoides	1	1	0.1	0.3			
Patersonia occidentalis	6	6	0.1	33.0			
Spyridium globulosum	2		0.1	0.5			
Stirlingia latifolia		3	0.1				
Tricoryne elatior	1		0.1	0.1			

Note: * denotes introduced species