Department of Transport and Main Roads

October 2024

Lowland Rainforest TEC Monitoring Report Kawana and Woondum Offset Areas 2024

Cooroy to Curra Stage D

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Lowland Rainforest TEC Monitoring Report Kawana and Woondum Offset Areas 2024 Cooroy to Curra Stage D

Department of Transport and Main Roads

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1 Introduction and purpose

The Department of Transport and Main Roads (TMR) is completing the construction on a section of the existing Bruce Highway, including a bypass to the east of Gympie (completion due end of 2024). This package of works is termed the Bruce Highway Cooroy to Curra Section D Project (the Project). The Project construction area extends for approximately 30 km and includes the acquisition of a project corridor to accommodate a four-lane divided carriageway.

TMR received conditions of approval (EPBC 2017/7941) for the Project from the Commonwealth Department of Agriculture, Water and Environment (DAWE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC approval conditions require the delivery of specific environmental offsets for direct and indirect impacts to the Lowland Rainforest of Subtropical Australia Threatened Ecological Community (Lowland Rainforest TEC) resulting from the Project.

To maintain compliance with the EPBC Act approval conditions, TMR is required to establish, manage, and monitor two project-related environmental offset areas, at Kawana and Woondum, containing the Lowland Rainforest TEC. BioCondition plots were established in 2020 to determine a baseline condition for the Lowland Rainforest TEC offsets in accordance with this approval. Monitoring has since been undertaken in both 2020, 2022 and now 2024.

The purpose of this report is to assess the current ecological condition of each offset area located at Kawana and Woondum and compare the 2024 data and progression of the Lowland Rainforest TEC offsets against the 2020 baseline and 2022 monitoring data, and against the BioCondition benchmarks for the relevant Regional Ecosystems (REs).

This report communicates to TMR, the results of the 2024 monitoring and provides recommendations to improve the ecological condition at the Kawana and Woondum offset areas. Specifically, this report provides details regarding the field survey methods, results, and discussion on the following elements for the monitored TECs, in accordance with the requirements of the baseline and monitoring survey program as prescribed by the Project Environmental Offsets Strategy (GHD 2019).

- The results of monitoring at each monitoring site in accordance with the BioCondition methodology (Eyre et al 2015) and the 'Modified Qld Habitat Quality Guide (DAWE)'.
- Species richness collected at each site including discussion on the number of species recorded across each offset area in relation to Appendix A of the Threatened Species Scientific Committee (TSSC) (2011) Commonwealth Listing Advice on Lowland Rainforest of Subtropical Australia.
- Qualitative observations and photo monitoring points of evidence of past and current land use and degradation (including cleared areas, evidence of disturbance, erosion, rubbish, access track etc.).
- Conclusions and recommendations.
- Details of the suitably qualified person (SQP) leading the surveys.

The 2020 and 2022 monitoring events also involved the monitoring of buffer zones adjacent to the mapped areas of Lowland Rainforest TEC, which included mapping of vegetation communities, detecting weed presence, and identifying sites for targeted natural regeneration. Noting the buffer zone monitoring was not completed in 2024, as it is programmed to occur every second biennial monitoring event (i.e. every four years) and is due for reassessment in 2026. Nonetheless, general commentary on buffer zone management and rehabilitation is provided herein.

2 Methods

In accordance with approval conditions, the monitoring was led by a suitably qualified person (refer CV Appendix A) and was undertaken from 20 – 24 May 2024.

The 2024 Lowland Rainforest TEC BioCondition monitoring was undertaken in accordance with the following methods:

- *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland method* (Eyre et al, 2015) (refer section Eyre et. al., 2015).
- *Guide to determining terrestrial habitat quality A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy* (the Guide) (DES 2020).
- Results of the field surveys were analysed using a combination of the BioCondition method and the *Modified QLD Habitat Quality spreadsheet – templat*e (DAWE 2019) (refer Section 2.2).

2.1 BioCondition monitoring and species richness

The BioCondition monitoring was conducted at four previously established monitoring transects including two transects in each offset area, as listed in Table 2.1 and depicted on Figure 2.2 for Kawana and Figure 2.3 for Woondum. Each BioCondition monitoring transect occupies a 100 m x 50 m (0.5 ha) area within which 13 site-based ecological condition indicators are measured.

Table 2.1 Lowland rainforest TEC BioCondition monitoring locations (MGA Zone 56)

Offset site	BioCondition site	GPS start	GPS centre	GPS end
Kawana	KBC1	510473 E 7041760 N	510515 E 7041742 N	510568 E 7041723 N
Kawana	KBC2	510339 E 7041471 N	510390 E 7041488 N	510428 E 7041503 N
Woondum	WBC1	471367 E 7096624 N	471296 E 7096558 N	471332 E 7096596 N
Woondum	WBC2	471223 E 7096498 N	471262 E 7096498 N	471308 E 7096509 N

The method for collecting monitoring data for the 13 site-based ecological condition indicators is summarised as follows:

- 100 x 50 m area:
  - number of large trees
  - recruitment of canopy species
  - tree canopy height
  - native tree species richness
- along 100 m transect centreline:
  - native tree canopy cover
  - native shrub canopy cover
- 50 x 10 m sub-transect, centred from the 25 m point to the 75 m point along the centre transect, and encompassing 5 m either side of the transect:
  - non-native plant cover
  - plant species richness of shrubs
  - plant species richness of grass

- plant species richness of forbs and others

- 50 x 20 m sub-transect, centred from the 25 m point to the 75 m point along the transect, and encompassing 10 m either side of the transect:
  - coarse woody debris
- five 1 x 1 m quadrats, starting at the 35 m point and located on alternate sides of the centreline, 10 m apart along the 100 m transect, with an average value derived the five 1 x 1 m quadrats:
  - native grass cover
  - organic litter.

In addition to the 13 site-based ecological condition indicators collected, four directional photos (N, E, S and W) were taken from at the beginning, mid-point and end of each monitoring plot, totalling 12 photos per monitoring transect.

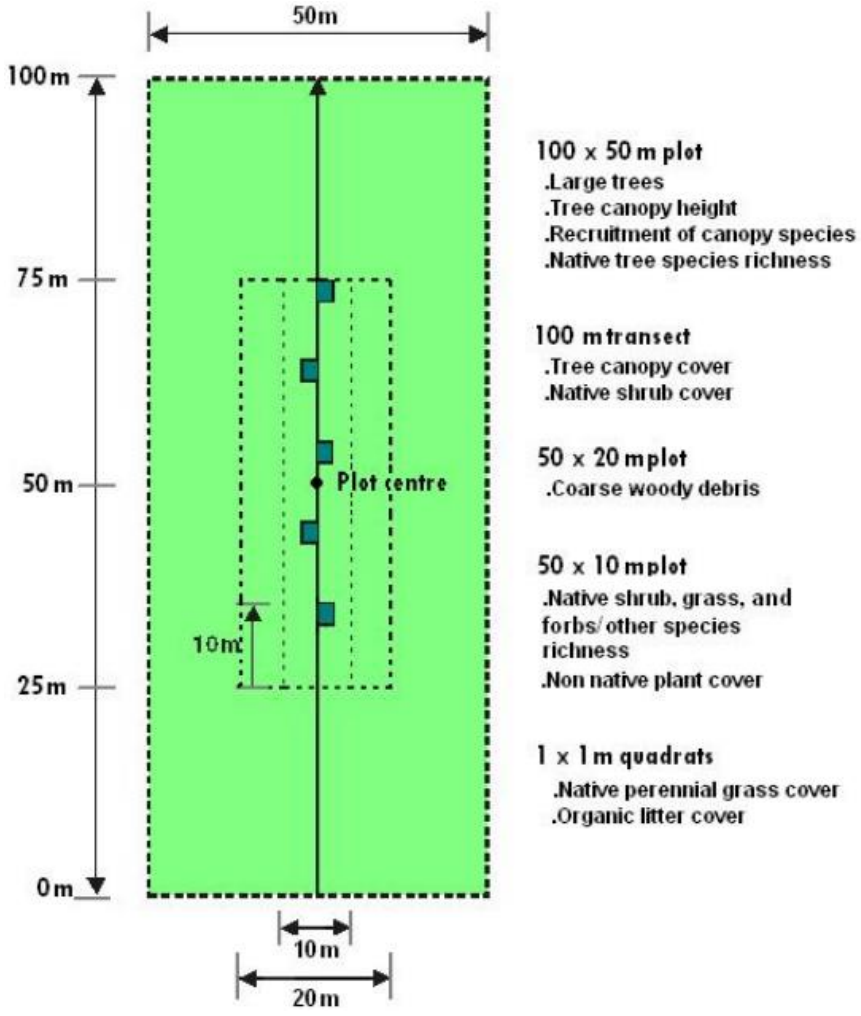


Figure 2.1 Standard layout of a BioCondition survey or monitoring transect

Within each monitoring transect, plants were either identified in the field by the suitably qualified person or samples were collected in a field herbarium for later identification using suitable reference keys and reference material including:

- *Rainforest Plants of Australia Rockhampton to Victoria. Interactive Key* (Harden et al 2014)
- *Rainforest Trees and Shrubs – Second Edition* (Harden, G. McDonald, B. & Williams 2018)
- *Rainforest Climbing Plants – Revised Edition* (Harden, G. McDonald, B. & Williams 2014).

Where plant samples were unable to be identified, or confirmed, they were forwarded to the Queensland Herbarium for verification. This provides quality assurance and an extra level of certainty for questionable identifications, as rainforest species can appear to be very similar, but in fact be a different species.

2.2 Habitat quality data analysis

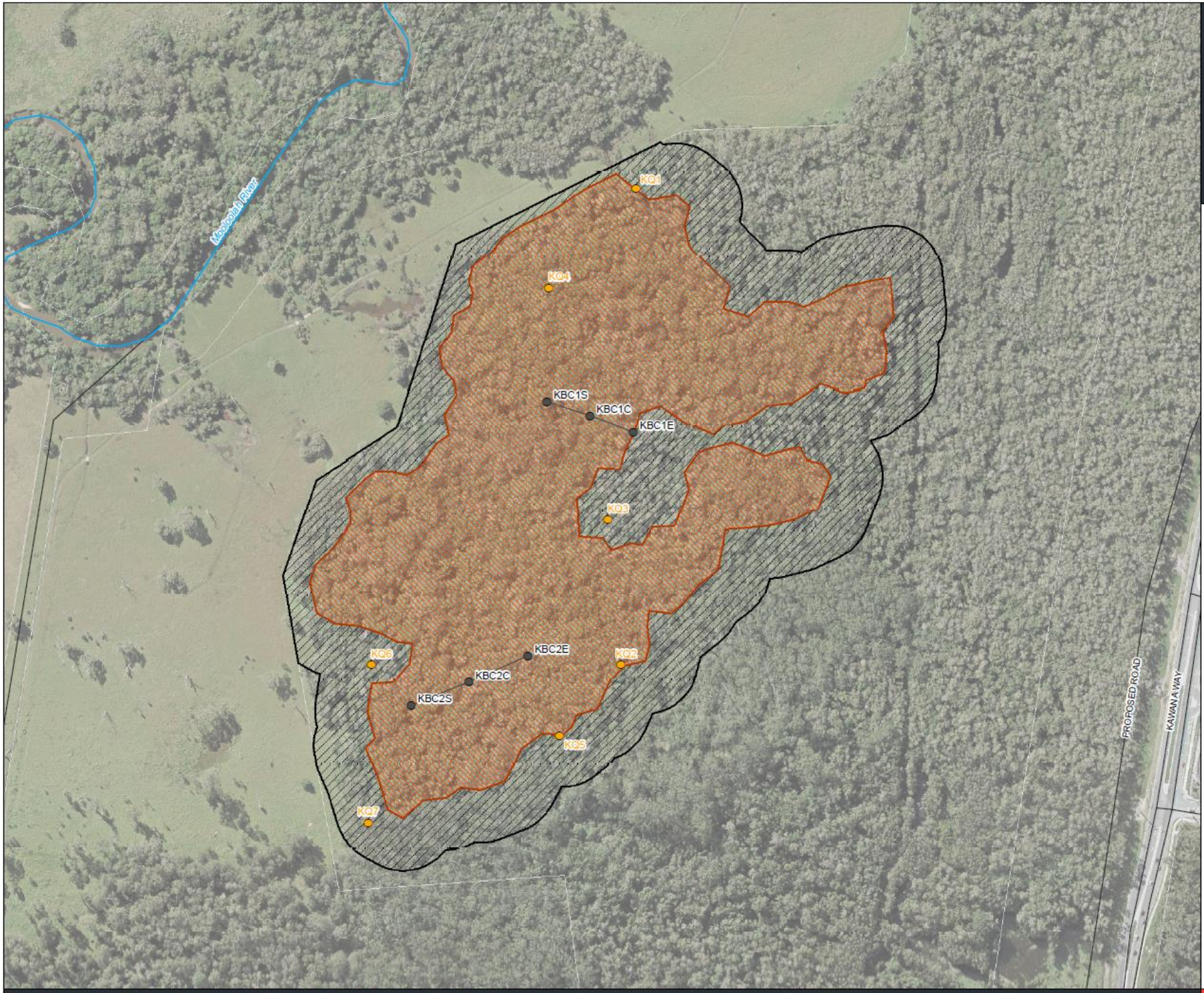
Benchmarks for scoring site ecological condition were sourced from BioCondition Benchmarks for Regional Ecosystem Condition Assessment South East Queensland for Regional Ecosystem 12.11.10 (DES, 2019) for Woondum and were also provided as Draft Benchmarks for Regional Ecosystem 12.3.1a by the Queensland Herbarium for Kawana.

Site condition scores for each of the regional ecosystems are derived from ecological condition indicators collected from respective BioCondition monitoring transects. The data for each ecological condition indicator was scored against benchmark data for each regional ecosystem, to derive an overall quality score in accordance with 'the Guide' (DES 2020). Where multiple BioCondition transects were completed for the same regional ecosystem, the quality scores were averaged.

Site context including the GIS attributes of size of patch, connectedness, context, and ecological corridors from the Guide were also included in the analysis. However, this was obtained from previous assessments prepared for the Project Environmental Offsets Strategy (GHD, 2019), Baseline Monitoring Report (WSP, 2020), and the 2022 Offset Monitoring Report (WSP, 2022).

Additional assessments for attributes of 'threats to the species' and 'the role of each offset site location to the overall population in the state,' were also analysed. Any changes to 'threats to the species' were assessed during field surveys, and 'the role of each offset site location to the overall population in the state' was obtained from the Baseline Monitoring Report (WSP, 2020) and 2022 Offset Monitoring Report (WSP, 2022).

The results of the ecological condition, site context and additional assessments were analysed to provide an overall habitat quality baseline score for each area using the Modified QLD Habitat Quality spreadsheet – template (DAWE 2019).

