



Offset Proposal Reserve 14301 – ‘Lake Caitup’ (and Adjoining Undeveloped Road Reserve)

For Shire of Esperance Strategic Purpose Permit CPS 10154

Prepared by:

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1 Summary

Reserve 14301, referred to in this report as 'Lake Caitup' after the natural waterbody within it, is a 54-ha reserve currently zoned as Public Open Space and purposed for 'Tourist, Picnic and Water' use. Reserve 14301 boasts an ecologically mosaic of vegetation assemblages, including *Melaleuca cuticularis* wetlands, *Nuytsia floribunda* over heath and *Banksia speciosa* shrublands.

Reserve 14301 and the adjacent undeveloped road reserve (13 ha) are proposed to be used as a conservation offset by the Shire of Esperance for the extensively-cleared Beard (1973) Vegetation Association (BVA) Esperance 6048, and for Carnaby's Black Cockatoo foraging habitat. The reserve is situated within agricultural land primarily utilised for sheep grazing, with the undeveloped road reserve connecting Reserve 14301 to the adjacent Helms Arboretum.

Reserve 14301 was surveyed by the Shire of Esperance Environmental Team on the 06/02/2024, consisting of Katherine Walkerden (Environmental Officer), Julie Waters (Environmental Coordinator) and Kahree Garnaut (Environmental Officer). Vegetation condition within the reserve ranged from excellent to completely degraded, with the majority of the vegetation existing in an Excellent or Very Good condition. Lake Caitup within the reserve was observed to be well-used by numerous shorebirds and large flocks of waterfowl, indicating the ecological importance of this waterbody, and therefore pertinence of maintaining its ecological integrity.

A large section of the reserve has been fenced off by the neighbouring landholder and managed as if it were his own farmland. The Shire of Esperance is currently examining the potential for exchanging this land for remnant vegetation immediately to the west of Reserve 14301.

2 Area Description

Reserve Name:	Unnamed Reserve and Undeveloped Road Reserve	Reserve No.	Reserve 14301
Named Features:	Lake Caitup	NRM Region:	South Coast
Location No.	Lot: 571 on Plan: 089151	Shire:	Esperance
Vesting:	Shire of Esperance	Nearest Towns:	Gibson, Esperance
Current Purpose:	"Tourist, Picnic and Water Supply" and "Road"	Nearest Roads:	South Coast Highway
Zoning:	Public Open Space	Map reference:	382431m E, 6267632m N
Area of Reserve:	67.976 ha (total) 54.653 ha (Reserve 14301) 13.322 ha (Undeveloped Road Reserve)	IBRA Sub Region:	Recherche



Figure 1: Contextual map of Reserve 14301 and undeveloped road reserve, Gibson.

Reserve 14301 'Lake Caitup' and Adjoining Undeveloped Road Reserve - Offset Proposal

3 Regional Context

Reserve 14301 is located approximately 17 km north-west of the Esperance Townsite and 10 km south-west of the Gibson Townsite. The regional landscape is highly fragmented due to agricultural clearing. The reserve is situated approximately 2 km from the Helms Forestry Reserve (Reserve 23527), connected via an undeveloped road reserve providing an important ecological linkage between the two habitat refugia. Helms Forestry Reserve is a 3747-ha reserve currently vested for forestry purposes which is planned to have a majority of its tenure changed to an A Class Nature Reserve (DEC, CCWA, 2012).

Reserve 14301 is mapped as containing the Beard Vegetation Associations Esperance 6048 and Esperance 27. VA 6048 vegetation association has been highly cleared for agricultural purposes, with only 14.21% of the original extent remaining. In addition, it is inadequately represented by the IUCN CAR system where only 0.97% of its pre-European extent is protected under conservation covenant.

Esperance 6048 is an appropriate vegetation association match for Vegetation Type A: *Nuytsia floribunda* and *Banksia speciosa* Low Woodland with Myrtaceous Shrubland over *Anarthria laevis* and *Anarthria scabra* Sedgeland, and Vegetation Type D: *Nuytsia floribunda* Low Open Woodland over Open Heathland with Restiad Closed Sedgeland. Esperance 27 is an appropriate vegetation association match for Vegetation Types B: *Melaleuca cuticularis* Closed Forest with *Juncus* Rushland and Vegetation Type C: *Melaleuca cuticularis* Low Open Woodland with *Melaleuca brevifolia* Tall Open Shrubland with *Austrostipa juncifolia* Grassland.

Table 1: Statistics for Beard Vegetation Association Esperance 6048.

Beard Vegetation Association	Esperance 6048	Esperance 27
Description	Shrublands; banksia scrub- heath on sandplains	Low woodland; paperbark (<i>Melaleuca</i> sp.)
Pre-European extent remaining	14.21%	70.95%
Pre-European extent remaining within the Shire of Esperance	14.21%	40.82%
Pre-European extent remaining within Recherche IBRA Sub-region	14.16%	40.82%
Pre- European extent in land protected for conservation	0.97%	54.44%

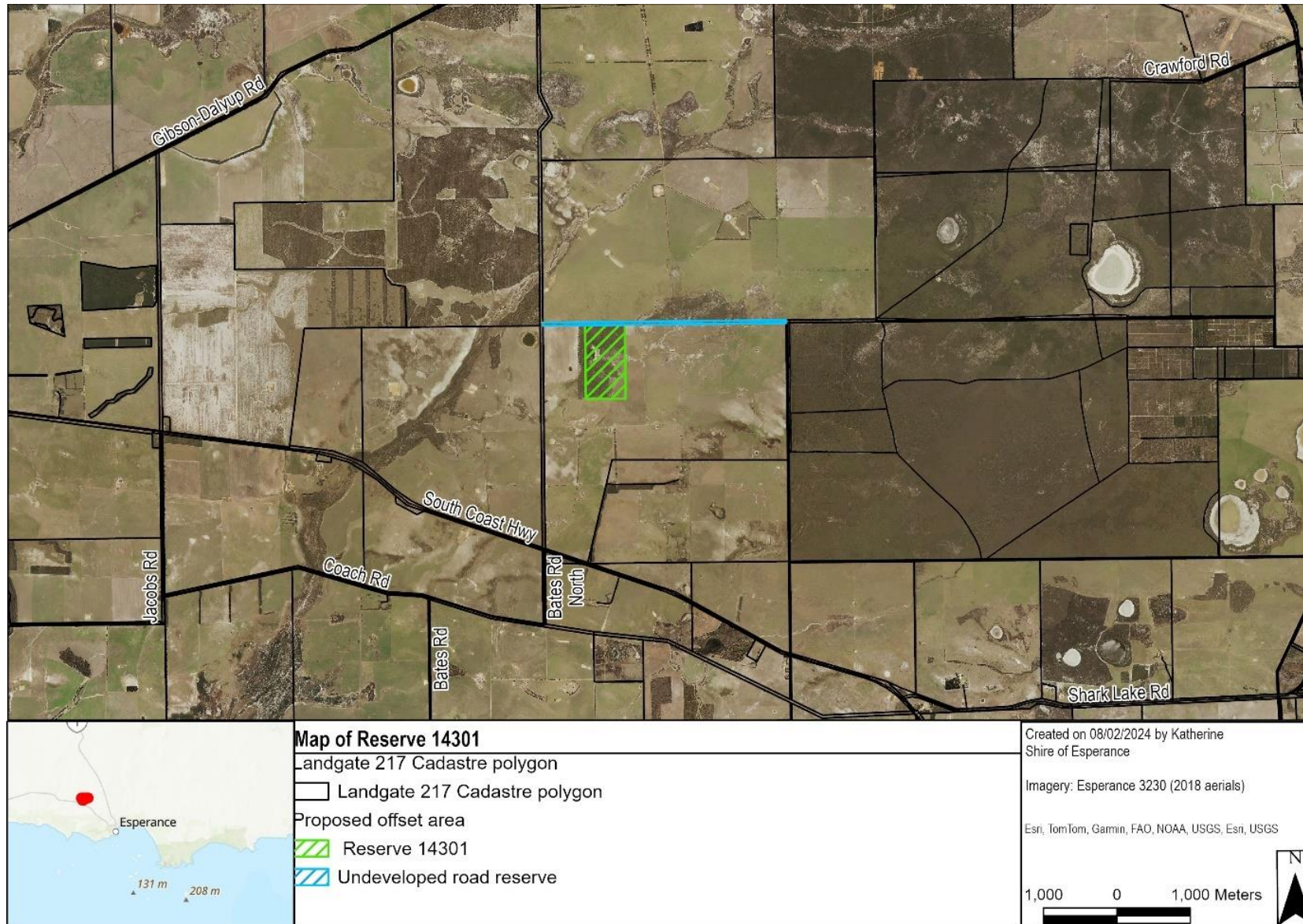


Figure 2: Regional context of Reserve 14301 and neighbouring undeveloped road reserve.