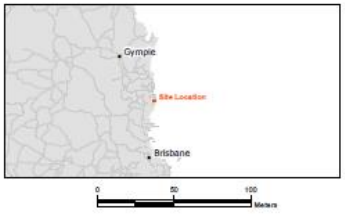


Cooroy to Curra Lowland Rainforest TEC Monitoring

Figure 2.2
Kawana Offset Area and Monitoring Sites

Legend

- BioCondition (2)
- Quaternary (7)
- Transect
- Watercourse
- Cadastre
- Lowland Rainforest TEC
- Threatened Ecological Communities *(offset buffer)*



Coordinate system: GDA 1994 MGA Zone 56

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Data sources: - DNRME, TMR, Translink, Geoscience Australia

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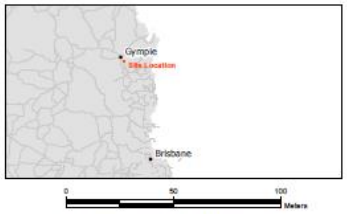
Cooroy to Curra
Lowland Rainforest TEC Monitoring

Figure 2.3
Woondum Offset Area and Monitoring Sites

Legend

- BioCondition (2)
- Quaternary (4)
- Photo Monitoring Site (2)
- Transect
- Watercourse
- Cadastre
- Lowland Rainforest TEC
- Threatened Ecological Communities *(offset buffer)*



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3 Site history and monitoring conditions

3.1 Monitoring history

This round of monitoring for the Lowland Rainforest TEC was undertaken 20 – 24 May 2024 at the Kawana and Woondum offset areas. This forms the second biennial monitoring event (i.e. once every 2 years), in accordance with the EPBC 2017/7941 approval conditions. The history of monitoring for the offset areas is presented in Table 3.1.

Table 3.1 Monitoring history for Kawana and Woondum offset areas

Month and year	Monitoring event	Detail
April/May 2020	Baseline	Kawana and Woondum Baseline monitoring survey.
May 2022	Monitoring event 1	Woondum biennial monitoring (originally scheduled for 2021, but delayed due to an unacceptable risk of COVID-19 infection).
July 2022	Monitoring event 1	Kawana biennial monitoring (originally scheduled for 2021, but delayed due to an unacceptable risk of COVID-19 infection).
May 2024	Monitoring event 2	Woondum and Kawana biennial monitoring.

3.2 Climate and rainfall

The temperature during the May monitoring event was cool, with below average rainfall for the month. However, in the months leading up to the surveys, periods of heavy rainfall had occurred in the region.

3.2.1 Kawana offset area

Above average rainfall was received at Kawana in the Summer and Autumn months preceding the survey. Significantly above average rainfall was received in January (679 mm, average January rainfall is ~231 mm). However, the survey month (i.e. May) experienced below average rainfall.

Above average monthly minimum and maximum temperatures were recorded for January, February and April prior to the survey, ranging from 0.2 to 0.9°C above average. The May maximum temperature (23.6°C) was approximately average, but the monthly minimum temperature for May (i.e. 14.9°C) was 1.2°C above the annual average.

The total annual rainfall received for 12 months preceding the survey was 1,914.6 mm and is significantly higher than the historical average of 1,466.1 mm (noting data is 1994-2024 and is a very small snapshot of historical data), owing mostly to significantly above-average rainfall in January 2024. The total annual rainfall received from January through to May 2024 exceed the average 12-month rainfall experienced over the past six years. 2023 had significantly less rainfall than the prior years.

A summary of the weather conditions recorded within the region at Caloundra Airport BoM AWS: 040998 (1994 – 20224 data) – approx. 8 km from Kawana offset area and Sunshine Coast Airport BoM AWS: 040861 – Approx. 16 km from Kawana offset area, over the 12 months prior to survey, are presented in Table 3.2 and historical annual rainfall since 2018 presented in Table 3.3.

3.2.2 Woondum offset area

Above average monthly rainfall was received at Woondum during March and April, prior to the May 2024 survey. However, the summer months of January and February 2024 received below average rainfall (119 mm and 197 mm, below the average of 160.1 mm and 168.9 mm respectively for the months).

Typical weather conditions at Woondum are dryer and more variable that the Kawana offset area. Mean monthly temperatures range from 6.4°C average minimum in July to 31.3°C maximum in summer. The monitoring month (i.e. May) experienced above average minimum temperature of 12.1°C (1.2°C above average) and approximately average maximum temperatures.

The total estimated annual rainfall received for Woondum for 12 months preceding the survey could not be calculated due to missing data for the weather station from September – November in 2023. However, if the monthly averages are supplemented to represent these absent months, the average annual rainfall equals ~1,043 mm, which is below the mean annual total rainfall for the weather station of 1122 mm.

A summary of the weather conditions recorded within the region (Gympie BoM AWS 040093, approx. 13 km from Woondum offset area) over the 12 months prior to survey, are presented in Table 3.4 and historical annual rainfall is presented in Table 3.5.

3.2.3 *Kawana offset area*

Table 3.2 Weather conditions (rainfall data from Caloundra Airport BOM AWS: 040998 – approx. 8 km from Kawana Offset Site; temperature data from Sunshine Coast Airport BoM AWS: 040861 – Approx. 16 km from Kawana Offset Site) June 2023 to May 2024

Weather data	June 2023	July 2023	Aug 2023	Sept 2023	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Annual
Total Monthly Rainfall (mm)	23.0	71.1	24.0	52.3	7.4	113.9	116.6	679.8	268.1	269.9	193.9	**94.6**	1,914.6
Mean Monthly Temperature (Min)	10.6	10.4	12.4	13.4	15.3	18.7	21.2	23.1	22.2	21.2	17.9	**14.9**	16.8
Mean Monthly Temperature (Max)	22.9	21.8	23.4	24.1	26.3	27.3	30.0	29.5	29.5	27.7	26.3	**23.6**	26.0

Table 3.3 Historical annual rainfall (Caloundra Airport BoM AWS: 040998 – approx. 8 km from Kawana Offset Site)

Weather data	2018	2019	2020	2021	2022	2023	2024 YTD
Total Annual Rainfall (mm)	1,540.1	1,193.6	1,591.1	1,868.1	1,589.7	897.8	1,629.6

3.2.4 *Woondum offset area*

Table 3.4 Weather conditions (Gympie BoM AWS: 040093 – approx. 13 km from Woondum Offset Site) June 2023 to May 2024

Weather data	June 2023	July 2023	Aug 2023	Sept 2023	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	ANNUAL
Total Monthly Rainfall (mm)	20.2	25.8	37.6	n/a	n/a	n/a	179.6	119.0	137.0	194.6	96.8	**29.0**	n/a
Mean Monthly Temperature (Min)	8.2	8.0	8.6	11.5	13.6	17.7	20.2	22.3	21.0	19.7	16.6	**12.1**	15.0
Mean Monthly Temperature (Max)	24.0	23.1	25.5	26.8	30.1	29.9	33.1	30.2	31.1	28.1	26.9	**24.4**	27.8

Table 3.5 Historical monthly rainfall for Gympie (Gympie BoM AWS: 040093 – approx. 13 km from Woondum offset area)

Weather data	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean rainfall	160.1	168.9	13.9	81.6	71.5	59.3	51.4	39.3	44.7	72.3	87.4	135.7	1,122.3

4 Discussion and results

The following section provides the discussion and results of the 2024 monitoring for the Kawana offset area (refer Section 4.1) and Woondum offset area (refer Section 4.2).

4.1 Kawana offset area

The Kawana offset area (Kawana) consists of a large patch (15.7 ha) of complex notophyll vine on coastal plains associated with Quaternary alluvium (Land Zone 3). Two permanent baseline BioCondition monitoring sites were established within Kawana during the 2020 surveys which were re-assessed during the 2022 round of monitoring and again during the most recent 2024 monitoring (refer Figure 2.2).

The vegetation communities and regional ecosystems verified within the Kawana offsets area were identical to those identified in the baseline data and remain unchanged from the 2020 report. The area was identified as RE 12.3.1a Complex notophyll vine forest on Quaternary alluvial plains and channels in areas of high rainfall (generally >1,300 mm), which is associated with the Lowland Rainforest TEC. This community is mapped in association with the Lowland Rainforest TEC in Figure 2.3.

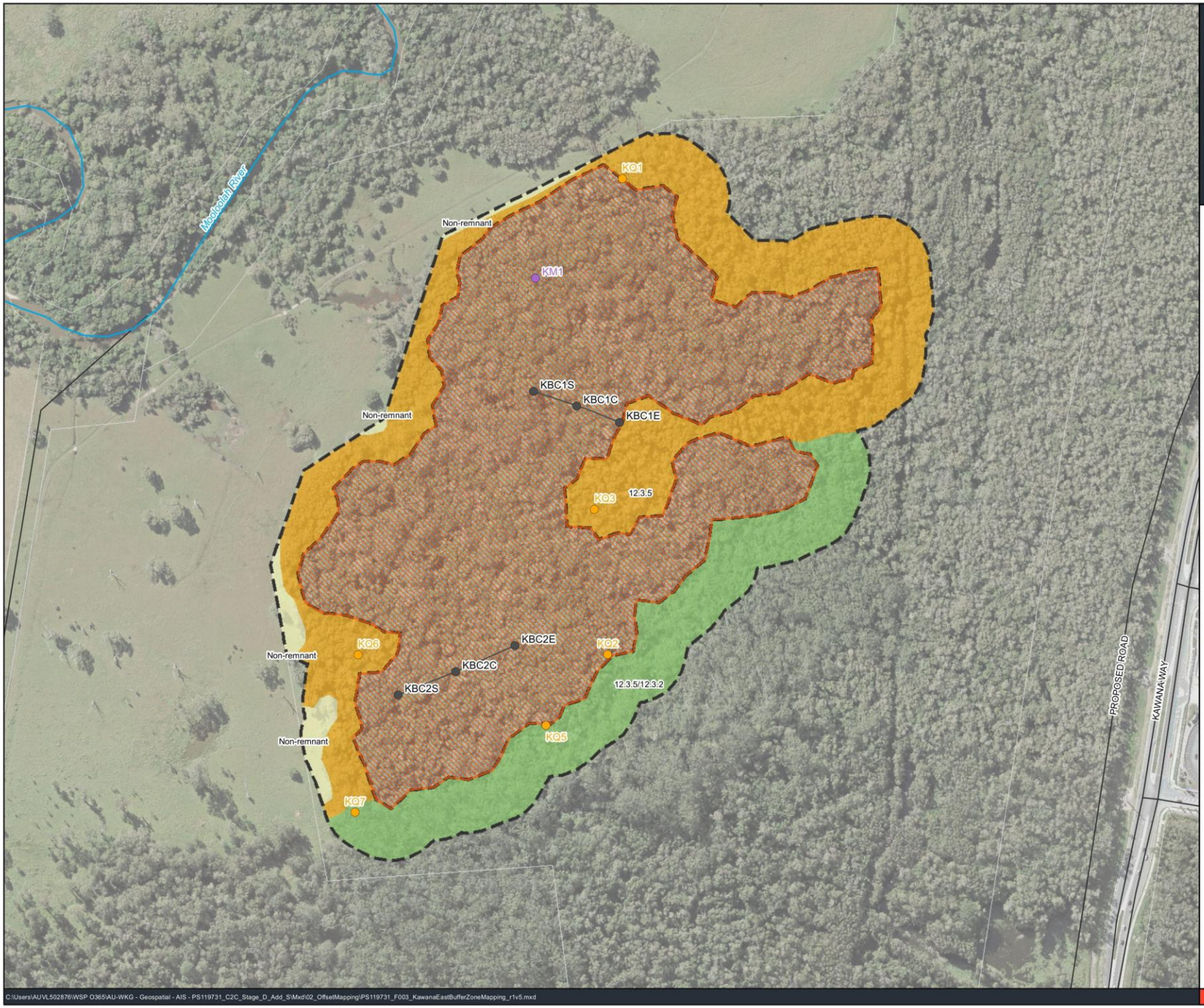
Several areas of palm forest dominated by Piccabeen Palm (*Archontophoenix cunninghamiana*) also occur within the mapped Lowland Rainforest TEC associated with RE 12.3.1a. These areas have lower species diversity than the more complex areas of the patch where permanent monitoring transects have been established but do provide opportunities to be potentially improved as revegetation enhancement plantings grow.

In accordance with the Listing Advice, in addition to a patch of Lowland Rainforest TEC, a minimum buffer zone that extends 50 m beyond the trunks of the outermost trees in the patch is required. These buffers assist in the preservation of the patch to help protect the ecological community from spray drift (fertiliser, pesticide or herbicide sprayed in adjacent land) and other threats (i.e. weed invasion). In addition, the buffer zone is to protect and manage the patch and to help avoid potential indirect impacts to the ecological community. Noting, its purpose is not specifically to extend the patch through regeneration and revegetation beyond its current extent.

As mapped in Figure 4.1, the vegetated buffer zone surrounding the mapped Lowland Rainforest TEC at Kawana includes the following vegetation communities and regional ecosystems:

- RE 12.3.5 – *Melaleuca quinquenervia* open forest on coastal alluvium.
- RE 12.3.2 – *Eucalyptus grandis* tall open forest on alluvial plains with vine forest understorey ('wet sclerophyll').
- Small strips of ‘non-remnant’ previously cleared pastures.

As noted previously, in 2022 several vegetation and weed surveys were undertaken to identify any changes in the dominant species, species richness and weed presence / abundance within the mapped buffer zone surrounding the Lowland Rainforest TEC at Kawana. However, the assessment of the buffer only occurs every four (4) years and was therefore not assessed during this monitoring event.



Cooroy to Curra Lowland Rainforest TEC Monitoring

Figure 4.1
Kawana Offsets Area Vegetation Communities and Monitoring Sites

Legend

- BioCondition
- Weed Monitoring Site
- Photo Monitoring Site
- Transect
- Watercourse
- Cadastre
- Threatened Ecological Communities *(offset buffer)*
- Lowland Rainforest TEC (RE 12.3.1a)

Field Verified Vegetation

- Cleared pastures (non-remnant)
- Melaleuca forest with notophyll vine forest understory on alluvium (RE 12.3.5 - remnant)
- Mixed Melaleuca forest and Eucalyptus grandis forest with notophyll vine forest understory on alluvium (RE 12.3.5/12.3.2 - remnant)

Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

1:3,500 Date: 4/11/2020

Data sources: - DNRME, TMR, Translink, Geoscience Australia

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4.1.1 2024 monitoring site condition results Kawana

The results from the two BioCondition transects for Kawana are presented in Figure 4.2 and Figure 4.3. The BioCondition parameters have been represented graphically against benchmark data to indicate where the transects data are performing well and/or where there is opportunity for improvement through intervention and management. Both monitoring transects performed well in most attributes compared to benchmark data, and the two monitoring transects scored similar results to one another.

It is relevant to note that in the previous monitoring report an overabundance of coarse woody debris was reported, however in the 2022 and 2020 (baseline) report, the benchmark score for coarse woody debris had been erroneously reported as 29.5 instead of 295. Hence, both monitoring sites supported approximately half the benchmark level of coarse woody debris, rather than having an overabundance. In 2024, both sites continue to support an underabundance of organic litter. Native shrub cover in KBC2, and organic litter and native tree richness at both transects, are substantially above the baseline amount.

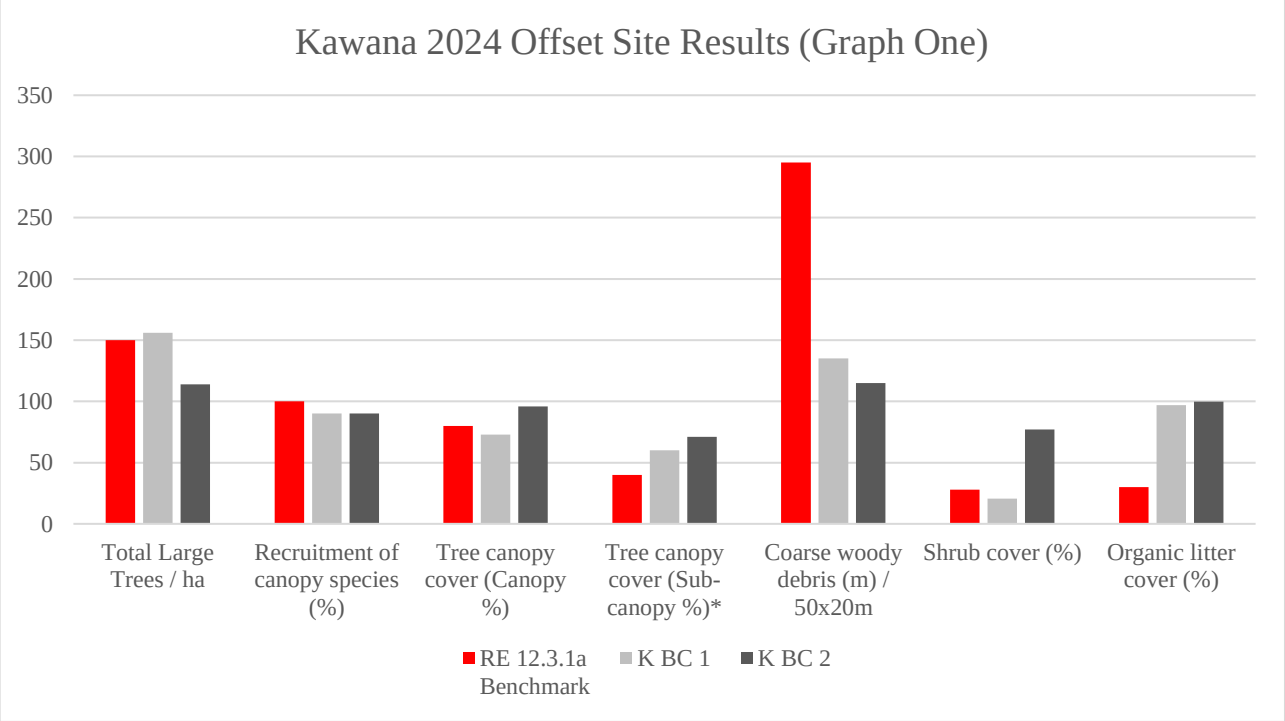


Figure 4.2 Kawana 2024 BioCondition monitoring results with comparison against RE benchmarks (graph one)

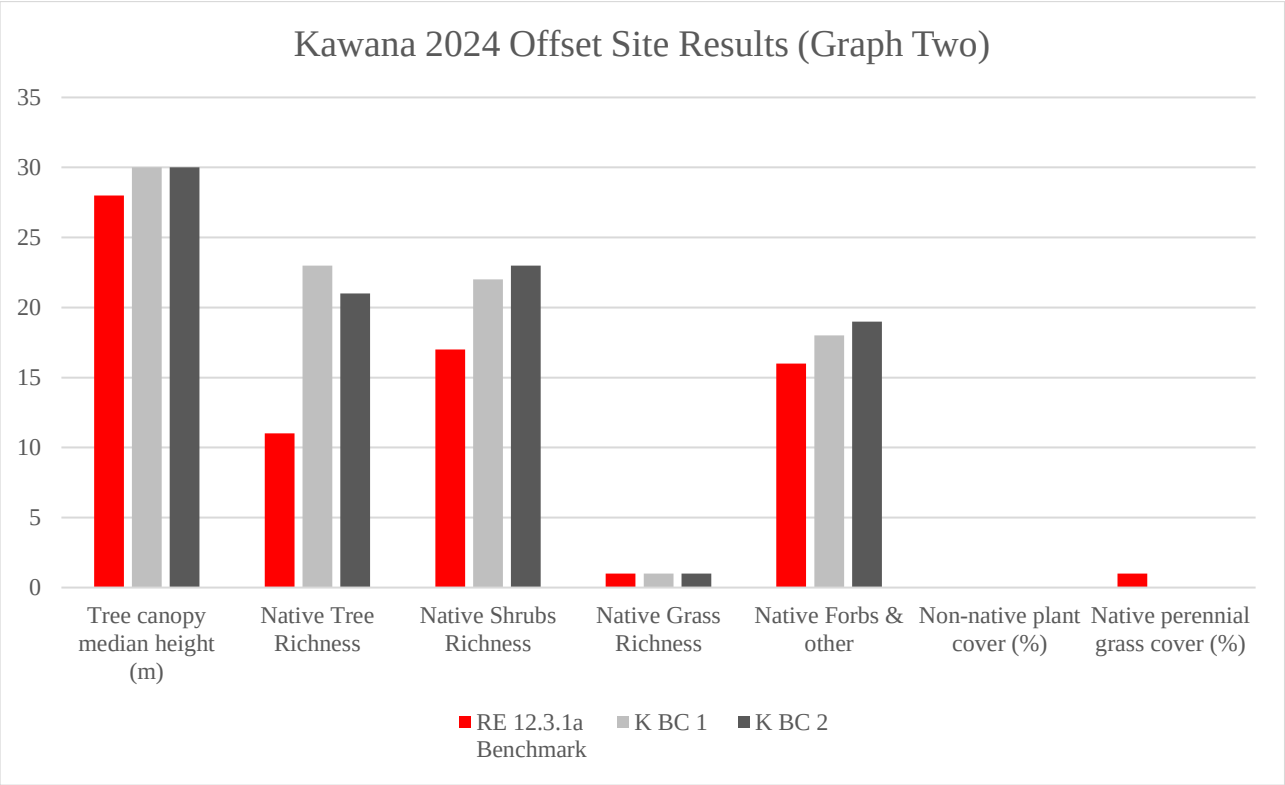


Figure 4.3 Kawana 2024 BioCondition monitoring results comparison against RE benchmarks (graph two)

Table 4.1 show the results of the data analysis for each site assessed against the site condition scores from the Modified QLD Habitat Quality spreadsheet (DAWE 2019). The results show site condition scores of 6.21 and 5.60 out of 7, with an average of 5.91 achieved overall.

The results for the two baseline BioCondition monitoring transects, completed in 2020 for Kawana, are provided in Appendix B. The 2020 baseline monitoring transects achieved the same site condition score of 4.94 out of 7 for each transect, with an overabundance of leaf litter, and a lack of species richness for native shrubs, grasses and forbs limiting the 2020 scores. Section 4.1.4 herein provides further comparison of the data between the three monitoring events.

Table 4.1 Kawana site condition results

Assessment unit – regional ecosystem	Kawana RE 12.3.1A								
Site reference	**Benchmark**	**KBC1**			**KBC2**			**Average% benchmark**	**Score**
Kawana offset site condition	**12.3.1a**	**Raw data**	**% Benchmark**	**Score**	**Raw data**	**% Benchmark**	**Score**		
Recruitment of woody perennial species in EDL	100	90	90%	5	90	90%	5	90%	5
Native plant species richness – trees	11	23	209%	5	21	191%	5	200%	5
Native plant species richness – shrubs	17	22	129%	5	23	135%	5	132%	5
Native plant species richness – grasses	1	1	100%	5	1	100%	5	100%	5
Native plant species richness – forbs	16	18	113%	5	19	119%	5	116%	5
Tree Height Canopy	28	30	107%	5	30	107%	5	107%	5
Tree Height Sub-canopy	8	8	100%		10	125%		113%	
Tree Cover Canopy	80	73	91%	5	96	120%	5	106	5
Tree Cover Sub-canopy*	40	N/A (60, in 2022)	N/A (150%, in 2022)		N/A (71, in 2022)	N/A (178%, in 2022)		N/A (163% in 2022)	
Shrub canopy cover	28	20.5	73%	5	77	275%	3	174%	4
Native perennial grass cover	1	0	0%	0	0	0%	0	0%	0
Organic litter	30	97	323%	3	99.8	333%	3	328%	3
Large trees (euc plus non-euc)	150	156	104%	15	114	76%	10	90%	12.5
Coarse woody debris	295	135	46%	3	115	39%	3	42%	3
Non-native plant cover	0	0	0%	10	0	0%	10	0%	10
Site Condition Score				71			64		67.5
Maximum Site Condition Score				*80*			*80*		*80*
Site Condition Score – out of 7				**6.21**			**5.60**		**5.91**

*Tree sub-canopy cover was counted with the canopy cover during the 2024 survey. Therefore, 2022 scoring has been applied for sub-canopy cover (in brackets) to provide an indicative score. In addition, the benchmark for sub-canopy cover was previously erroneously reported in 2022 (Table 4.1) to be 28 rather than 40.

4.1.2 Site context and habitat quality results Kawana

Table 4.2 highlights the scores for each site against the site context and habitat quality assessments including the 'role of site location to the Lowland Rainforest TEC overall population in the state' and the 'threat to the species.' These figures were unchanged from the baseline data collected during the 2020 monitoring. Results of field surveys indicate there is still a low threat to the community, asides from some invasive plant species occurring within the vegetated buffer zone.

Table 4.3 provides the overall habitat quality results for the Kawana offset area which incorporates the site context data that was compiled during the 2020 baseline assessment. Recommendations for improving the habitat score at Kawana are provided in Section 5.

Table 4.2 Kawana site context results

Site context	KBC1	Score	KBC2	Score	Average KBC1 / KBC2	Average score
Size of patch (ha)	181	7	181	7	181	7
Connectedness	90	5	90	5	90	5
Context	37	4	37	4	37	4
Ecological Corridors	Within	6	Within	6	–	6
Role of site location to TEC overall population in the state	Yes	5	Yes	5	–	5
Threats to the species	Low	15	Low	15	–	15
Site Context Score	–	42		42	–	42
MAX Site Context Score	–	*46*		*46*	–	*46*
Site Context Score – out of 3	**–**	**2.74**		**2.74**	**–**	**2.74**

Table 4.3 Kawana habitat overall habitat quality baseline results

Final habitat quality score (weighted)	KBC1	KBC2	Average / final
Site Condition score (out of 7)	6.21	5.60	5.91
Site Context Score (out of 3)	2.74	2.74	2.74
Habitat Quality score (out of 10)	8.95	8.34	8.65
Assessment Unit area (ha)	181	181	181.00
Total offset area (ha) for this MNES	181	181	181.00
Size Weighting	1.00	1.00	1.00
Weighted Habitat Quality Score out of maximum of 10	**8.95**	**8.34**	**8.65**

4.1.3 Weed and invasive plant presence at Kawana

A recommendation of the 2022 monitoring report (WSP, 2022) was to remove a small infestation of *Ipomoea cairica*, which had established at KBC2 sometime after the baseline assessment was completed. This invasive species was not observed at the monitoring transect in 2024.

It is recommended that annual weed control works continue in the vegetated buffer zone surrounding the mapped Lowland Rainforest TEC which supports Lantana (*Lantana camara*) and the pasture grass, Bastard summergrass (*Digitaria violascens*), and to ensure ongoing stock exclusion from the offset area and buffer zone.

4.1.4 Comparison between Baseline and 2022 site condition data Kawana

The general upward trend in Habitat Quality continues this year for the Kawana offset site. This is attributable to a minor improvement in the condition scores for KBC1 in 2024, which builds on an improvement recorded in both transect plots between the 2022 assessment and the baseline scores. Also contributing to the improved score for condition in 2024 was the detection of two benchmark scoring errors in the previous reporting, for 'coarse woody debris' and 'tree cover sub-canopy'. Table 4.4 presents the improvement in condition score and overall habitat quality scores over time.

Figure 4.4 and Figure 4.5 depict the changes to the average results for each site condition criterion.