4 Asset Values

Table 2: Natural assets and their corresponding values for Reserve 14301.

Natural Asset	Description
Landform	<ul style="list-style-type: none"> ▪ Gently undulating plain, 1-3% slope ▪ Depressions ▪ Open depressions and ephemeral water courses
Soils	<ul style="list-style-type: none"> ▪ Deep uniform sand, Podzol > 80 cm (Corinup), Uc2.22 ▪ Saline wet soils with minor grey deep sandy duplex soils ▪ Salt affected soils with surface salt crusting
Geology/Regolith	<ul style="list-style-type: none"> ▪ Quaternary aeolian sand overlying Tertiary sediments of the Pallinup formation ▪ Tertiary marine sediments of the Pallinup formation over granite and gneiss bedrock
Threatened and Priority Flora	<ul style="list-style-type: none"> ▪ <i>Dampiera sericantha</i> – Priority 3 – KSW0224 ▪ <i>Kunzea salina</i> - Priority 3 - KSW00424 ▪ <i>Austrobaeckea uncinella</i> – Priority 3 - KSW00524
Native Fauna	20 species of native fauna were positively identified within the reserve and adjoining road reserve.
Mapped Beard Vegetation Associations	Esperance 6048 - Shrublands; banksia scrub-heath on sandplains. Esperance 27 - Low woodland; paperbark (<i>Melaleuca</i> sp.)
Catchment	Lake Gore catchment.
European Evidence	The site has been intensively grazed by the neighbouring landholder's sheep.
Aboriginal Heritage	No Registered Aboriginal Heritage Sites are listed for the reserve.
Recreational Activity	A single firepit was found within the reserve. No other evidence of recreational activity was found.
Fire	No recent fire history.

4.1 Vegetation Communities

In 2024, the vegetation communities of the reserves were mapped using a combination of aerial photography interpretation and ground truthing. Additional high-resolution drone orthomosaics will be produced in 2024 and these vegetation maps will be further refined.

Reserve 14301 and the undeveloped road reserve consists of five vegetation communities:

- A) *Nuytsia floribunda* and *Banksia speciosa* Low Woodland with Myrtaceous Shrubland over *Anarthria laevis* and *Anarthria scabra* Sedgeland.
 - Sandy soil
 - 21.310 ha
- B) *Melaleuca cuticularis* Closed Forest with *Juncus* Rushland.
 - Wetland vegetation
 - 6.235 ha
- C) *Melaleuca cuticularis* Low Open Woodland with *Melaleuca brevifolia* Tall Open Shrubland with *Austrostipa juncifolia* Grassland.
 - Occurring in degraded floodway
 - 15.374 ha
 - Heavily grazed
- D) *Nuytsia floribunda* Low Open Woodland over Open Heathland with Restiad Closed Sedgeland.
 - Sandy soil
 - 16.220 ha
 - Heavily grazed
- E) *Eucalyptus littorea* Open Woodland over *Melaleuca cuticularis*, *Melaleuca brevifolia* and *Melaleuca scabra* Shrubland with *Gahnia ancistrophylla*.
 - 0.346 ha
 - Saline waterlogging present

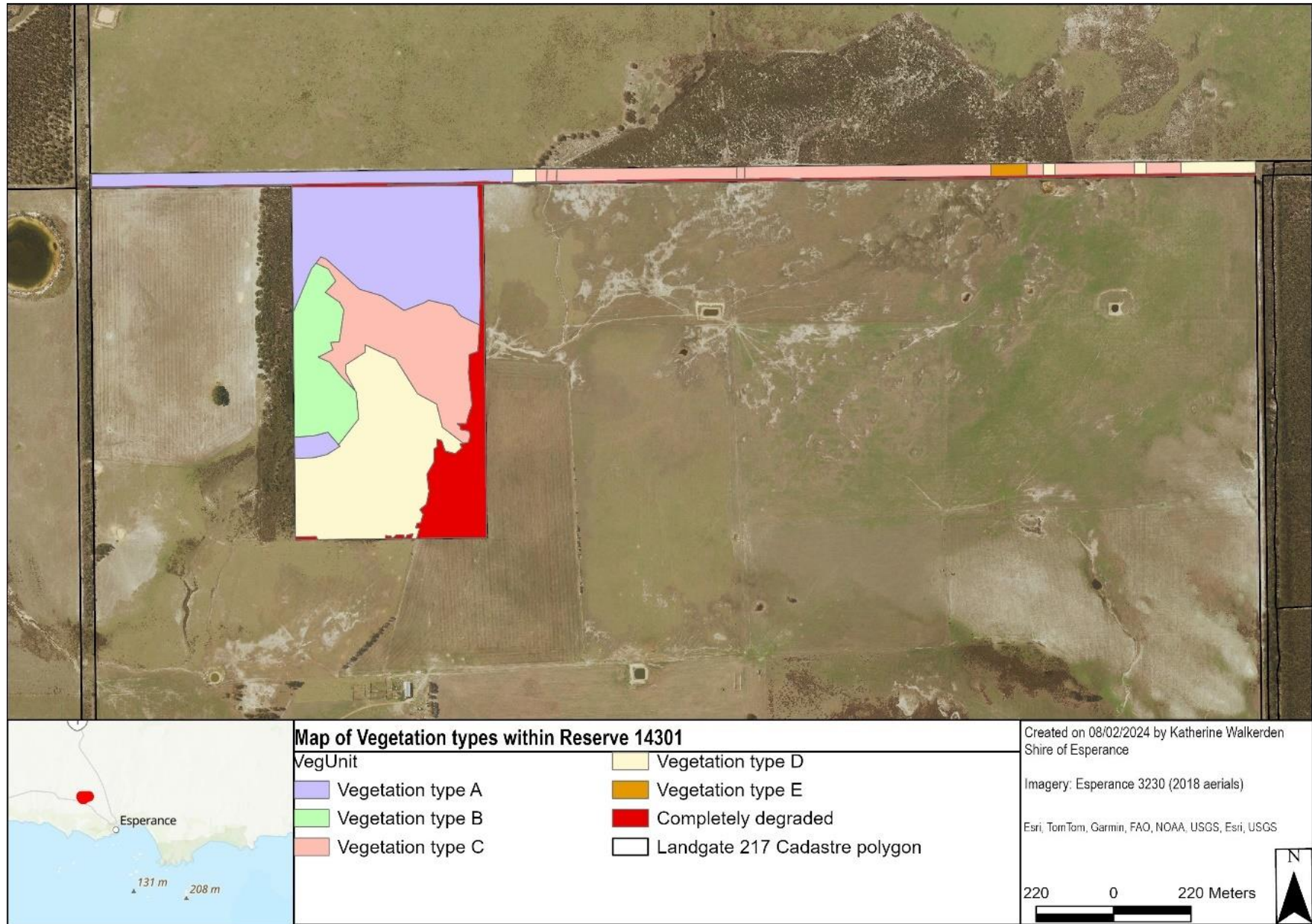


Figure 3: Map of vegetation types present within Reserve 14301 and neighbouring undeveloped road reserve.

4.2 Vegetation Condition

A great variability of vegetation condition was evident within the reserve, with an observed gradient of decreasing vegetation condition in a south-east direction. Vegetation condition ranged from Excellent to Completely Degraded, with the northern third of the site primarily in Excellent condition, the middle third averaging Very Good condition and the southern third primarily in a Degraded condition. Within the adjacent road reserve, the vegetation ranged in condition from Excellent to Very Good.

The fencing between the undeveloped road reserve and the adjacent farm was in poor condition, and several sheep were observed to be grazing within the road reserve during the inspection. Numerous sheep carcasses in varying stages of decomposition were located throughout Reserve 14301. It was evident that the reserve has been intensively grazed by the neighbouring landholder for a substantial period of time, which had over time driven changes in the vegetation composition and structure. For example, the southern third of the reserve where there once would have been *Nuytsia floribunda* and *Banksia speciosa* Open Woodland has been altered to a relatively shrub-less sedgeland of mostly unpalatable species. Within Vegetation Type C, grazing appeared to be hindering the recruitment of the dominant *Melaleuca* species, with no germinants or seedlings observed. Upon examination of historical aerial imagery, the decline in vegetation condition across the reserve has been drastic over the past two decades, with a significant loss of vegetative cover observed for Vegetation Type C. Additionally, erosion was recognised to be a significant degradation factor within Vegetation Type C, with soil scouring occurring as a result of surface water flow. The south-eastern 6.28 ha has been historically cleared and fenced off as part of the neighbouring farmer's paddock.

Table 3: Quantifying vegetation by vegetation type and condition.