Table 4.4 Change in condition and habitat quality scores at Kawana

Habitat quality scores 2020–2024	KBC1	KBC2	Average/final
2020 (Baseline)			
Site condition score (out of 7)	4.94	4.94	4.94
Weighted Habitat Quality Score (out of 10)	7.68	7.68	7.68
2022			
Site condition score (out of 7)	6.04	5.60	5.82
Weighted Habitat Quality Score (out of 10)	8.78	8.34	8.56
2024			
Site Condition score (out of 7)	6.21	5.60	5.91
Weighted Habitat Quality Score (out of 10)	8.95	8.34	8.65

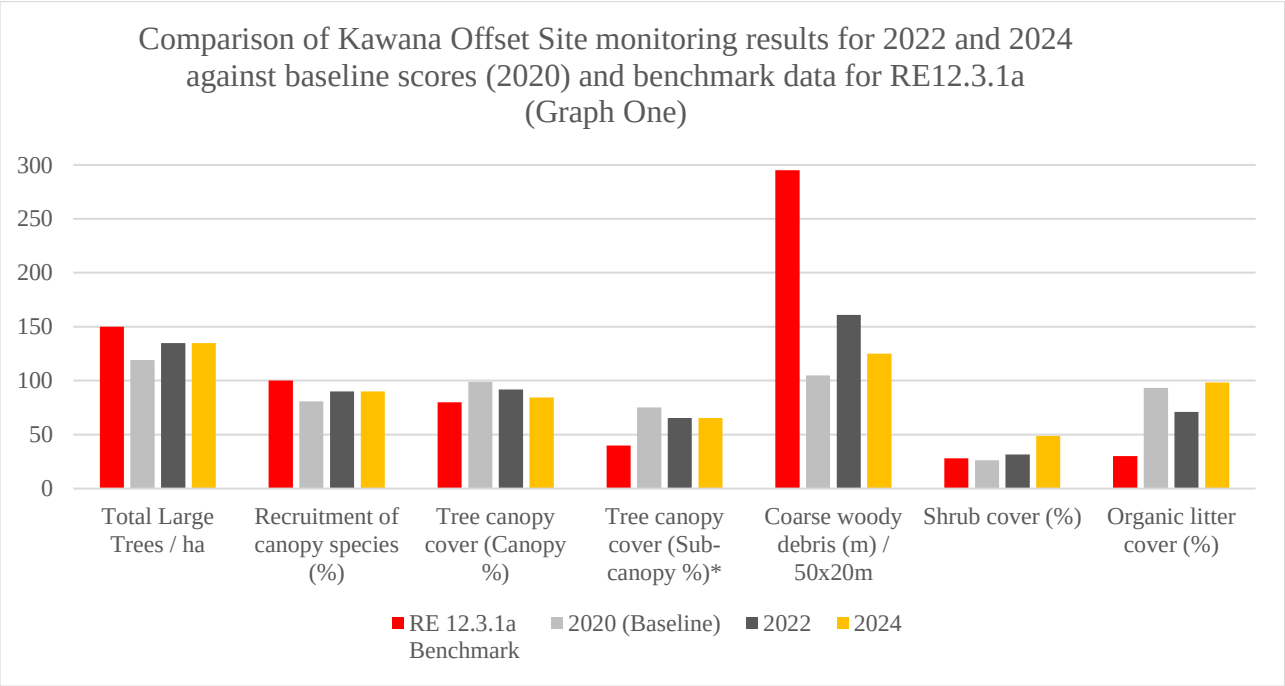


Figure 4.4 Comparison of Kawana offset monitoring results for 2020, 2022 and 2024 against benchmark

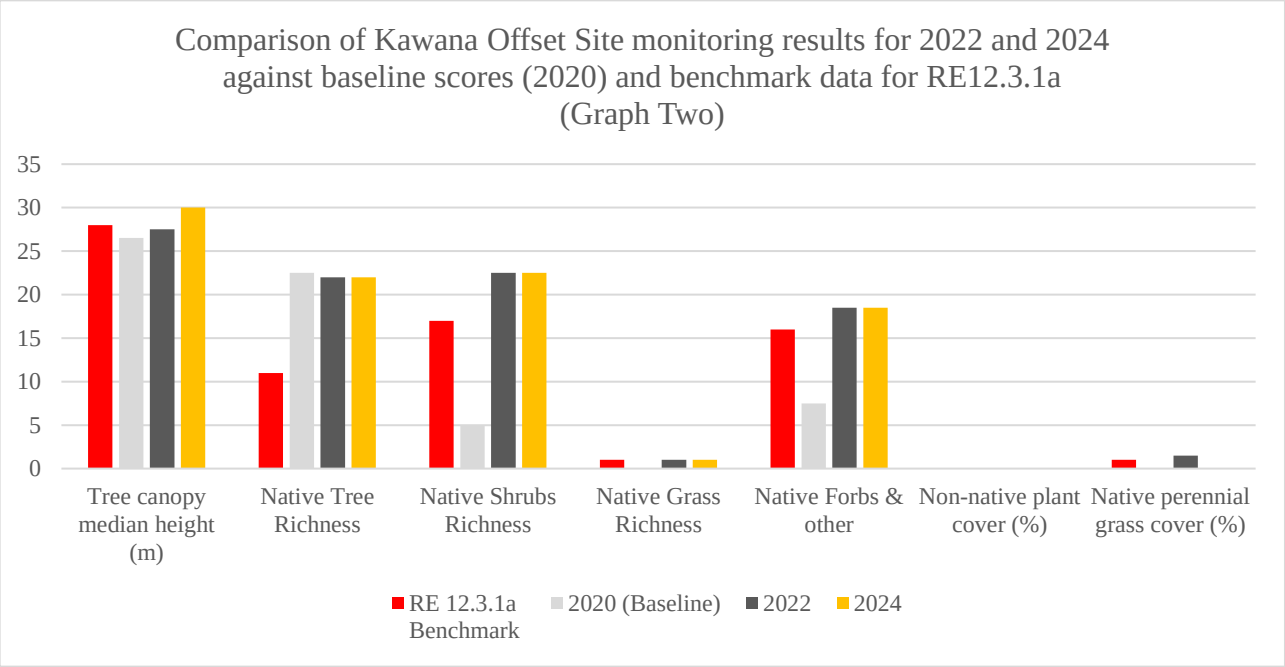


Figure 4.5 Comparison of Kawana offset monitoring results for 2020, 2022 and 2024 against benchmark

As shown, most attributes are tracking steadily compared to the previous monitoring event in 2022 and have generally improved (i.e. scored more closely to the benchmark) compared to the baseline assessment. A considerable increase in shrub and forb richness and shrub cover can be observed since the 2020 baseline was measured.

The above-average rainfall experienced in recent years is likely to have contributed to this, encouraging the survival of specimens, and increasing the extent of shrub cover. Coarse woody debris requires a substantial increase to achieve the benchmark level, and organic leaf litter is well above the required amount.

4.2 Woondum offset area

The Woondum Offsets Area (Woondum) consists of a small patch (2.7 ha) of mixed notophyll vine forest on low hills of basaltically enriched colluvial slopes on metasediments of the Gympie province associated with Land Zone 11. The small corridor of mixed notophyll vine forest on colluvium occurs as a small valley between two steeper ridges dominated by Eucalypt communities on shallow soils.

The regional ecosystem verified within the Woondum offset area recorded in association with the Lowland Rainforest TEC supports RE 12.11.10 Notophyll vine forest +/- *Araucaria cunninghamii* on metamorphics +/- interbedded volcanics. However, in accordance with the Listing Advice, in addition to a patch of Lowland Rainforest TEC, a minimum buffer zone that extends 50 m beyond the trunks of the outermost trees in the patch is required. These buffers assist in the preservation of the patch to help protect the ecological community from spray drift (fertiliser, pesticide or herbicide sprayed in adjacent land) and other threats. The vegetated buffer zone surrounding the Lowland Rainforest TEC at Woondum supports other RE's (i.e. RE 12.11.3, RE 12.11.5 and High Value Regrowth RE 12.11.10) as shown in Figure 4.6.

Two permanent baseline BioCondition monitoring transects were established within Woondum during the 2020 baseline assessment. These were re-assessed in 2022 and again during this 2024 round of monitoring. As noted previously, in 2022 several vegetation and weed surveys were undertaken to identify any changes in the dominant species, species richness and weed presence / abundance within the mapped buffer zone surrounding the Lowland Rainforest TEC at Woondum. However, the assessment of the buffer zone only occurs every four (4) years and was therefore not assessed during this monitoring event.

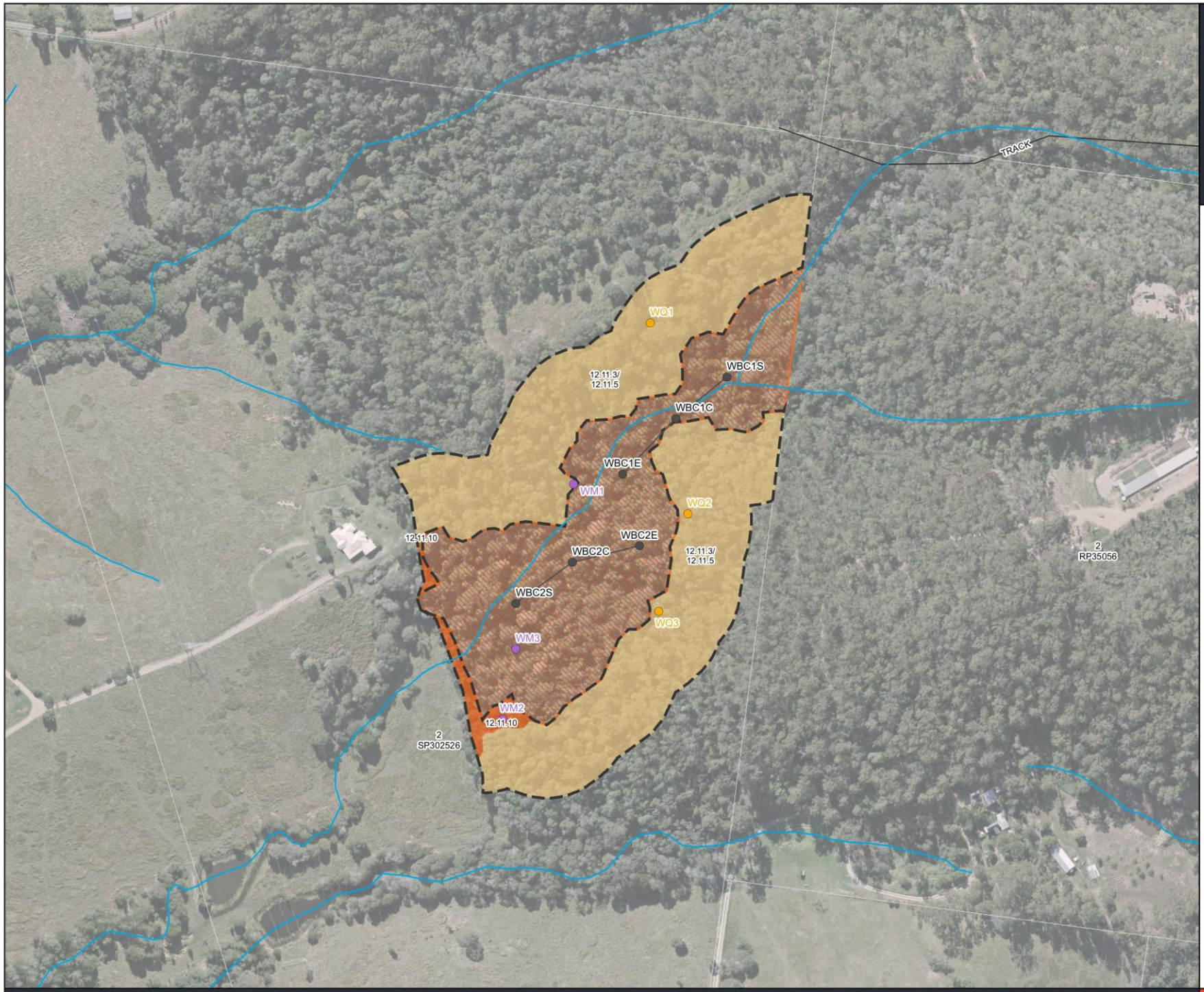
4.2.1 2024 site condition results Woondum

The results of the two BioCondition monitoring transects for Woondum are presented in Figure 4.7 and Figure 4.8. The BioCondition parameters for each site have been represented graphically against benchmark data to indicate where the Woondum monitoring sites are performing well and/or have the opportunity for improvement through intervention and management.

Both monitoring transects performed well in relation to recruitment of canopy species, native tree richness, tree canopy cover and tree canopy median height. WBC2 also performed well in relation to organic litter, native grass species richness, and non-native plant cover. While both transects fell below the required scores for native shrub and native forb species richness, WBC1 had the lowest scores. WBC1 also supports the highest non-native plant cover and the lowest scores for grass species richness and native perennial grass cover, compared to the benchmark. Both sites continued to support an overabundance of shrub cover and coarse woody debris.

Table 4.5 shows the results of the data analysis for the two monitoring transects when assessed against the site condition scores of the Modified QLD Habitat Quality spreadsheet (DAWE 2019). The results indicate that Woondum offset scored an average of 5.05 out of a possible 7 for site condition.

The results for the two baseline BioCondition monitoring transects, completed in 2020 for Woondum, are provided in Appendix B. The 2020 baseline monitoring transects achieved site condition score of 4.48 and 5.25 for WBC1 and WBC2 respectively averaging to a score of 4.86 out of 7. It is relevant to note that the condition score for WBC1 in 2024 has declined by 0.43 since the 2020 baseline measurement, while the score for WBC2 has improved by 0.79, resulting in a slight overall condition improvement (i.e. 0.18) since baseline. Section 4.2.4 herein provides further comparison of the data between the three monitoring events.



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Cooroy to Curra
Lowland Rainforest TEC Monitoring

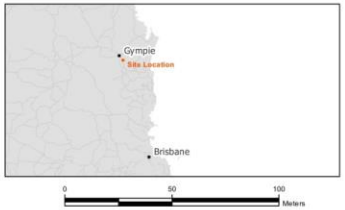
Figure 4.6
Woondum Offsets Area Vegetation Communities and Monitoring Sites

Legend

- BioCondition
- Weed Monitoring Site
- Photo Monitoring Site
- Transect
- Watercourse
- Cadastre
- Threatened Ecological Communities *(offset buffer)*
- Lowland Rainforest TEC (RE 12.11.10)

Field Verified Vegetation

- High Value Regrowth Mixed Notophyll Vine Forest On Metasediments (RE 12.11.10 - HVR)
- Mixed open shrubby Eucalypt forest on metasediments with Lophostemon confertus, E. propinqua, E. siderophloia (RE 12.11.3/12.11.5 - remnant)



Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

1:2,500 Date: 23-Sep-20

Data sources: - DNRME, TMR, Translink, Geoscience Australia

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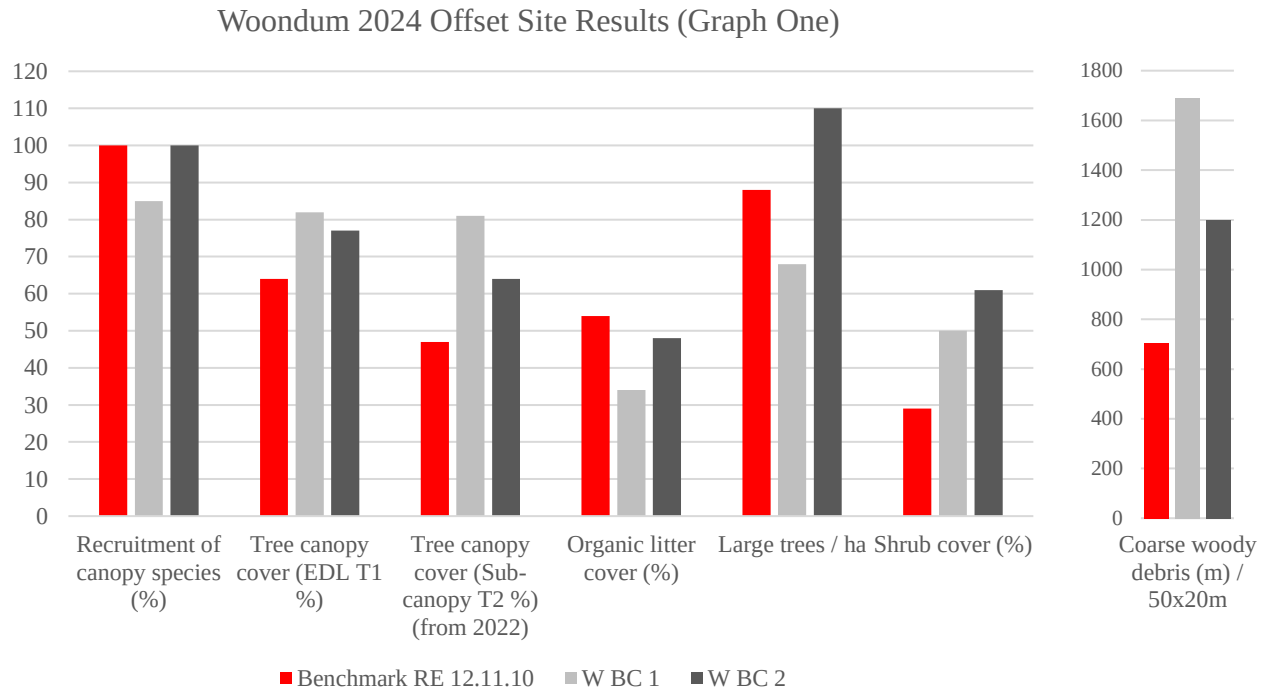


Figure 4.7 Woondum 2024 BioCondition monitoring results comparison against benchmarks (graph one)

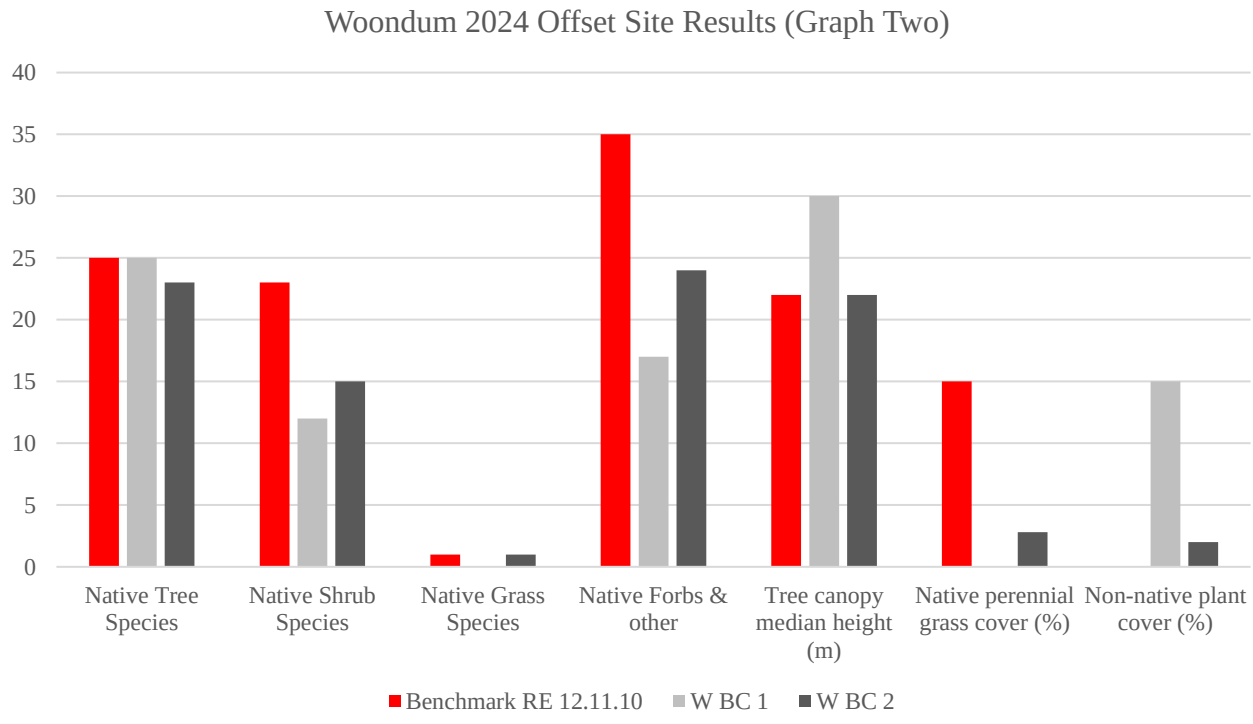


Figure 4.8 Woondum 2024 BioCondition monitoring results comparison against benchmarks (graph two)

Table 4.5 Woondum site condition results

Assessment unit – regional ecosystem	Woondum RE 12.11.10								
Site reference	**Benchmark**	**WBC1**			**WBC2**			**Average % Benchmark**	**Score**
Woondum offset site condition	**12.11.10**	**Raw data**	**% Benchmark**	**Score**	**Raw data**	**% Benchmark**	**Score**		
Recruitment of woody perennial species in EDL	100	85	85%	5	100	100%	5	93%	5
Native plant species richness – trees	25	25	100%	5	23	92%	5	96%	5
Native plant species richness – shrubs	23	12	52%	2.5	15	65%	2.5	59%	2.5
Native plant species richness – grasses	1	0	0%	0	1	100%	5	50%	2.5
Native plant species richness – forbs	35	17	49%	2.5	24	69%	2.5	59%	2.5
Tree Height Emergent	33	35	0%	5	30	91%	5	45%	5
Tree Height Canopy	22	30	136%		22	100%		118%	
Tree Height Sub-canopy	8	12	150%		9	113%		131%	
Tree Cover Emergent	5	N/A (0 in 2022)	N/A (0% in 2022)	3.3	N/A (6.5 in 2022)	N/A (130% in 2022)	5	N/A (65% in 2022)	4.2
Tree Cover Canopy	64	82	128%		77	120%		124%	
Tree Cover Sub-canopy*	47	N/A (81 in 2022)	N/A (172% in 2022)		N/A (64 in 2022)	N/A (136% in 2022)		N/A (154% in 2022)	
Shrub canopy cover	29	50	172%	5	61	210%	3	191%	4
Native grass cover	15	0	0%	0	2.8	19%	1	9%	0.5
Organic litter	54	34	63%	5	48	89%	5	76%	5
Large trees (euc plus non-euc)	88	68	77%	5	110	125%	15	101%	10
Coarse woody debris	705	1690	240%	3	1200	170%	5	205%	4
Non-native plant cover	0	15	15%	5	2	2%	10	9%	7.5
Site Condition Score				46.3			69		57.7
Maximum Site Condition Score				80			80		80
Site Condition Score – out of 7				**4.05**			**6.04**		**5.05**

*Tree sub-canopy and emergent cover was counted with the canopy cover during the 2024 survey. Therefore 2022 scoring has been applied (in brackets) to provide an indicative score.

4.2.2 Site context and habitat quality results Woondum

Table 4.6 highlights the scores for each monitoring transect against the site context and habitat quality assessments including the 'role of site location to the Lowland Rainforest TEC overall population in the state' and the 'threat to the species.' These figures were unchanged from the baseline data collected during the 2020 monitoring.

Results of the monitoring indicate there is still a threat to the community predominantly associated with the presence of invasive plant species in within the community and buffer zone, in particular the presence of Cats Claw Creeper (*Dolichandra unguis-cati*) (refer Section 4.2.3 and recommendations in Section 5).

Table 4.7 provides the overall habitat quality results for the Woondum offset area. It is recommended the best opportunity for improving the habitat score at Woondum continues to be from reducing the 'threat to species' associated with invasive plant species. Recommendations for improving the habitat score at Woondum are provided in Section 5.

Table 4.6 Woondum site context results

Site context	WBC1	Score	WBC2	Score	Average WBC1 / WBC2	Average score
Size of patch	622	10	622	10	622	10
Connectedness	97	5	97	5	97	5
Context	50	4	50	4	50	4
Ecological Corridors	Not within	0	Not within	0	–	0
Role of site location to TEC overall population in the state	No	1	No	1	–	1
Threats to the species	Moderate	7	Moderate	7	–	7
Site Context Score	–	27		27	–	27
MAX Site Context Score	–	*46*		*46*	–	*46*
Site Context Score – out of 3	**–**	**1.76**		**1.76**	**–**	**1.76**

Table 4.7 Woondum Habitat overall habitat quality baseline results

Final habitat quality score (weighted)	WBC1	WBC2	Average/final
Site Condition score (out of 7)	4.05	6.04	5.05
Site Context Score (out of 3)	1.76	1.76	1.76
Habitat Quality score (out of 10)	5.81	7.80	6.81
Assessment Unit area (ha)	622	622	622
Total offset area (ha) for this MNES	622	622	622
Size Weighting	1.00	1.00	1
Weighted Habitat Quality Score	**5.81**	**7.80**	**6.81**

4.2.3 Weed and invasive plant presence at Woondum

The presence of Cats Claw Creeper (*Dolichandra unguis-cati*) and other invasive weed species, pose a significant threat to the Lowland Rainforest TEC. Cats claw creeper is still present in the vicinity of the monitoring sites and in the south-western portion of the offset area, and is still posing a major threat to the ecological condition of the Woondum offset area.

This species is known as a 'transformer' species in some vegetation communities due to its ability to smother native vegetation and alter ecosystems. The control of this species should form the highest priority for future weed control works. It will also require thorough post-treatment surveillance for many years to ensure it does not re-establish from ground-based tubers.

It is recommended invasive plant weed management continues throughout the Lowland Rainforest TEC offset area and in the buffer zone. Detailed recommendations and weed species to target are provided in Section 5.

4.2.4 Comparison between Baseline and 2022 site condition data Woondum

When the 2024 monitoring transects are combined, the data displays a slight overall improvement in Habitat Quality at Woondum. However, this is mostly attributable to improvements recorded at WBC2, which has lifted the overall score for both monitoring transects. As noted, the site condition at WBC1 has reduced, lower than the baseline score. When comparing WBC1 site condition attributes between 2024 and 2020, the site condition elements that brought the 2024 score down were from:

- native plant species richness of grasses, which were not observed in the relevant monitoring plot for WBC1 in 2024, but were observed in 2020 (note: the scoring for this attribute is based on a percent of the benchmark number of grasses, which for this RE equals 1, which can make this attribute tenuous to achieve); and
- an increase in non-native plant cover, which in 2020 was <5% of vegetation cover but is now 15%.

Table 4.8 presents the site condition scores and the overall habitat quality scores over time.

Table 4.8 Change in condition and habitat quality scores at Woondum

Habitat quality scores 2020 – 2024	WBC1	WBC2	Average / final
2020 (Baseline)			
Site condition score (out of 7)	4.48	5.25	4.86
Weighted Habitat Quality Score (out of 10)	6.24	7.01	6.62
2022			
Site condition score (out of 7)	4.61	5.16	4.89
Weighted Habitat Quality Score (out of 10)	6.37	6.92	6.65
2024			
Site Condition score (out of 7)	4.05	6.04	5.05
Weighted Habitat Quality Score (out of 10)	5.81	7.80	6.81

Figure 4.9 and Figure 4.10 depict the changes to the average results for each site condition criterion over the monitored years. As depicted in the graphs, the BioCondition monitoring data for 2024 shows plant species richness is reasonable and holding steady. However, more diversity of forbs and shrubs is still required to reach benchmark rates. Native tree and grass species richness are at, or near, the benchmark for RE 12.11.10. The number of large trees achieved the benchmark level during 2024, and the scores for recruitment of canopy species and tree canopy cover are close to the benchmark amounts.

A negative trend is forming in relation to shrub cover, which is considerably higher than previous years and is above the benchmark amount, requiring a reduction in future years, potentially resulting from increasing canopy cover. Coarse woody debris measured in 2024 is approximately double the required benchmark amount and has increased since the last monitoring event. Organic litter cover has dropped below the benchmark in 2024, although not substantially so.

The overall non-native plant cover in 2024 has reduced slightly since the last monitoring event but is above both the benchmark and baseline levels. Weed management efforts will need to be continued at the Woondum site to improve this score for the next round of monitoring.

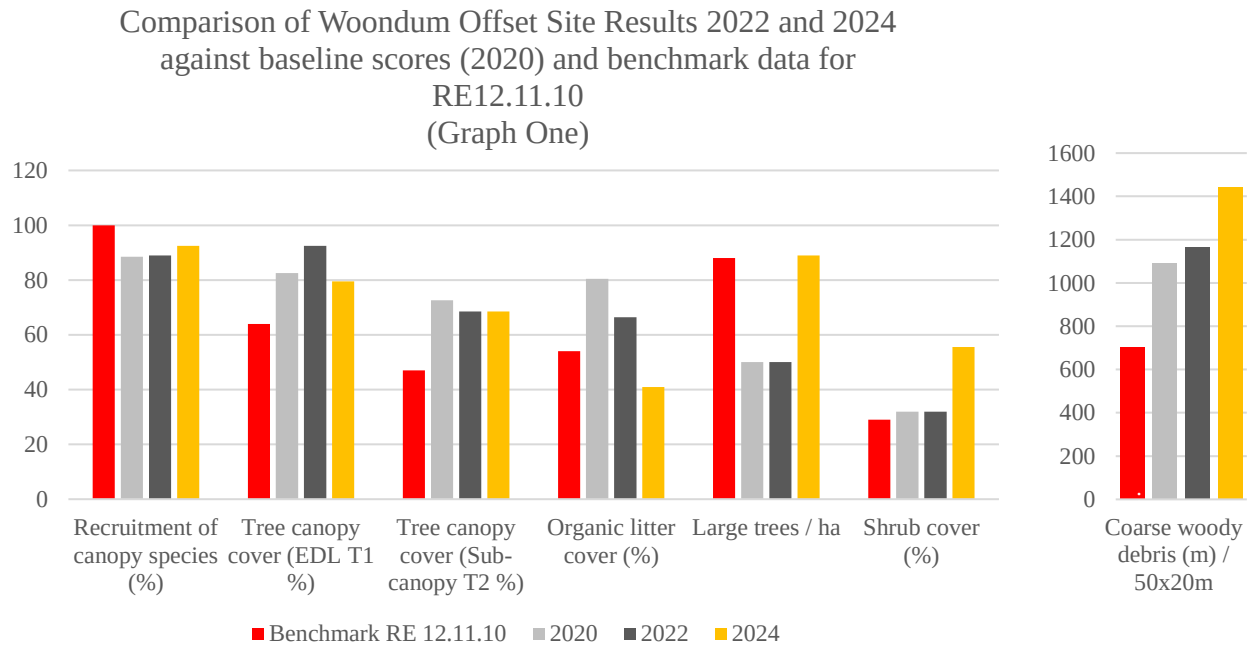


Figure 4.9 Comparison of Woondum monitoring results for 2020, 2022 and 2024 against benchmark (graph one)