Vegetation Type	Excellent	Very Good	Good	Degraded	Completely degraded	Total
A	18.138	3.172	-	-	-	21.310
B	5.896	0.339	-	-	-	6.235
C	1.054	9.102	0.098	4.051	1.069	15.374
D	0.023	12.702	0.362	3.132	-	16.220
E	-	0.346	-	-	-	0.346
Completely degraded					8.491	8.491
Total	25.111 ha	25.662 ha	0.460 ha	7.183 ha	9.560 ha	67.976 ha

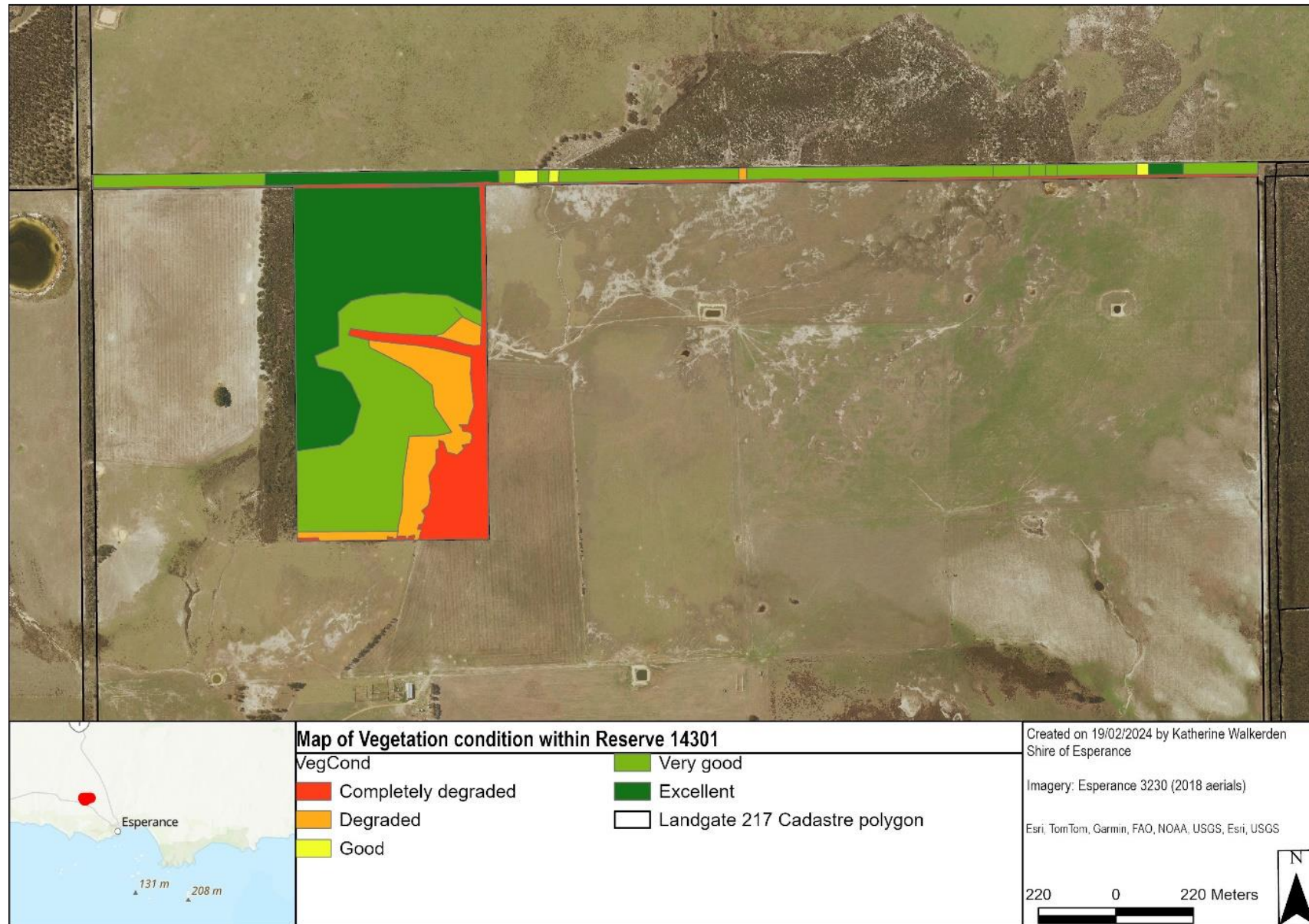


Figure 4. Map of vegetation condition within Reserve 14301 and neighbouring undeveloped road reserve.

4.3 Priority Flora

The desktop survey identified 43 Priority flora (PF) and 4 Threatened Flora (TF) species to be have records within 20 km of the project area. Due to the late-summer timing of the flora survey outside the peak flowering period for the Recherche IBRA subregion, a high likelihood remains that several species of cryptic, annual, and otherwise difficult to distinguish flora would remain unidentified, including PF or TF. This likelihood is elevated given the entire reserve was not traversed systematically, and only a small area of the adjoining road reserve was surveyed. Suitable habitat within the reserve and adjacent undeveloped road reserve was determined for 16 TF and PF, three of which were found to be present within the proposed offset area. These consist of the Priority 3 flora listed under the BC Act, *Austrobaecka uncinella*, *Dampiera sericantha*, and *Kunzea salina*. A specimen from each species was taken by Katherine Walkerden (FT61000788) and will be forwarded to the Western Australian Herbarium. Refer to Figure 5 for a map of TF and PF recorded within the proposed offset site.

Austrobaecka uncinella – Priority 3 – KSW00524

Austrobaecka uncinella was found within the undeveloped road reserve within Vegetation Type C. Ten plants were observed scattered throughout the undeveloped road reserve. A specimen of the plant was collected and will be forwarded to the WA Herbarium.

Dampiera sericantha – Priority 3 – KSW00224

Dampiera sericantha (P3) was found as a seemingly localised population of approximately 12 plants within Vegetation Type D (GDA 94, Zone 51 382348m E, 6267579m N). Scattered plants were also seen Within the undeveloped road reserve in Vegetation Type A, scattered plants were observed, with 61 plants individually recorded. A specimen of the plant was collected and will be forwarded to the WA Herbarium.

Kunzea salina – Priority 3 – KSW00424

Within the undeveloped road reserve, *Kunzea salina* was found as a population of approximately 50 plants within Vegetation Type C. A specimen of the plant was collected and will be forwarded to the WA Herbarium.

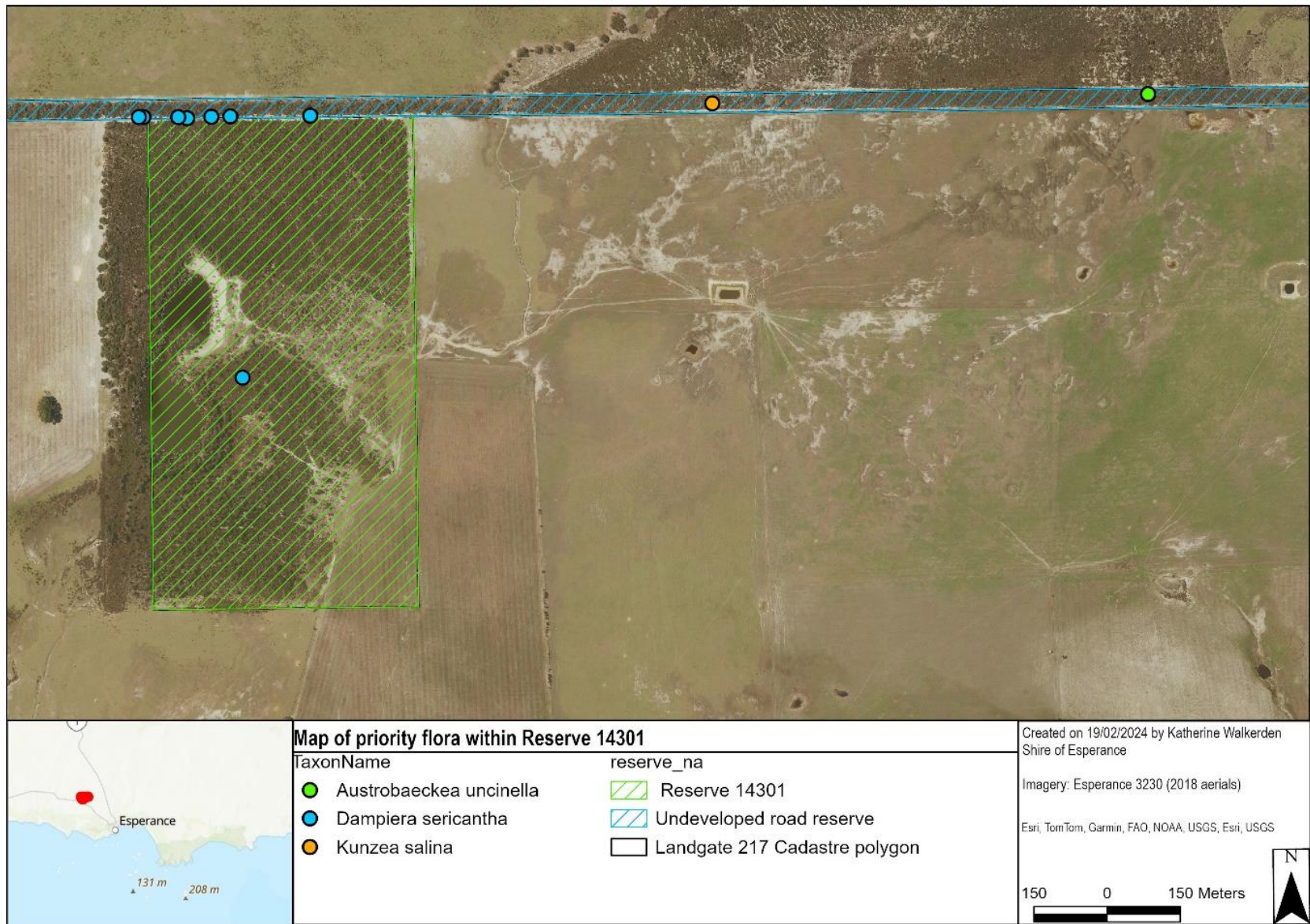


Figure 5: Map of priority flora recorded within Reserve 14301 and neighbouring undeveloped road reserve.

4.4 Carnaby's Black Cockatoo Foraging Habitat

Within Reserve 14301 and the adjacent undeveloped road reserve, suitable foraging habitat for the EPBC Act-listed Carnaby's Black Cockatoo (*Zanda latirostris*) was identified for a total of 51.232 ha within all vegetation types where each vegetation type existed in a 'Good' or better condition. The undeveloped road reserve provides an ecological linkage between Reserve 14301 and Helms Arboretum, which is known to host a night Carnaby's Black Cockatoo roost, and within which the species is frequently sighted, particularly during the species' non-breeding season. A confirmed DBCA record of the Carnaby's Black Cockatoo exists within 1 km of Reserve 14301.

Across both tenures, Vegetation Type A provides 21.310 ha of foraging habitat where *Banksia speciosa* seed cones form the key foraging resource. Vegetation Type B provides 6.235 ha of foraging habitat where Melaleuca fruits and blossom would be opportunistically foraged by the black cockatoos. Approximately 10.254 ha of Vegetation Type C habitat in the form of Melaleuca fruits and blossom. Vegetation Type D provides 13.087 ha of foraging habitat in the form of blossom, fruit and wood-embedded invertebrates provided by of the *Nuytsia floribunda* and the Proteaceous and Myrtaceous heath understorey. A very small area (0.346 ha) of Vegetation Type E provides medium-quality forage in the form of *Eucalyptus littorea* blossom and fruit.

The Foraging Quality Scoring Tool (DAWE 2022) was used to assess the quality of the foraging habitat within both Reserve 14301 – Lake Caitup and the adjacent undeveloped road reserve. Only vegetation in a good or better condition were considered suitable Carnaby's habitat. Due to the small (< 1 ha) size of Vegetation Type E, it was not utilised in the foraging scoring tool. Given the site is within close proximity to known foraging sites (Helms Arboretum, nature reserves and surrounding pine plantations / corridors), known roosting sites, and available water sources, the following scores were received by each of the vegetation types:

- Vegetation Type A – 8 out of 10 points; high-quality foraging habitat over 21.310 ha;
- Vegetation Type B – 6 out of 10 points; medium-quality foraging habitat over 6.235 ha;
- Vegetation Type C – 6 out of 10 points; medium-quality foraging habitat over 10.254 ha; and
- Vegetation Type D – 6 out of 10 points; medium-quality foraging habitat over 13.087 ha.

Inclusive of the 0.346 ha of foraging habitat available within Vegetation Type E within the undeveloped road reserve, an estimated 51.232 ha of Carnaby's Cockatoo foraging habitat is available across the proposed offset site. Of this, 21.310 ha is high-quality foraging habitat equivalent to Beard Vegetation Association 6048, whilst the remaining 29.922 ha is considered medium-quality foraging habitat (Appendix 5).

5 Threats to Environmental Values

Table 4: Threats to environmental values identified within the proposed offset site.

Threat	Description
Altered Hydrology	<p>Significant unauthorised drainage works have been completed through and surrounding the reserve, including the clearing of numerous 10 -15 m <i>Melaleuca cuticularis</i> trees. A total of 1 ha of native vegetation was cleared within Reserve 14301, consisting of Vegetation Type D in a degraded condition.</p> <p>Previous aerial imagery indicates that the linear drainage construction through the centre of the reserve was once a meandering natural creek line through neighbouring farmland before discharging into Lake Caitup within Reserve 14301. This altered hydrology may result in increased importation of sediment into Lake Caitup, increasing turbidity, and also increasing salinity.</p>
Invasive Flora	<p>Numerous grassy weeds were observed to be prolific throughout the reserve, particularly within areas in degraded and completely degraded condition.</p> <p>A small patch (~ 10 plants) of Victorian Tea Tree (<i>Gaudium laevigatum</i>; approximate location GDA94 Zone 51H 382481mE, 6267410mN) was identified within the reserve and determined to be at an early stage of infestation. Therefore, prompt management of this weed should see effective control results.</p>
Introduced Fauna	<p>Two Declared Pest – C3 Management fauna were recorded within the proposed offset site, namely the European rabbit (<i>Oryctolagus cuniculus</i>) and the European red fox (<i>Vulpes vulpes</i>). Numerous rabbit warrens were scattered throughout the reserve, and two fox dens were identified. The remains of 30-40 domestic sheep were also present within the reserve, and two live animals were sighted within the undeveloped road reserve.</p>
Disease	<p>No obvious signs of disease were present. Vegetation Type A was dominated by <i>Banksia speciosa</i>, a highly-susceptible species to Phytophthora dieback infection.</p>
Extractive Activities	<p>There is no history of extractive activities within this reserve.</p>
Unauthorised / Competing Land Use	<p>There is significant unauthorised sheep grazing occurring within the reserve.</p>
Unauthorised Clearing	<p>Significant unauthorised clearing had occurred within the reserve, with approximately 1 ha of vegetation within Vegetation Type D cleared for drainage purposes, presumed to have been undertaken landholder.</p> <p>600m² of vegetation type B had been cleared for drainage works and an additional 2000m² of vegetation type B had been cleared on the adjoining private property.</p>

Threat	Description
	<p>At some time in the past the south-east portion of the reserve had been cleared and used as grazing and cropping land. This historic clearing predates all of Shire of Esperance's digital aerial photographs of the area.</p> <p>Due to the length of time that this area has been grazed and cropped, ecological restoration of this area would require some fairly intensive works, as well as being expensive to remove and relocate existing fencing to the actual property boundary. As an alternative, with better potential for ecological restoration, the Shire of Esperance is currently examining the potential for exchanging this cleared portion of land for remnant vegetation within Lot 33, Pln 36593 immediately adjacent to the west of Reserve 14301.</p>
Rubbish	<p>Significant rubbish dumping had occurred along the eastern edge of the reserve with large tyre piles, tarps, swing sets and water tanks being dumped in the reserve.</p>
Grazing	<p>The reserve had been heavily grazed by the neighbouring landholder, there was no southern fence present to prevent grazing. Grazing was actively degrading the reserve.</p> <p>The undeveloped road reserve was completely fenced but needed repairs, sheep were grazing within the undeveloped road reserve when the site inspection was conducted. However, it was clear that grazing pressure was much lower in the undeveloped road reserve.</p>
Beekeeping	<p>None present, however feral bee hive present in <i>Melaleuca cuticularis</i> hollow on eastern side of Lake Caitup.</p>
Utilities	<p>None present.</p>
Recreation	<p>No signs of recreation were present.</p>
Erosion	<p>Significant flooding events had occurred in January 2007 and February 2017, resulting in significant water erosion.</p> <p>Analysis of aerial and satellite imagery between 2018 and 2023 shows significant drainage works were conducted within Reserve 14301 and the neighbouring private property, this appears to have worsened erosion on the eastern bank of Lake Caitup.</p>
Adjoining Land Use	<p>The surrounding land is primarily used for sheep grazing. Helms Forestry Reserve (Reserve 23527) is situated approximately 2 km to the east, containing a large quantity of native vegetation and plantations.</p>



Figure 6: Map of drainage works conducted within Reserve 14301. Aerial imagery retrieved from Google Maps, Imagery taken on the 29/11/2022.