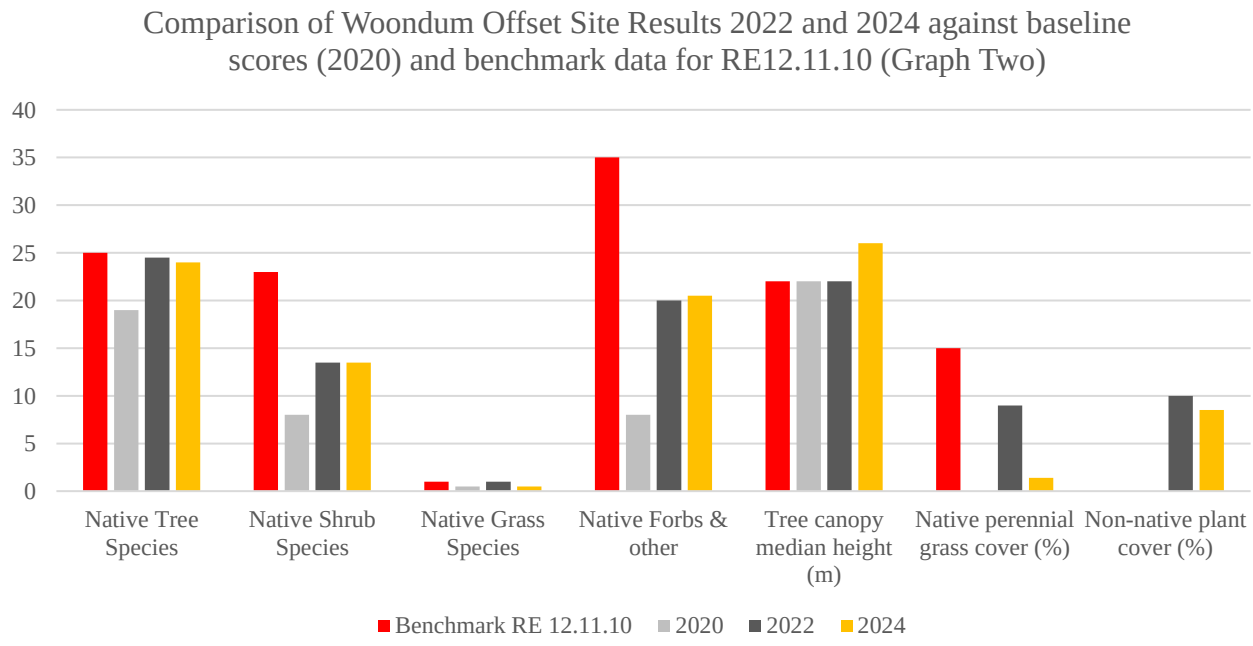


Figure 4.10 Comparison of Woondum monitoring results for 2020, 2022 and 2024 against benchmark (graph two)

5 Recommendations

This section provides recommended management actions required to improve the site condition for each offset area based on the findings of the monitoring. The purpose of the recommendations is to improve each offset area's overall habitat quality score over time. Recommendations have been split into the following categories:

- Weed Control and Buffer Zone Management
- Revegetation and Natural Regeneration.

5.1 Weed control and buffer zone management

5.1.1 Kawana offset area

Results of field surveys indicate there continues to be a low threat to the community at Kawana apart from several invasive plant species occurring within the vegetated buffer zone. Current weed management practices appear to be improving overall conditions within the offset site. It is recommended the maintenance of the buffer zone is continued through an annual weed control program targeting the weed species recorded during the monitoring surveys listed in Table 5.1, and any additional species that have recently established.

Table 5.1 Invasive plants and naturalised pastures Kawana Lowland Rainforest TEC vegetated buffer zone

Species name	Invasive plant status (DAF)
Digitaria violascens	Naturalised pasture
Ipomoea cairica	Other invasive
Lantana camara	Restricted invasive

The weed management area is shown on Figure 5.1, and in accordance with the requirements of the Project Draft Environmental Offsets Strategy (GHD 2019), it is also recommended that ongoing weed monitoring is undertaken within the buffer zone and at all weed monitoring sites established during the baseline survey.

5.1.2 Woondum offset area

It is recommended the best opportunity for improving the habitat score at Woondum is still to reduce the 'threat to species' associated with restricted invasive plant species. Of importance is the control of weeds associated with the threat to the community including Cats claw creeper (*Dolichandra unguis-cati*) as a priority, along with Chinese elm (*Celtis sinensis*) and Lantana (*Lantana camara*). As noted, Cats claw creeper will require many years of monitoring to ensure it does not re-establish from underground tubers.

The control of Lantana is showing signs of effectiveness throughout the monitoring area, with rainforest species showing increased signs of recruitment in areas where cover of Lantana has decreased. This indicates the current management practices are beginning to have positive impacts on the overall condition throughout the offset area. It is recommended the weed management area identified in the buffer zone and across the entire offset areas (refer Figure 5.2) continues to be maintained and managed through an annual weed control program targeting the weed species recorded during the baseline surveys, as listed in Table 5.2.

Table 5.2 Invasive plants and naturalised pastures Woondum Lowland Rainforest TEC vegetated buffer zone

Species name	Invasive plant status (DAF)
Ageratina riparia	Other invasive
Celtis sinensis	Restricted invasive
Dolichandra unguis-cati	Restricted invasive
Lantana camara	Restricted invasive
Passiflora suberosa	Other invasive
Rivina humilis	Environmental weed
Solanum mauritianum	Other invasive
Solanum seaforthianum	Environmental weed

5.2 Revegetation and natural regeneration

5.2.1 Kawana offset area

Revegetation plantings have been established throughout the Kawana TEC site since the 2020 baseline monitoring. It is evident from the increase in species richness of grass, forb and shrub species that these plantings are surviving, and this is having a positive effect on the overall condition of the offset site. No additional plantings are recommended following this round of monitoring.

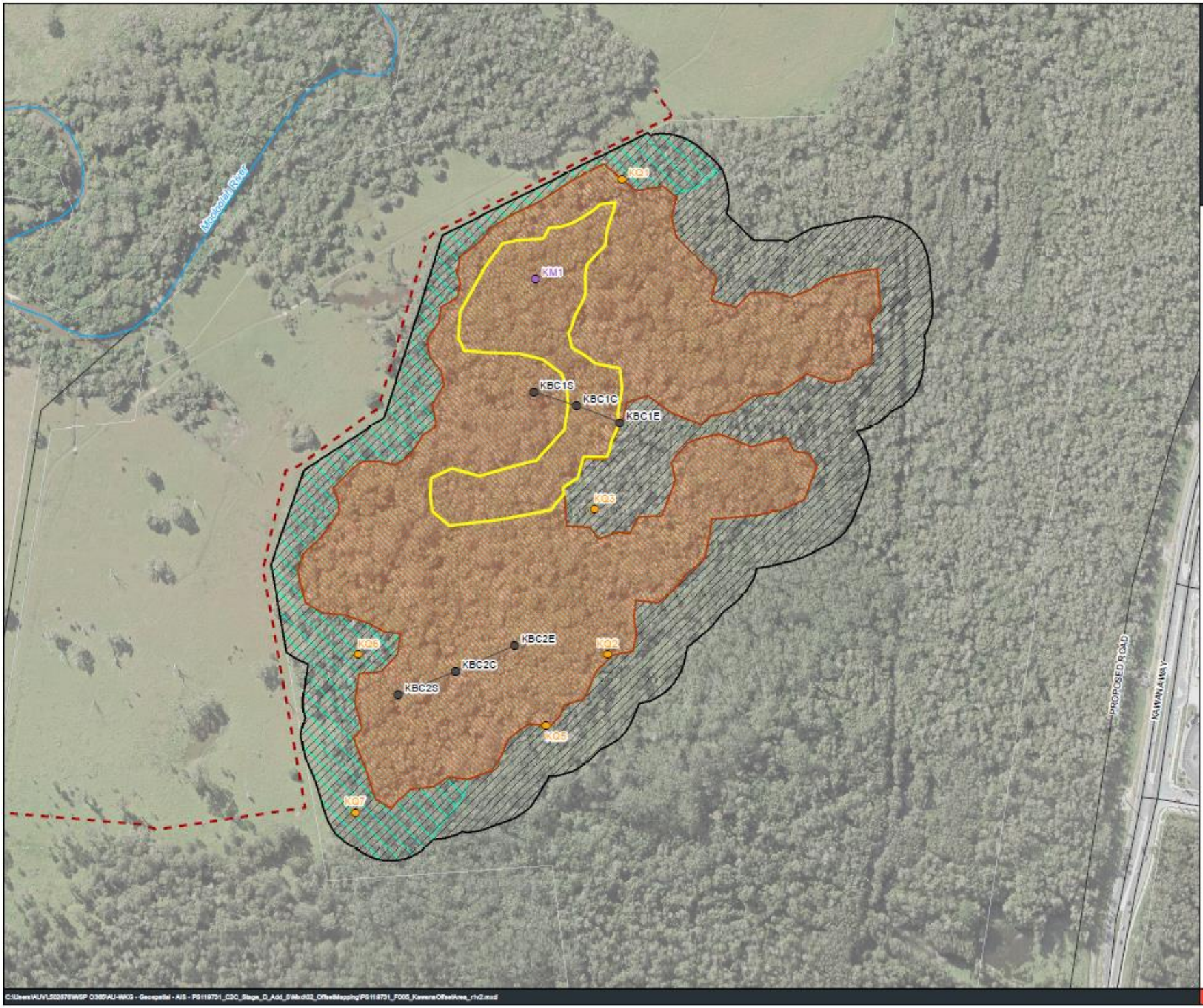
5.2.2 Woondum offset area

The results of the field surveys indicate that species richness has generally increased in all layers of vegetation at Woondum within the two BioCondition transects. The current annual weed management and revegetation planting program is having a positive impact on the overall condition at the offset. However, there is still room for improvement as native shrub and forb richness are still well below the benchmarks, and non-native plant cover is still well above the benchmark, particularly at WBC1. More rigorous weed control is required.

It is recommended that weed management is continued throughout the weed management area identified in 2020 (refer Figure 5.2). This should be followed by revegetation of species in Table 5.3, taken from a combination of the draft BioCondition Benchmarks for RE 12.11.10 (Queensland Herbarium 2019) and Appendix A of the Listing Advice, to improve species richness for the offsets area.

Table 5.3 Woondum offsets recommended species for revegetation

Revegetation strata	Recommended species	
Native Trees and Shrubs	*Acacia disparrima* *Acmena smithii* *Backhousia kingii* *Breynia oblongata* *Cleistanthus cunninghamii* *Ficus coronata* *Ficus fraseri*	*Mallotus discolor* *Melicope micrococca* *Pittosporum revolutum* *Pittosporum undulatum* *Aphananthe philippinensis* *Flindersia australis* *Flindersia schottiana*
Native Grasses	*Oplismenus aemulus* *Ancistrachne uncinulata*	
Native Forbs and other	*Pararistolochia praevenosa* *Lomandra hystrix* *Dianella caerulea*	



wsp

Cooroy to Curra
Lowland Rainforest TEC Monitoring

Figure 5.1
Kawana Offsets Area Management Areas

Legend

- BioCondition
- Weed Monitoring Site
- Photo Monitoring Site
- Proposed Access
- Transect
- Watercourse
- Cadastre
- Lowland Rainforest TEC
- Weed Management
- Recommended Revegetation Area
- Threatened Ecological Communities *(offset buffer)*

Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

1:3,500 Date: 4/11/2020

Data sources: - DNRME, TMR, Transitis, Geoscience Australia

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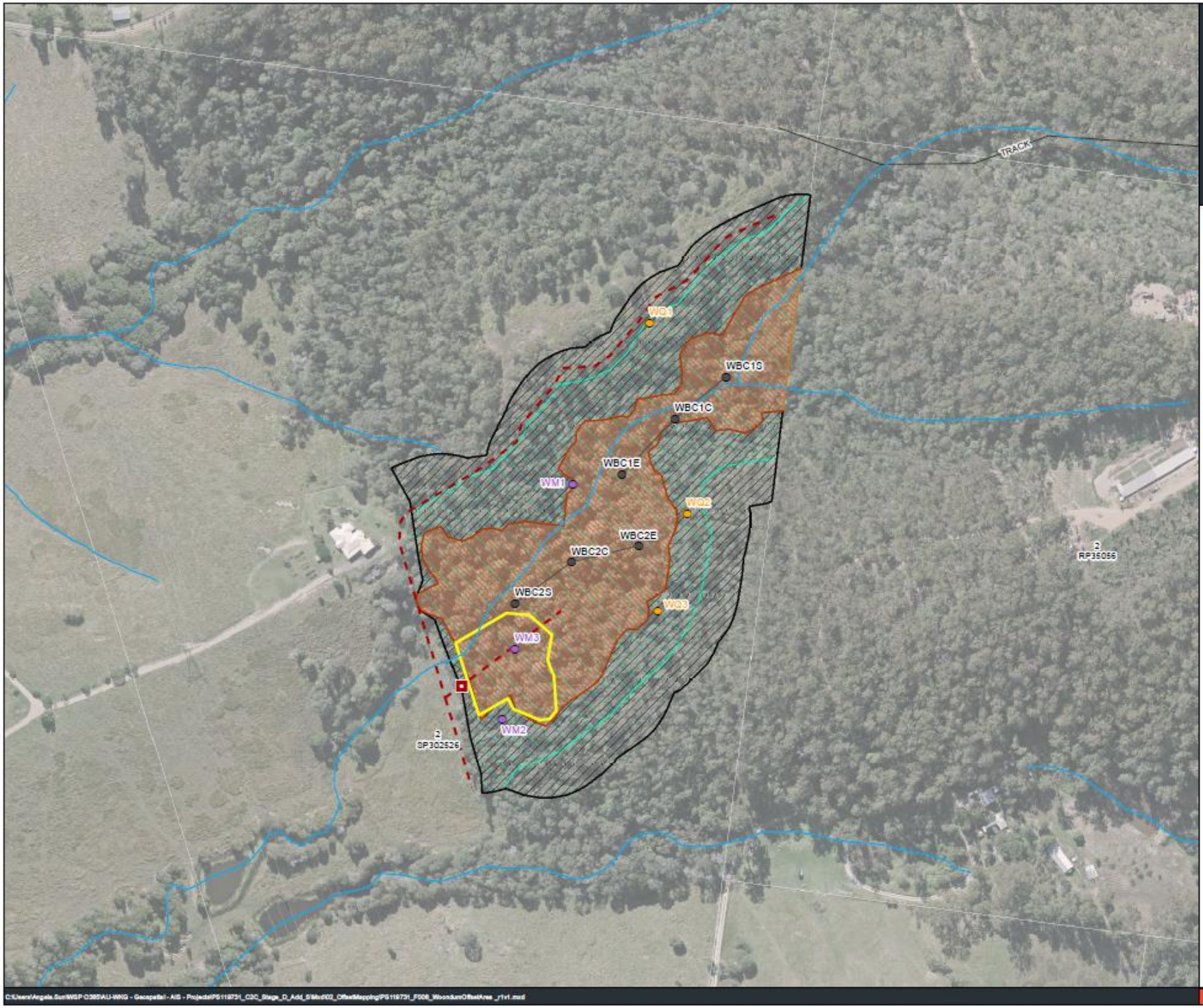

Cooroy to Curra
Lowland Rainforest TEC Monitoring

Figure 5.2
Woondum Offsets Area Management Areas

Legend

- BioCondition
- Weed Monitoring Site
- Photo Monitoring Site
- Proposed Access Gate
- Proposed Access Track
- Transect
- Watercourse
- Cadastre
- Lowland Rainforest TEC
- Weed Management Area
- Recommended Revegetation Area
- Threatened Ecological Communities *(offset buffer)*

Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

1:2,500 Date: 23-Sep-20

Data sources: - DNRME, TMR, Transitek, Geoscience Australia

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6 Limitations

6.1 Scope of services

This report has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or disturbance constraints.