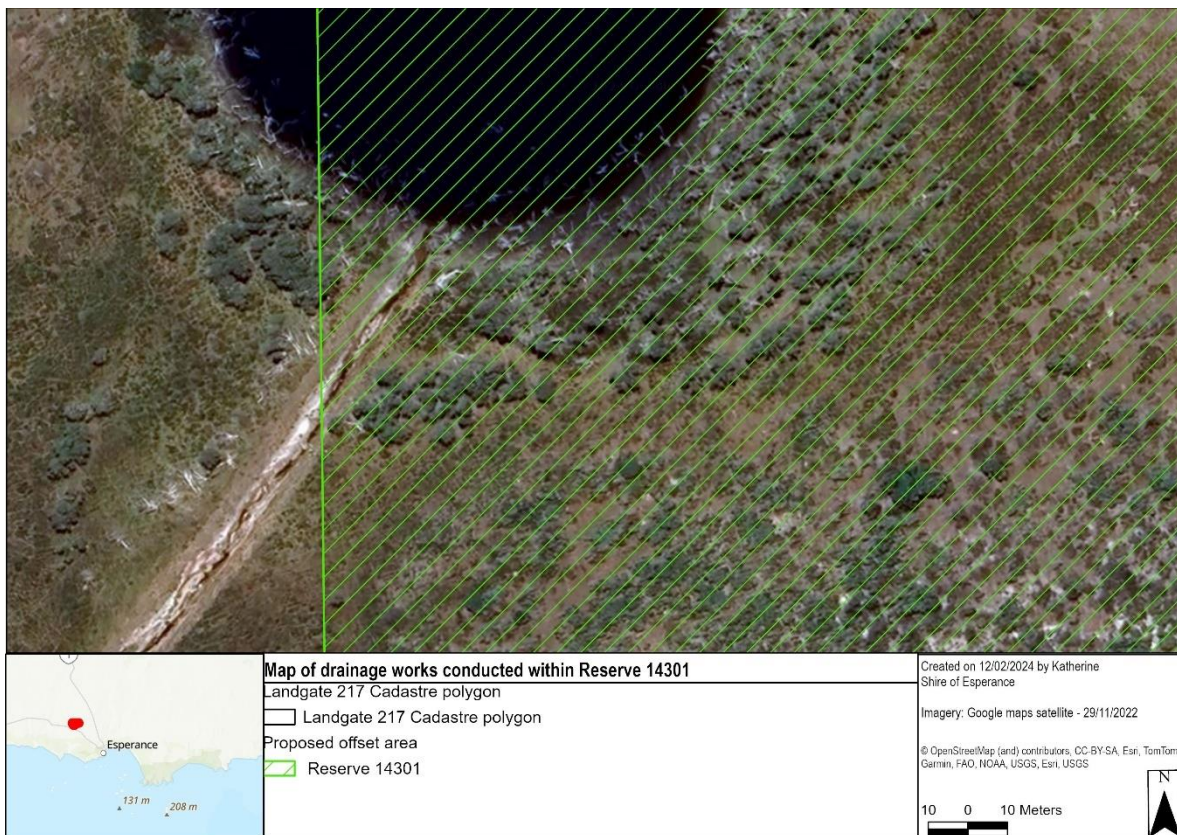


Figure 7: Map of drainage works conducted within and surrounding Reserve 14301. Aerial imagery retrieved from Google Maps, Imagery taken on the 29/11/2022.

6 Site Remediation

Reserve 14301 has suffered from the Shire of Esperance's lack of regular inspections and it now needs urgent action to halt degrading processes, including grazing, unauthorized clearing and drainage occurring within the reserve. It is clear from aerial imagery that vegetation cover within the reserve has been reduced in recent years.

Reserve 14301 is currently experiencing degradation by unauthorised grazing pressure within the reserve with a complete lack of recruitment present within Vegetation Type C. Vegetation Type D has been highly altered with shrub cover being significantly reduced and understory being dominated by Restionaceae sedges.

6.1 Fencing Improvements

The southern and western border of the reserve is currently unfenced and some minor maintenance is required on some of the existing fencing. The high grazing pressure within the reserve is the primary driver of land degradation within this reserve, and any successful revegetation results will be dependent on the exclusion of sheep. A total of 0.45 km of new mesh exclusion fencing is required.

6.2 Weed control

Godium laevigatum is currently present within the reserve in a patch of around dozen plants. Larger *Godium laevigatum* plants will be removed via chain-sawing the trunk, whilst smaller plants will be manually removed by hand-pulling. The approximate location of these advised works is GDA94 Zone 51H 382481mE, 6267410mN.

6.3 Erosion control

The neighboring landholder has excavated drainage lines through Reserve 14301, resulting in significant acceleration of water erosion around Lake Caitup, partially derived from the removal of significant patches of native vegetation along the drainage line.

The Shire of Esperance proposes additional earthworks to be conducted in order slow the flow of water, such as returning the natural meander of the creek and revegetating with riparian sedges and shrubs. Small swales will be dug out across the constructed drainage line, with soil from the swales being used to partially obstruct water flow, this will be completed on each side of the drainage line in an alternating pattern, returning the flow of water to a slower more meandering state, reducing the velocity and erosive nature of water movements. Alternatively, 3000 mm x 300 mm coir logs could be installed approximately every 20 metres, partially blocking the flow of water. Coir logs are to be installed on each side of the drainage line in an alternating pattern, returning the flow of water to a slower more meandering state.

6.4 Planting and direct seeding

Local-provenance seed to be used in direct seeding activities has been sourced within Vegetation Type D. Sparsely vegetated areas within Vegetation Type D will be ripped to enable direct seeding. Completely bare areas (Figure 8) will be actively revegetated and partially bare areas will be monitored for natural regeneration after fencing works have been completed. The need for weed control prior to planting will be assessed. The following species were outlined on our preliminary list of suitable species for Vegetation Type D:

Melaleuca cuticularis

Melaleuca brevifolia

Melaleuca pulchella

Melaleuca calycina

Ficinia nodosa

Gahnia trifida

Acacia saligna

Machaerina juncea

The Shire of Esperance has sought quotes for local provenance seed from a local supplier.

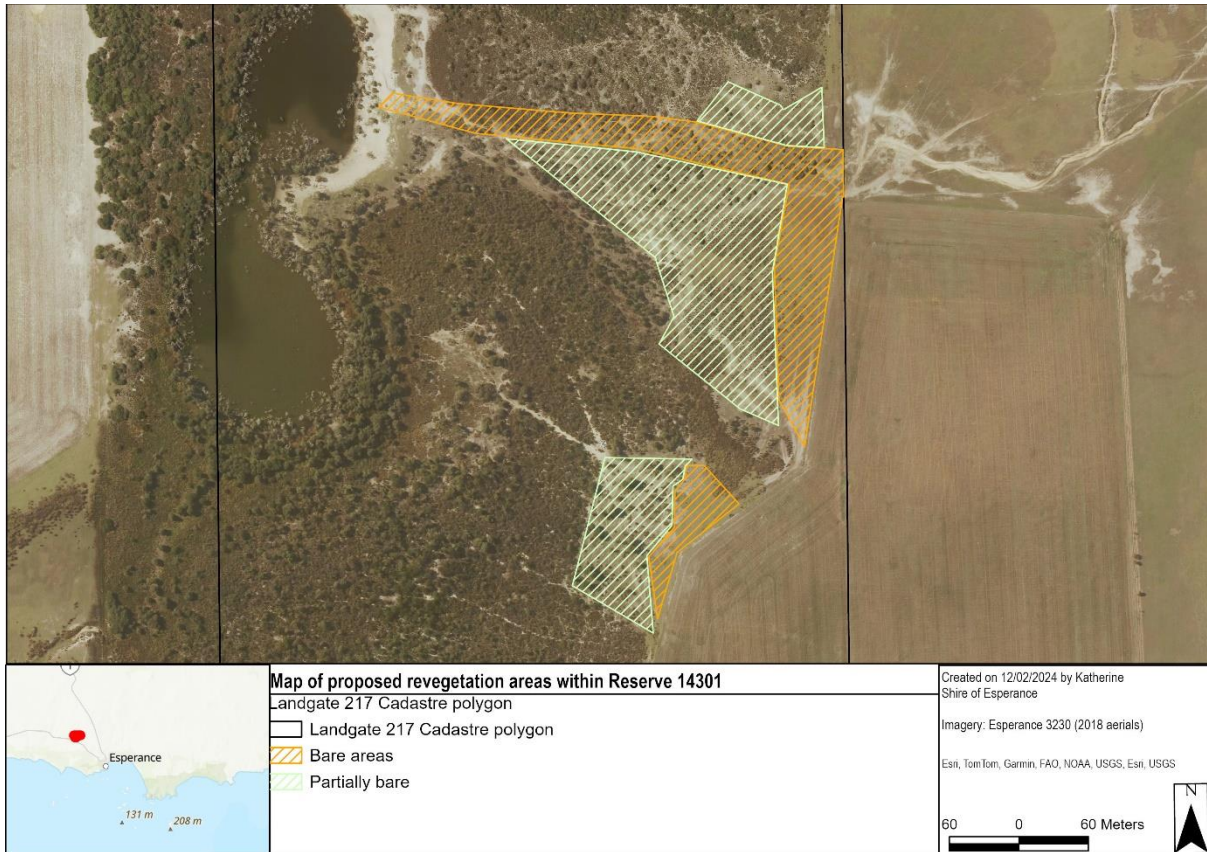


Figure 8: Map of proposed revegetation areas within Reserve 14301.

7 Disease Hygiene Management

The water-borne plant pathogen, *Phytophthora cinnamomi*, can be easily spread by the movement of contaminated water through the soil, or by the movement of infected soil / plant material to new locations. This pathogen, alongside numerous other species known to cause the disastrous disease known as Phytophthora Dieback, is widely reported to occur in the Esperance region, and the site falls within the acceptable rainfall zone for the disease. Additionally, the site contains a high diversity of Proteaceous and Myrtaceous species which are highly susceptible to Phytophthora Dieback. Currently, there does not appear to be any Phytophthora Dieback within the Reserve, according to DIDMS mapping and site survey observations of healthy susceptible species. Therefore, hygiene measures to minimise the risk of disease introduction into the site is imperative to maintain the environmental and ecological values of the reserve. The Shire of Esperance employs a number of standard protocols to minimise the risk of disease transmission during site works, including:

- a) All machinery, plant and equipment shall be free of soil and vegetative matter prior to entering and leaving the site; and
- b) The movement of soil shall be avoided in wet conditions.

Accessing the Reserve 14301 from the east through Helms Forestry Reserve does pose a risk due to a number of positive *Phytophthora* spp. points from within Helms Forestry Reserve. The Shire of Esperance will use best practice vehicle hygiene measures (e.g. methylated spirits spray-down and boot brushing) to ensure dieback is not introduced into the site due to our operations. Shire of Esperance staff or contractors will also not enter the site from the east during wet soil conditions.

8 Monitoring

Monitoring of the rehabilitated area will determine if completion criteria have been achieved and if contingency measures are required. The methodology for monitoring will involve onsite visual assessments to determine whether revegetation has been implemented as planned and that completion criteria have been met, as outlined in Table 3. Monitoring will occur annually every year by the Shire of Esperance's Environmental Officers, who have a tertiary level education in Environmental Science or similar qualifications. This will continue for up to six years post rehabilitation event or until rehabilitation has been deemed successful.

Table 5: Completion criteria following the SMART (specific, measurable, achievable, relevant, timebound) principles for the rehabilitation of Reserve 14301.

Criterion	Baseline Floristic data	Completion Target	Completion Criteria
1.	a) 7.183 ha of degraded vegetation; b) 9.56 ha of completely degraded vegetation.	degraded areas to achieve a condition rating of very good or better. Completely degraded areas to achieve a condition rating of good or better.	a) Improvement of 60% (4.310 ha) of previously Degraded vegetation to Very Good condition after 5 years; b) Improvement of 60% (5.736 ha) of previously Completely Degraded vegetation to Good condition after 5 years.
2.	Localised infestation of <i>Gaudium laevigatum</i> within the reserve (~ 12 plants)	Eradication of <i>G. laevigatum</i> from the reserve	No records of <i>G. laevigatum</i> after 5 years of control works commenced.
3.	Significant water erosion present in reserve.	Create creek resilient to water erosion.	Recruitment and establishment of native seedlings evident across >60% of creek banks and eastern shores of Lake Caitup.
4.	Grazing pressure by feral and domestic animals	Exclude non-native fauna from reserve.	Installation of 0.45 km of exclusion fencing around reserve where fencing is absent.

9 Contingency Measures

Where the rehabilitation is deemed unsuccessful by comparison to the completion criteria, contingency measures will be undertaken, until the completion criteria are met sufficiently. This is an adaptive process and dependent on what completion criteria have failed, and a determination of how. A few standard techniques are outlined below:

- a) If seedling density is inadequate, additional direct seeding or direct planting will occur;
- b) If site soil characteristics appear to be limiting revegetation success, soil amelioration may be engaged;
- c) If grazing from feral animals (i.e. rabbits) is evident on regrowth / revegetation areas, rabbit-exclusion fencing may be installed for the short-term;
- d) If environmental weeds persist within the site, increased severity of control works (e.g. mechanical and chemical methods) will be applied.

Numerous other contingency measures will be undertaken according to the emergence of issues at the site regarding ecological rehabilitation and soil remediation.

10 Offset Suitability

Reserve 14301 is highly diverse, containing four distinct vegetation communities and a lake supporting an abundance of waterfowl and shorebird life. The undeveloped road reserve to the north of Reserve 14301 provides an important ecological linkage in a highly cleared landscape, connecting Helms Forestry Reserve to nearby vegetation.

CPS 10154/1 requires a small quantity of Beard Vegetation Association 6048 to be offset. A total of 37.530 ha of vegetation suitable for this Beard Vegetation Association offset is available within Reserve 14301 and the adjacent undeveloped road reserve.

Table 6: Quantifying vegetation matching Beard Vegetation Association 6048 by vegetation type and condition.

Vegetation Type	Excellent	Very Good	Good	Degraded	Completely Degraded	Total
A	18.138	3.172	-	-	-	21.310
D	0.023	12.702	0.362	3.132	-	16.220
Total	18.161	15.874	0.362	3.132	0	37.530

The remainder of the site will be banked for use as an offset for future projects. The site also provides high quality foraging habitat for the Carnaby's cockatoo which will be a valuable offset for future projects.

Reserve 14301 is actively degrading due to unauthorised grazing, drainage, clearing and subsequent water / wind erosion occurring within the reserve. Recruitment has failed within large sections of the reserve due to these persistent pressures. Ameliorative works, detailed in Section 6 of this report, are required to prevent further degradation of the reserve.

11 Photos



Figure 9: Vegetation Type A: *Nuytsia floribunda* and *Banksia speciosa* Low Woodland with Myrtaceous Shrubland with *Anarthria laevis* and *Anarthria scabra* Sedgeland. Photo taken on the 06/02/2024 by Katherine Walkerden.



Figure 10: Vegetation type B: *Melaleuca cuticularis* Closed Forest with *Juncus* sp. Rushland. Photo taken on the 06/02/2024 by Katherine Walkerden.



Figure 11: Vegetation type C: *Melaleuca cuticularis* low open woodland with *Melaleuca brevifolia* dominated tall open shrubland with *Austrostipa juncifolia* dominated grassland. Photo taken on the 06/02/2024 by Katherine Walkerden.



Figure 12: Vegetation type D: *Nuytsia floribunda* Low Open Woodland over Open Heathland with Restiad-dominated Closed Sedgeland. Photo taken on the 06/02/2024 by Katherine Walkerden.

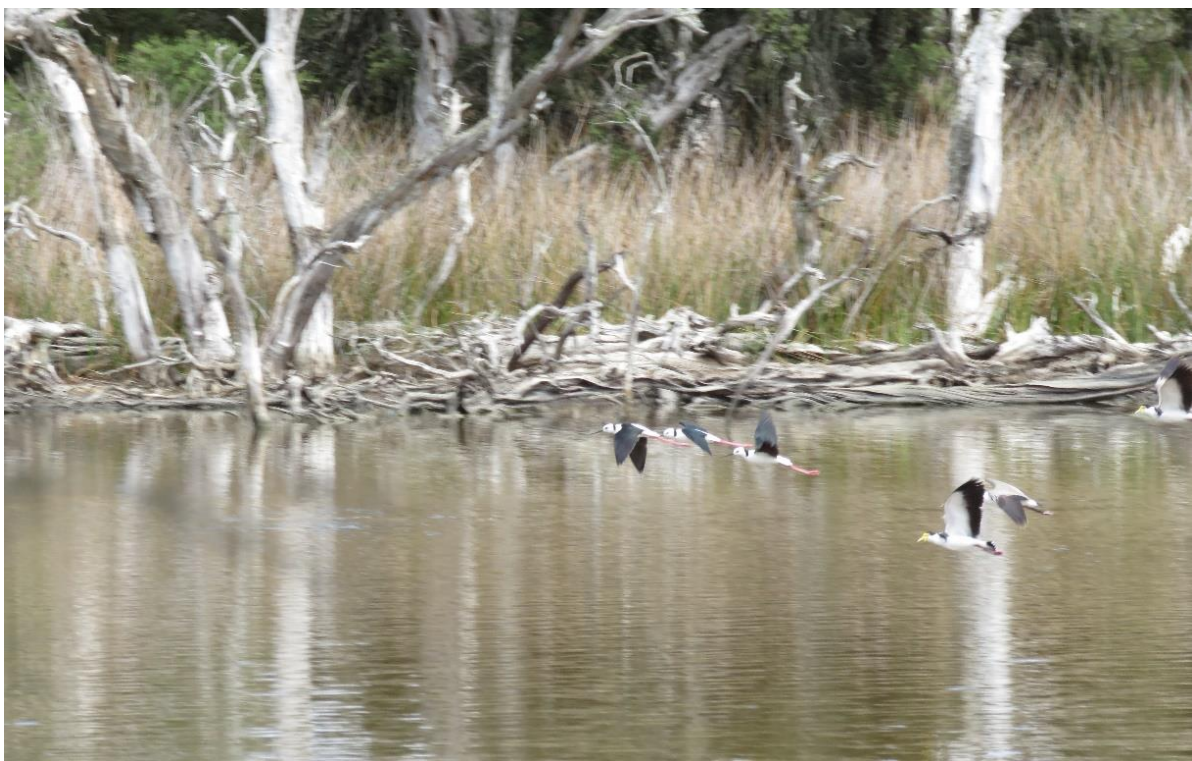


Figure 13: Pied stilts and masked lapwings present at Lake Caitup within Reserve 14301. Photo taken by Kahree Garnaut on the 06/02/2024.