6.2 Reliance on data

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

6.3 Environmental conclusions

In accordance with the scope of services, WSP has relied upon the data and has conducted environmental field surveys in the preparation of the report. The nature and extent of survey conducted is described in the report.

Varying degrees of non-uniformity are encountered across all natural areas. Hence no sampling technique can eliminate the possibility that results are not totally representative of conditions encountered. The conclusions are based upon the data and the ecological surveys and are therefore merely indicative of the environmental condition of the study area at the time of preparing the report.

Also, it should be recognised that conditions, including the presence of threatened biodiversity, can change with time. No sampling technique can eliminate the possibility that a species is present within the proposal area. For example, some flora may be present in the soil seed bank and some fauna species use habitats on a sporadic or seasonal basis and may not be present within the study areas during surveys.

Within the limitations imposed by the scope of services, the surveys and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

6.4 Report for benefit of client

The report has been prepared for the benefit of the client (and no other party). WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Except as provided below parties other than the client should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

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WSP (2022) Lowland Rainforest TEC Baseline Monitoring Report Kawana and Woondum Offset Areas 2022 Cooroy to Curra Stage D. Prepared for Department of Transport and Main Roads.

Appendix A

Suitably qualified person curriculum vitae

DARYL EVANS

Principal Botanist/Flora survey team lead

<1 year with WSP

20 years of experience

Location

Brisbane (900 Ann Street), Australia

Areas of expertise

Regional Ecosystem verification

Planning and approval development

Botanical curation

Ecological restoration

Ecological management

Conservation Management Plans

PROFILE

Daryl is a highly experienced Principal Botanist with 20 years' experience working across government, commercial, and not-for-profit sectors. Daryl specialises in holistic approaches to land and river-scape scale restoration and management and has successfully integrated community, government and commercial interests to achieve ecologically balanced and sustainable outcomes across multiple projects.

EDUCATION

Bachelor of Science (Honors), Griffith University	2016
Bachelor of Science – Ecology and Conservation Biology, Griffith University	2011

PROFESSIONAL ASSOCIATIONS

Ecological Society of Australia: Member	ESA
Environment Institute of Australian and New Zealand: Member	EIANZ
The International Association for Ecology	INTECOL

PROFESSIONAL EXPERIENCE

- **Brisbane Botanic Gardens & High-Profile Parks, Queensland (2020-2023). Brisbane City Council: Assistant Curator**

  Coordinated the development of planning and scheduling activities to support the ongoing delivery of Horticultural and Natural Area maintenance and Asset Management at Sherwood Arboretum, ensuring all work complies with Brisbane City Council policies, relevant legislation and industry best practice. Provided direct support via planning and operational delivery for the Curator and Manager of High Profile Parks (HPP) which includes the Mount Coot-tha and City Botanic Gardens, Sherwood Arboretum and the Brisbane's designated High Profile Parks.

- **Brisbane City Council, Queensland (2019-2020): Habitat Brisbane Officer**

  Scoped, procured and managed ecological restoration works across 30 project sites. Demonstrated knowledge and experience of nature conservation principles, bushland rehabilitation principles and practices and knowledge of native flora, fauna and invasive species. Lead performance through setting clear direction and expectations, providing support and feedback and monitoring on-going performance of individuals and the team. Delivered multiple training events for Habitat Groups. Built strong working relationships with internal Natural Areas, Parks, Roads & Drainage, Arbor and Contracts teams to deliver multiple projects. Undertake flora, fauna and habitat assessments and provide appropriate ecological advice regarding their management.

- **Natural Area Operations, Logan, Queensland (2018-2019). Logan City Council: Parks Communities Officer**

  Ecological profiling (flora, fauna and habitat assessments) of all project sites and subsequent scoping, project planning, procurement and management of ecological restoration works across these projects' sites in-line with best practice ecological restoration methods. Delivered community volunteer programs including the Logan Community Bushcare Program, Trail Care Program, mountain bike projects, corporate volunteer opportunities. Plan and assist Community Groups to implement community environmental restoration projects in bushland and riparian areas. Develop, review and deliver environmental engagement talks and public speaking related to environmental restoration and other branch based environmental education initiatives.

- **Waterways & Catchments Team / Environmental Projects Team, Logan, Queensland (2017-2018). Logan City Council: Senior Environmental Officer**

  Scope, procure and manage Councils premier restoration projects including the Belivah Creek Endangered Lowland Rainforest Restoration Project, Logan and Albert Riverside Restoration Projects, maintain and improve the constructed fish passages while also managing a broad portfolio of restoration projects across the city. Mentoring and guiding junior staff. Responsibilities included preparing Technical reports/advice to internal and external stakeholders, Develop and review Council's policies, planning scheme instruments, local laws and strategic plans and Plan and implement complex projects that are regionally focused, have significant impact on Council's activities and operations and require high level negotiation with multiple stakeholders.

- **Bushcare Services, Brisbane (2016-2017): Restoration Ecologist & Field Supervisor**

  Lead multiple field teams undertaking ecological restoration across multiple Council areas. Trained and mentored junior staff in bushland management & restoration methods. Responsibilities included:

  - Ecological restoration of bushland areas within SEQ.
  - Undertook/supervised on-ground restoration works.
  - Ensured WHS and development plans/policies are implemented in the field.
  - Flora and fauna identification.

- **Management Committee Member - Bulimba Creek Catchment Coordinating Committee (B4C), Brisbane (2003-2016): Catchment Ecologist; Coordinator: Science & Planning Team; Field Crew Supervisor**

  B4C Management Committee Member (ex-officio); Conducted flora, fauna and habitat surveys of the entire Bulimba Creek catchment area along with the associated ecological restoration programs. Provide high level technical advice to B4C management/staff regarding ecological management outcomes on a catchment wide scale. Multiple environmental positive outcomes through action in the Queensland Planning & Environment Court. Worked with multiple stakeholders to secure 250ha of inner-city bushland to create a wildlife corridor network linking the Brisbane River to Bulimba Creek and Brisbane Koala Bushland. Developed and led the Catchment Science & Planning Team. Led multiple environmental campaigns. Provide training and mentoring to junior staff and associated programs such as Green Army. Developed working relationships with government officers and politicians at all levels. Undertake rehabilitation of bushlands, environmental corridors, waterways and wetlands in line with B4C objectives.

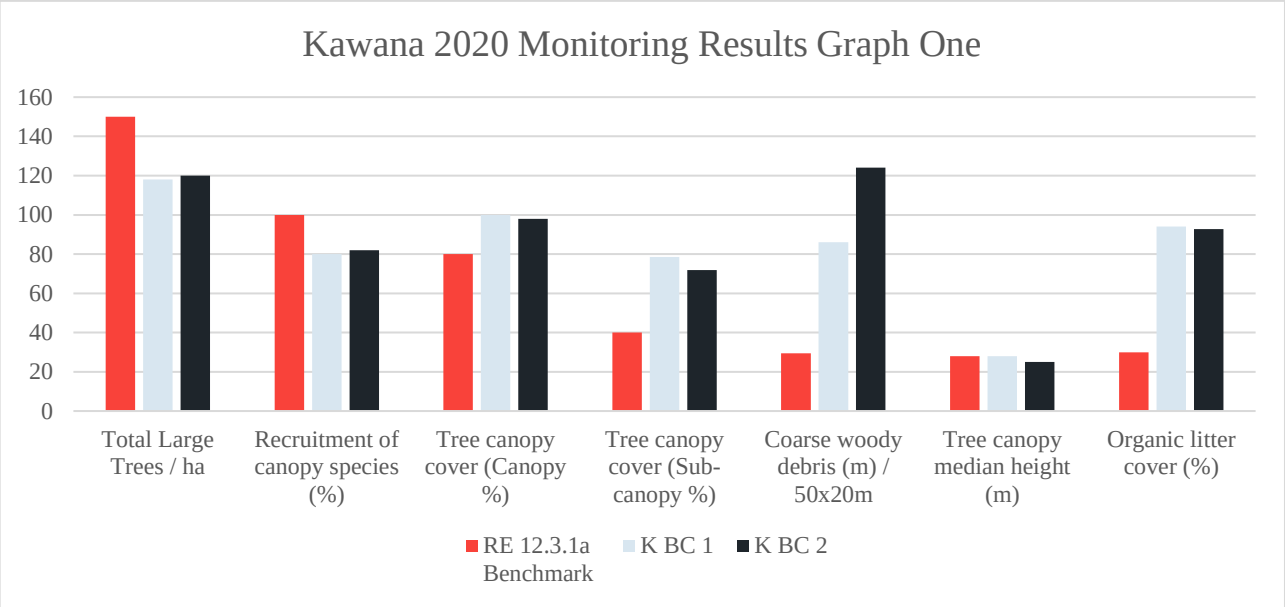
PROFESSIONAL HISTORY

WSP	2023 – Present
Brisbane City Council	2019 – 2023
Logan City Council	2017 – 2019
Bushcare Services	2016 – 2017
Bulimba Creek Catchment Coordinating Committee (B4C)	2003 – 2016
Parsons Brinckerhoff	2012-2014

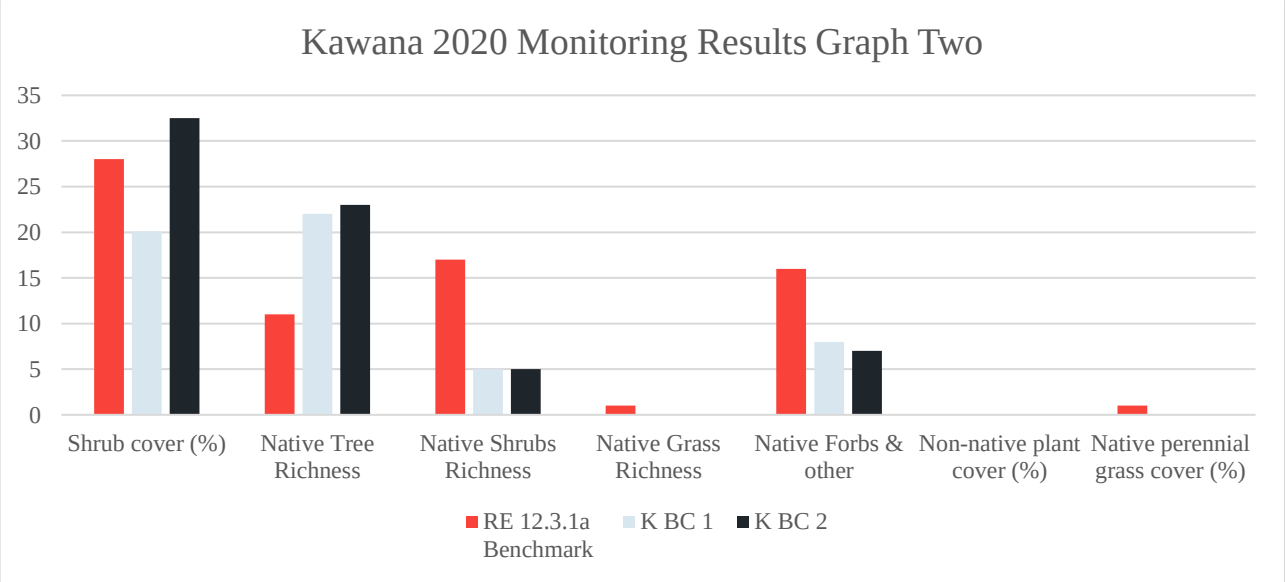
Appendix B

Baseline vegetation site survey results and species lists

B1 Kawana baseline monitoring graphs



Kawana 2020 BioCondition monitoring results comparison against benchmarks (graph one)



Kawana 2020 BioCondition monitoring results comparison against benchmarks (graph two)

B2 Kawana baseline vegetation site survey results

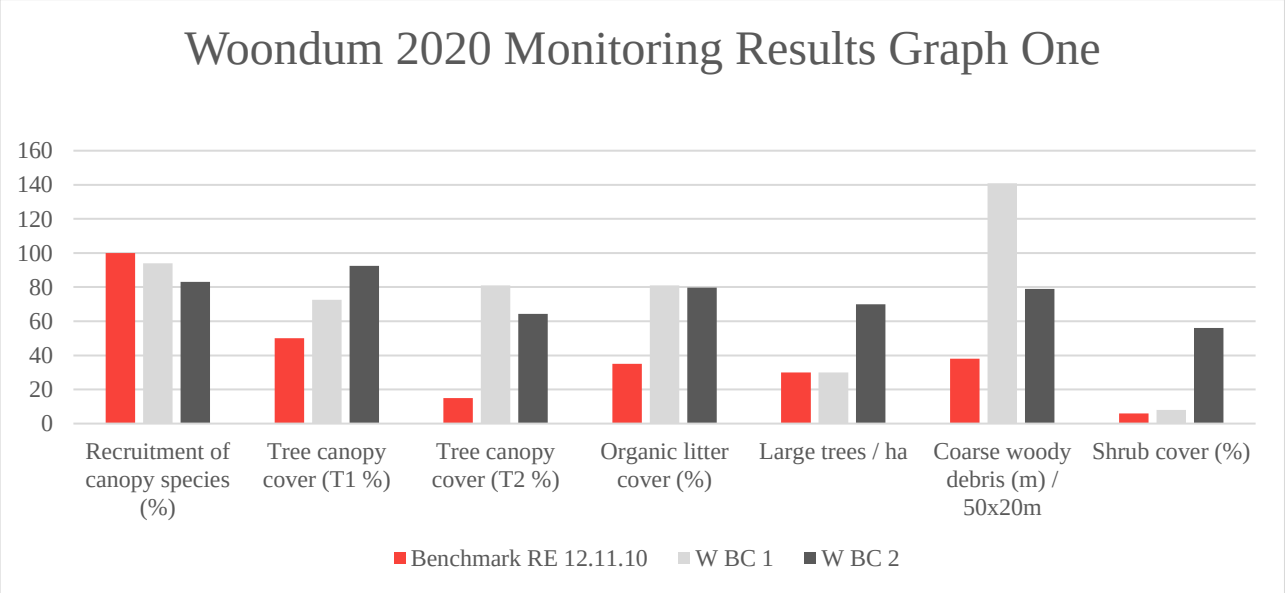
Survey sites		KBC1	KBC2	KQ1	KQ2	KQ3	KQ4	KQ5	KQ6	KQ7
Field verified regional ecosystems (RE)		RE12.3.1a	RE12.3.1a	12.3.5	12.3.2	12.3.5	12.3.1a	12.3.5	12.3.5	12.3.5/12.3.2
Ecological dominant layer (EDL)		T1	T1	T1	T1	T1	T1	T1	T1	T1
EDL median height (m)		28	25	22	35	25	25	30	23	28
EDL Canopy Cover % (estimated Quaternary sites)		100	98	90	55	65	100	60	70	75
Species Name	**Lowland Rainforest TEC Appendix A Flora Species**									
Adiantum atroviride		X								
Adiantum hispidulum			X							
Alocasia brisbanensis		X	X							
Alphitonia excelsa	X	X	X	X		X			X	
Alpinia caerulea		X	X					X		
Archidendron grandiflorum		X								
Archontophoenix cunninghamiana	X	X	X		X		X	X		
Argyrodendron trifoliolatum	X						X			
Atractocarpus chartaceus	X	X	X							
Austrosteenisia blackii		X	X							
Beilschmiedia obtusifolia	X		X							
Blechnum indicum	X	X								
Calamus muelleri	X	X	X					X		
Castanospermum australe	X	X	X							
Christella dentata			X		X				X	