Figure 14: Masked lapwing present within Reserve 14301. Photo taken by Kahree Garnaut on the 06/02/2024.



Figure 15: Pink-eared ducks and grey teals present within Reserve 14301. Photo taken by Kahree Garnaut on the 06/02/2024.



Figure 16: Red-necked avocets foraging in Lake Caitup within Reserve 14301. Photo taken by Kahree Garnaut on the 06/02/2024.



Figure 17: Erosion on eastern banks of Lake Caitup within Reserve 14301. Photo taken on the 06/02/2024 by Katherine Walkerden.



Figure 18: Pile of tyres present within Reserve 14301. Photo taken on the 06/02/2024 by Katherine Walkerden at GDA94 Zone 51 382689m E, 6267731m N.



Figure 19: Photo of tarp present within Reserve 14301. Photo taken on the 06/02/2024 by Katherine Walkerden. Photo taken at GDA94 Zone 51 382495m E, 6267404m N.



Figure 20: Disposed water tank present within Reserve 14301. Photo taken on the 06/02/2024 by Katherine Walkerden. Photo taken at GDA94 Zone 51 382465m E 6267183m N.

12 References

Department of Agriculture, Water and the Environment (2022) *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black-cockatoo*, Department of Agriculture, Water and the Environment, Canberra, February 2022.

Appendix 1: Incidental Flora Species List

Family	Taxon	Invasive	WAConStat	HerbRef
Anarthriaceae	<i>Anarthria laevis</i>			
Anarthriaceae	<i>Anarthria scabra</i>			
Asparagaceae	<i>Lomandra hastilis</i>			
Asteraceae	<i>Cirsium vulgare</i>	X		
Asteraceae	<i>Hypochaeris radicata</i>	X		
Chenopodiaceae	<i>Atriplex sp.</i>			
Chenopodiaceae	<i>Tecticornia sp.</i>			
Cyperaceae	<i>Caustis dioica</i>			
Cyperaceae	<i>Cyathochaeta equitans</i>			
Cyperaceae	<i>Ficinia nodosa</i>			
Cyperaceae	<i>Gahnia trifida</i>			
Cyperaceae	<i>Lepidosperma sp.</i>			
Cyperaceae	<i>Tricostularia aphylla</i>			
Dilleniaceae	<i>Hibbertia cuneiformis</i>			
Fabaceae	<i>Acacia cyclops</i>			
Fabaceae	<i>Acacia saligna</i>			
Fabaceae	<i>Jacksonia spinosa</i>			
Frankeniaceae	<i>Frankenia tetrapetala</i>			
Geraniaceae	<i>Pelargonium capitatum</i>	X		
Goodeniaceae	<i>Dampiera sericantha</i>		P3	KSW00224
Goodeniaceae	<i>Goodenia incana</i>			
Haemodoraceae	<i>Haemodorum sp.</i>			
Iridaceae	<i>Patersonia sp.</i>			
Juncaceae	<i>Juncus sp.</i>			
Loranthaceae	<i>Nuytsia floribunda</i>			
Myrtaceae	<i>Austrobaeckea uncinella</i>		P3	KSW00524
Myrtaceae	<i>Darwinia diosmoides</i>			
Myrtaceae	<i>Eucalyptus pleurocarpa</i>			
Myrtaceae	<i>Eucalyptus littorea</i>			
Myrtaceae	<i>Gaudium laevigatum</i>	X		
Myrtaceae	<i>Kunzea salina</i>		P3	KSW00424
Myrtaceae	<i>Leptospermum sp.</i>			
Myrtaceae	<i>Melaleuca brevifolia</i>			
Myrtaceae	<i>Melaleuca cuticularis</i>			
Myrtaceae	<i>Melaleuca pulchella</i>			
Myrtaceae	<i>Melaleuca scabra</i>			
Myrtaceae	<i>Melaleuca striata</i>			
Myrtaceae	<i>Melaleuca thymoides</i>			
Myrtaceae	<i>Melaleuca tuberculata</i>			
Myrtaceae	<i>Micromyrtus elobata</i>			
Myrtaceae	<i>Phymatocarpus maxwellii</i>			
Pittosporaceae	<i>Billardiera fusiformis</i>			

Family	Taxon	Invasive	WAConStat	HerbRef
Poaceae	<i>Austrostipa juncifolia</i>			
Poaceae	<i>Briza maxima</i>	X		
Poaceae	<i>Ehrharta calycina</i>	X		
Poaceae	<i>Eragrostis curvula</i>	X		
Poaceae	<i>Lagurus ovatus</i>	X		
Poaceae	<i>Neurachne alopecuroidea</i>			
Proteaceae	<i>Adenanthos cuneatus</i>			
Proteaceae	<i>Banksia media</i>			
Proteaceae	<i>Banksia repens</i>			
Proteaceae	<i>Banksia speciosa</i>			
Proteaceae	<i>Hakea adnata</i>			
Proteaceae	<i>Hakea cinerea</i>			
Proteaceae	<i>Hakea obliqua</i>			
Proteaceae	<i>Hakea prostrata</i>			
Proteaceae	<i>Hakea ruscifolia</i>			
Proteaceae	<i>Isopogon polycephalus</i>			
Proteaceae	<i>Lambertia inermis</i>			
Restionaceae	<i>Desmocladius sp.</i>			
Restionaceae	<i>Hypolaena sp.</i>			
Restionaceae	<i>Lepyrodia macra</i>			
Rhamnaceae	<i>Spyridium globulosum</i>			
Xanthorrhoeaceae	<i>Xanthorrhoea platyphylla</i>			

Appendix 2: Incidental Fauna Species List

Class	Family	Taxon	Common name	Introduced	Shorebird	Waterfowl
Aves	Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped thornbill			
Aves	Anatidae	<i>Anas castanea</i>	Chestnut teal			X
Aves	Anatidae	<i>Anas gracilis</i>	Grey teal			X
Aves	Anatidae	<i>Malacorhynchus membranaceus</i>	Pink-eared duck			X
Aves	Artamidae	<i>Cracticus torquatus</i>	Grey butcherbird			
Aves	Charadriidae	<i>Elseya melanops</i>	Black-fronted dotterel		X	
Aves	Columbidae	<i>Ocyphaps lophotes</i>	Crested pigeon			
Aves	Corvidae	<i>Corvus coronoides</i>	Australian raven			
Aves	Hirundinidae	<i>Hirundo neoxena</i>	Welcome swallow			
Aves	Hirundinidae	<i>Petrochelidon nigricans</i>	Tree martin			
Aves	Meliphagidae	<i>Anthochaera lunulata</i>	Western wattlebird			
Aves	Meliphagidae	<i>Manorina flavigula</i>	Yellow-throated miner			
Aves	Podicipedidae	<i>Poliiocephalus poliocephalus</i>	Hoary-headed grebe			X
Aves	Psittaculidae	<i>Purpureicephalus spurius</i>	Red-capped parrot			
Aves	Recurvirostridae	<i>Himantopus leucocephalus</i>	Pied stilt		X	
Aves	Recurvirostridae	<i>Recurvirostra novaehollandiae</i>	Red-necked avocet		X	
Aves	Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie wagtail			
Aves	Vanellinae	<i>Vanellus miles</i> subsp. <i>novaehollandiae</i>	Masked lapwing		X	
Insecta	Apidae	<i>Apis mellifera</i>	European honey bee	*		
Mammalia	Bovidae	<i>Ovis aries</i>	Sheep	*		
Mammalia	Canidae	<i>Vulpes vulpes</i>	European red fox	*DP		
Mammalia	Leporidae	<i>Oryctolagus cuniculus</i>	European rabbit	*DP		
Mammalia	Macropodidae	<i>Macropus fuliginosus</i>	Western grey kangaroo			
Reptilia	Elapidae	<i>Notechis scutatus</i> subsp. <i>occidentalis</i>	Western tiger snake			

Appendix 3: Threatened and Priority flora species identified within 20 km

Threatened or priority flora identified by the desktop study to be present within a 20 km radius of Reserve 14301, using Internal shire data, Threatened and Priority Flora Reporting, WA Herbarium and Esperance District Threatened Flora datasets.

Taxon	Conservation Status	Distance from site (km)
<i>Darwinia</i> sp. Gibson (R.D. Royce 3569)	P1	10.95
<i>Goodenia turleyae</i>	P1	19.29
<i>Hibbertia carinata</i>	P1	13.73
<i>Leucopogon</i> sp. Lake Magenta (K.R. Newbey 3387)	P1	16.51
<i>Myriophyllum muelleri</i>	P1	13.36
<i>Schoenus</i> sp. Grey Rhizome (K.L. Wilson 2922)	P1	6.01
<i>Stenantha lacsalaria</i>	P2	16.48
<i>Comesperma griffinii</i>	P2	4.33
<i>Fabronia hampeana</i>	P2	9.95
<i>Goodenia exigua</i>	P2	6.38
<i>Hibbertia turleyana</i>	P2	4.33
<i>Leucopogon corymbiformis</i>	P2	6.84
<i>Paracaleana parvula</i>	P2	7.66
<i>Patersonia inaequalis</i>	P2	10.99
<i>Spyridium mucronatum</i> subsp. <i>multiflorum</i>	P2	15.06
<i>Adelphacme minima</i>	P3	10.19
<i>Astartea reticulata</i>	P3	6.05
<i>Austrobaecka uncinella</i>	P3	4.10
<i>Austrostipa mundula</i>	P3	17.32
<i>Brachyloma mogin</i>	P3	4.51
<i>Caladenia arrecta</i>	P3	10.95
<i>Comesperma calcicola</i>	P3	6.60
<i>Commersonia rotundifolia</i>	P3	10.95
<i>Conostephium marchantiorum</i>	P3	16.84
<i>Dampiera sericantha</i>	P3	6.92
<i>Dampiera triloba</i>	P3	6.54
<i>Daviesia pauciflora</i>	P3	3.25
<i>Eucalyptus famelica</i>	P3	3.46
<i>Eucalyptus foliosa</i>	P3	8.70
<i>Eucalyptus semiglobosa</i>	P3	14.74
<i>Gonocarpus pycnostachyus</i>	P3	6.23
<i>Isopogon alcicornis</i>	P3	12.85
<i>Kunzea salina</i>	P3	3.51
<i>Melaleuca dempta</i>	P3	13.29
<i>Melaleuca fissurata</i>	P3	17.81
<i>Persoonia scabra</i>	P3	4.32

Taxon	Conservation Status	Distance from site (km)
<i>Pterostylis faceta</i>	P3	8.70
<i>Styphelia rotundifolia</i>	P3	16.67
<i>Banksia prolata subsp. calcicola</i>	P4	19.81
<i>Eucalyptus dolichorhyncha</i>	P4	10.95
<i>Eucalyptus preissiana subsp. lobata</i>	P4	12.97
<i>Grevillea baxteri</i>	P4	16.54
<i>Kennedia beckxiana</i>	P4	19.59
<i>Anigozanthos bicolor subsp. minor</i>	T	13.15
<i>Conostylis lepidospermoides</i>	T	10.33
<i>Eremophila glabra</i> subsp. Scaddan (C. Turley s.n. 10/11/2005)	T	16.61
<i>Lambertia echinata subsp. echinata</i>	T	13.61

Appendix 4: Threatened Fauna Species Identified Within 20 km

Assessment of Threatened and Priority fauna potentially occurring within 20 km of Reserve 14301 was conducted utilising the DBCA Threatened Fauna database on the SOE's internal data interrogation program.

Taxon	Common name	WA status	EPBC status	Distance (km)
<i>Thinornis rubricollis</i>	Hooded plover, hooded dotterel	P4		0.57
<i>Zanda latirostris</i>	Carnaby's Black Cockatoo	EN	EN	1.14
<i>Cereopsis novaehollandiae grisea</i>	Recherche Cape Barren goose	VU	VU	2.67
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	3.26
<i>Tringa nebularia</i>	Common greenshank	MI	MI	6.38
<i>Calidris ruficollis</i>	Red-necked stint	MI	MI	6.38
<i>Calidris ferruginea</i>	Curlew sandpiper	CR	MI	6.57
<i>Actitis hypoleucos</i>	Common sandpiper	MI	MI	8.65
<i>Oxyura australis</i>	Blue-billed duck	P4		10.35
<i>Hydroprogne caspia</i>	Caspian tern	MI	MI	10.38
<i>Thalasseus bergii</i>	Crested tern	MI	MI	10.38
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	MI	MI	10.56
<i>Limicola falcinellus</i>	Broad-billed sandpiper	MI	MI	10.96
<i>Calidris alba</i>	Sanderling	MI	MI	11.22
<i>Pluvialis fulva</i>	Pacific golden plover	MI	MI	11.22
<i>Pseudohydryphantes doegi</i>	Doeg's watermite	P2		11.47
<i>Tringa glareola</i>	Wood sandpiper	MI	MI	11.65
<i>Falco peregrinus</i>	Peregrine falcon	OS		13.44
<i>Isodon fusciventer</i>	Quenda, southwestern brown bandicoot	P4		13.97
<i>Arenaria interpres</i>	Ruddy turnstone	MI	MI	14.67
<i>Calidris tenuirostris</i>	Great knot	CR	MI	14.67
<i>Plegadis falcinellus</i>	Glossy ibis	MI	MI	15.79
<i>Tringa stagnatilis</i>	Marsh sandpiper	MI	MI	16.20
<i>Tringa brevipes</i>	Grey-tailed tattler	MI and P4	MI	16.32
<i>Limosa lapponica</i>	Bar-tailed godwit	MI	MI	16.32
<i>Calidris canutus</i>	Red knot	EN	EN	16.32
<i>Ardenna carneipes</i>	Flesh-footed shearwater	VU	MI	17.19
<i>Elanus scriptus</i>	Letter-winged kite	P4		17.19
<i>Calidris melanotos</i>	Pectoral sandpiper	MI	MI	17.80
<i>Eubalaena australis</i>	Southern right whale	VU	EN	18.62
<i>Thalassarche chlororhynchos</i>	Atlantic yellow-nosed albatross	VU	MI	18.88
<i>Pluvialis squatarola</i>	Grey plover	MI	MI	19.19
<i>Charadrius leschenaultii</i>	Greater sand plover	VU	MI	19.20
<i>Neophoca cinerea</i>	Australian sea-lion	EN	EN	19.23
<i>Stercorarius antarcticus lonnbergi</i>	Brown Skua	P4		19.23
<i>Westralunio carteri</i>	Carter's freshwater mussel	VU	VU	19.23
<i>Apus pacificus</i>	Fork-tailed swift	MI	MI	19.86

Appendix 5 : Foraging Habitat Quality Scoring Tool (DAWE 2022)

Starting Score		Carnaby's Cockatoo	
10		<p>Start at a score of 10 if your site is native shrubland, Kwongkan heathland or woodland, dominated by proteaceous plant species such as <i>Banksia</i> spp., <i>Hakea</i> spp. and <i>Grevillea</i> spp., as well as native eucalypt woodland and forest that contains foraging species, within the range of the species, including along roadsides and parkland cleared areas. Also includes planted native vegetation.</p> <p>This tool only applies to sites equal to or larger than 1 hectare in size.</p>	
Attribute	Subtractions	Context adjustor (attributes reducing functionality of foraging habitat)	Site performance
Foraging potential	-2	Subtract 2 from your score if there is no evidence of feeding debris on your site.	Veg Type A: 10/10 Veg Type B: 8/10 Veg Type C: 8/10 Veg Type D: 8/10
Connectivity	-2	Subtract 2 from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	Veg Type A: 10/10 Veg Type B: 8/10 Veg Type C: 8/10 Veg Type D: 8/10
Proximity to breeding	-2	Subtract 2 if you have evidence to conclude that your site is more than 12 km from breeding habitat.	Veg Type A: 8/10 Veg Type B: 6/10 Veg Type C: 6/10 Veg Type D: 6/10
Proximity to roosting	-1	Subtract 1 if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	Veg Type A: 8/10 Veg Type B: 6/10 Veg Type C: 6/10 Veg Type D: 6/10
Impact from significant plant disease	-1	Subtract 1 if your site has disease present (e.g. <i>Phytophthora</i> spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	Veg Type A: 8/10 Veg Type B: 6/10 Veg Type C: 6/10 Veg Type D: 6/10
Total score			Veg Type A: 8/10 Veg Type B: 6/10 Veg Type C: 6/10 Veg Type D: 6/10
Appraisal		High quality habitat = Veg A Medium quality = Veg B, C & D	