Survey sites		KBC1	KBC2	KQ1	KQ2	KQ3	KQ4	KQ5	KQ6	KQ7
Cissus antarctica	X	X								
Commersonia bartramia	X	X	X			X				
Cordyline rubra	X	X	X			X			X	
Crinum pedunculatum		X	X							
Croton verreauxii		X	X							
Cryptocarya obovata	X	X	X							
Cryptocarya triplinervis		X	X							
Cupaniopsis anacardioides			X							
Cyperus exaltus			X		X				X	
Cyperus polystachyos		X								
*Digitaria violascens**										X
Diospyros pentamera	X	X	X							
Diploglottis australis	X	X								
Endiandra discolor		X	X							
Eucalyptus grandis		X			X					X
Eucalyptus microcorys										X
Eustrephus latifolius	X	X								
Ficus fraseri	X	X	X							
Ficus obliqua	X	X					X			
Ficus watkinsiana	X	X	X			X	X			
Flagellaria indica		X								
Freycinetia scandens		X			X					
Geitonoplesium cymosum	X	X	X							
Glochidion sumatranum		X	X	X	X	X		X	X	X

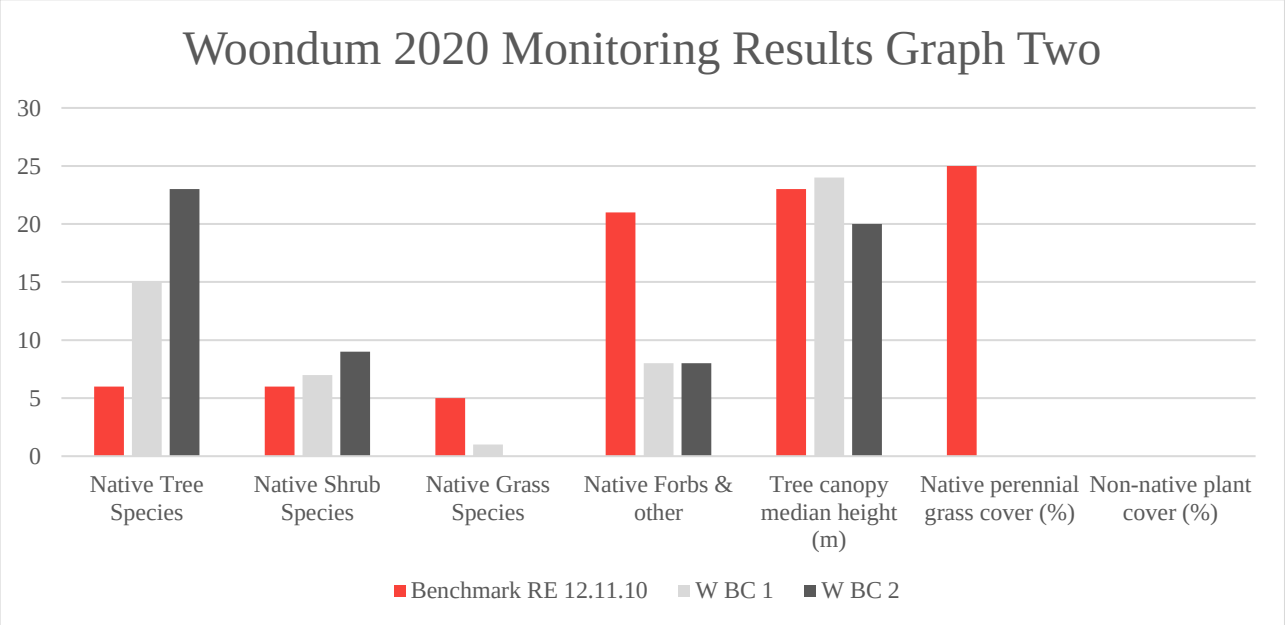
Survey sites		KBC1	KBC2	KQ1	KQ2	KQ3	KQ4	KQ5	KQ6	KQ7
Goodenia rotundifolia		X								
Gossia bidwillii	X		X							
Guioa semiglauca	X	X	X							
Halfordia kendack										
Helicia glabriflora	X	X	X							
*Ipomoea cairica***			X							
Jagera pseudorhus	X	X								
*Lantana camara***										X
Livistona australis	X	X	X	X	X	X			X	
Lomandra hystrix		X	X							
Lophostemon suaveolens		X		X					X	
Maclura cochinchinensis	X		X							
Melaleuca quinquenervia		X	X	X		X			X	X
Melicope elleryana		X	X							
Melodinus acutifolius		X	X			X				X
Microsorum pustulatum			X							
Mischocarpus pyriformis		X								
Mucuna gigantea		X								
Oplismenus aemulus		X	X							X
Oxalis sp		X								
Parsonsia straminea	X	X	X		X					
*Paspalum scrobiculatum**										
Pittosporum multiflorum	X	X	X							
Planchonella australis	X	X	X							

Survey sites		KBC1	KBC2	KQ1	KQ2	KQ3	KQ4	KQ5	KQ6	KQ7
Pothos longipes		X	X							
Ripogonum album		X	X							
Sloanea australis	X	X	X							
Sloanea woollsii	X	X	X							
Smilax australis	X	X						X		
Stenocarpus sinuatus			X							
Streblus brunonianus		X	X							
Symplocos thwaitesii		X	X							
Syzygium francisii	X	X	X		X					
Syzygium luehmannii		X	X							
Syzygium oleosum		X				X				
Trophis scandens		X	X	X	X					
Wilkiea huegeliana	X	X								
Sub totals	**33**	**60**	**50**	**6**	**10**	**9**	**4**	**5**	**8**	**8**
Total native tree species		**23**	**21**	**5**	**5**	**7**	**4**	**2**	**5**	**4**
Total exotic species * and exotic invasive plant species**	**4**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
Total shrub tree species		**23**	**22**							
Total forbs and other		**19**	**18**							
Total native grasses		**1**	**1**							
Proportion of canopy recruiting %		**90**	**90**							
Total Species	**76**									

B3 Woondum baseline monitoring graphs



Woondum 2020 BioCondition transect comparison results against benchmarks (Graph One)



Woondum 2020 BioCondition transect comparison results against benchmarks (Graph Two)

B4 Woondum baseline vegetation site survey results

Survey sites		WBC1	WBC2	WQ1	WQ2	WQ3	WQ4
Field verified regional ecosystems (RE)		12.11.10	12.11.10	12.11.5 (HVR)	12.11.3	12.11.5	12.11.10 (HVR)
Ecological dominant layer (EDL)		T1	T1	T1	T1	T1	T1
EDL median height (m)		24	20	8	20	20	18
EDL Canopy Cover % (estimated Quaternary sites)		72.5	88.5	30	40	40	20
Species Name	**Lowland Rainforest TEC Appendix A Flora Species**						
Acacia disparrima			X				X
Acacia glaucophylla							
Acacia irrorata subsp. velutinella		X					
Acacia maidenii		X		X		X	
Acronychia laevis		X			X		
Actephila lindleyi	X		X				
Adiantum hispidulum		X	X				
Adiantum silvaticum			X				
*Ageratina riparia**					X		
Alchornea ilicifolia			X				
Alectryon tomentosus		X	X				
Alphitonia excelsa	X	X		X			
Alyxia ruscifolia		X	X				
Aphananthe philippinensis	X	X	X				
Araucaria cunninghamiana	X	X	X				

Survey sites		WBC1	WBC2	WQ1	WQ2	WQ3	WQ4
Argyrodendron trifoliolatum	X		X				
Argyrodendron sp. (Kin Kin W.D.Francis AQ81198)			X				
Arytera distylis	X		X				
Arytera divaricata		X					
Asplenium attenuatum		X	X				
Atractocarpus chartaceus	X		X				
Austrosteenisia blackii			X				
Backhousia subargentea			X				
Bosistoa medicinalis							
Callicarpa pedunculata		X					
Capparis arborea	X	X	X				
*Celtis sinensis***							X
Cissus antarctica	X		X				
Cissus oblonga		X	X				
Clerodendrum tomentosum							
Commersonia bartramia	X	X					
Cordyline rubra	X	X	X				
Corymbia citriodora var. variegata		X		X		X	
Corymbia intermedia					X		
Croton insularis							
Croton stigmatosus			X				
Croton verreauxii		X					
Cryptocarya laevigata							

Survey sites		WBC1	WBC2	WQ1	WQ2	WQ3	WQ4
Cryptocarya triplinervis var. pubens			X				
Cupaniopsis parvifolia							
Cupaniopsis serrata	X						
Cyperus haspan			X				
Dendrobium spp.			X				
Dianella caerulea var. caerulea		X					
Dioscorea transversa	X	X	X				
Diospyros fasciculosa		X					
Dissiliaria baloghioides							
*Dolichandra unguis-cati***		X				X	
Doodia aspera		X					
Drypetes deplanchei		X	X				
Erythroxylon australe							
Eucalyptus acmenoides					X		
Eucalyptus propinqua var. propinqua				X		X	
Eucalyptus siderophloia				X	X		
Eustrephus latifolius	X		X				
Everistia vacciniifolia		X	X				
Flindersia australis	X		X				
Flindersia schottiana	X		X				
Gahnia melanocarpa		X	X				
Geitonoplesium cymosum	X	X	X				
Gossia acmenoides			X				
Gossia bidwillii	X	X	X				

Survey sites		WBC1	WBC2	WQ1	WQ2	WQ3	WQ4
Guioa semiglauca	X	X	X				
Gymnostachys anceps		X					
Hibiscus heterophyllus		X	X		X		
Jagera pseudorhus	X	X		X			
*Lantana camara***		X	X	X	X	X	X
Lastreopsis decomposita			X				
Lastreopsis marginans			X				
Lophostemon confertus	X	X		X	X		
Mallotus philippinensis	X	X	X	X	X	X	
Medicosma cunninghamii			X				
Melia azedarach	X						X
Mischocarpus pyriformis			X				
Myrsine variabilis		X					
Oplismenus aemulus							
Oplismenus imbecilis		X	X				
Pandorea baileyana		X					
*Passiflora suberosa***		X	X	X	X	X	
Pellaea paradoxa		X	X				
Pilidiostigma rhytispermum		X					
Pittosporum ferrugineum			X				
Pittosporum multiflorum	X		X				
Pittosporum revolutum	X	X	X				
Platycerium superbum	X		X				
Pollia crispata	X	X	X				

Survey sites		WBC1	WBC2	WQ1	WQ2	WQ3	WQ4
Polyalthia nitidissima		X					
Polyscias elegans	X	X	X	X	X		
Psychotria daphnoides f. 'large-leaved'		X	X				
Psychotria loniceroides		X	X				
Psydrax odorata		X	X				
Pseuderanthemum variabile		X	X				
Rhodamnia dumicola							
Rhodamnia rubescensCR	X	X					
Ripogonum album		X	X				
Ripogonum discolor			X				
*Rivina humilis***		X	X				
Sarcopteryx stipata	X	X					
Sloanea australis	X						
Smilax australis	X	X	X				
Solanum aviculare							
*Solanum mauritianum**			X				
*Solanum seaforthianum***		X	X			X	
Stenocarpus sinuatus			X				
Streblus brunonianus		X	X				
Syzygium luehmannii		X	X				
Tabernaemontana pandacaqui	X		X				
Tapeinosperma repandulum			X				
Tragia novae-hollandiae		X					
Vitex lignum-vitae			X				

Survey sites		WBC1	WBC2	WQ1	WQ2	WQ3	WQ4
Wilkiea austroqueenslandica		X	X				
Wilkiea macrophylla		X					
Sub totals	**33**	**34**	**46**	**11**	**11**	**8**	**4**
Total native tree species		**15**	**24**	**9**	**6**	**4**	**2**
Total exotic species * and exotic invasive plant species**	**7**	**3**	**5**	**2**	**3**	**4**	**2**
Total shrub tree species		**7**	**9**				
Total forbs and other		**8**	**8**				
Total native grasses		**1**	**0**				
Proportion of canopy recruiting %		**94**	**83**				
Total Species	**112**						

Appendix C

Site photos and monitoring points

C1 Kawana site photos

Photo C.1 Kawana BC 1 North 2020

Photo C.2 Kawana BC 1 East 2020

Photo C.3 Kawana BC 1 South 2020

Photo C.4 Kawana BC 1 West 2020

Photo C.5 Kawana BC 2 North 2020

Photo C.6 Kawana BC 2 East 2020

Photo C.7 Kawana BC 2 South 2020

Photo C.8 Kawana BC 2 West 2020

Photo C.9 Kawana BC 2 North 2022

Photo C.10 Kawana BC 2 East 2022

Photo C.11 Kawana BC 2 South 2022

Photo C.12 Kawana BC 2 West 2022

Kawana ground quadrats KBC1

Kawana ground quadrats KBC2

C2 Woondum site photos

Photo C.13 Woondum BC 1 North 2020

Photo C.14 Woondum BC 1 East 2020

Photo C.15 Woondum BC 1 South 2020

Photo C.16 Woondum BC 1 West 2020

Photo C.17 Woondum BC 1 North 2022

Photo C.18 Woondum BC 1 East 2022

Photo C.19 Woondum BC 1 South 2022

Photo C.20 Woondum BC 1 West 2022

Photo C.21 Woondum BC 2 North 2020

Photo C.22 Woondum BC 2 East 2020

Photo C.23 Woondum BC 2 South 2020

Photo C.24 Woondum BC 2 West 2020

Photo C.25 Woondum BC 2 North 2022

Photo C.26 Woondum BC 2 East 2022

Photo C.27 Woondum BC 2 South 2022

Photo C.28 Woondum BC 2 West 2022

BC1 Ground Quadrats

BC2 Ground Quadrats

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