

Hydro Swift Parrot and Regent Honeyeater important habitat expert assessment

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Executive summary:

GHD Pty. Ltd. engaged Dr Ross Crates on behalf of Hydro Aluminium Pty Ltd. to undertake an expert assessment of important habitat for Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) as part of the supporting documents to the Biodiversity Certification Assessment report for the Hydro development site located at Kurri Kurri, NSW. The proposed development footprint contains 68.6 Ha of mapped important habitat for the Swift Parrot and 50.6 Ha of mapped important habitat for the Regent Honeyeater.

Aims:

- Undertake a comprehensive assessment of vegetation condition within the Hydro development footprint mapped as important habitat for Regent Honeyeater and / or Swift Parrot.
- Undertake habitat and targeted bird surveys within the Hydro development footprint mapped as important habitat for Regent Honeyeater and / or Swift Parrot.
- Refine the important habitat mapping for both species based on field surveys and expert elicitation such that only important habitat for either species is included in the mapping.
- Undertake habitat assessments and bird surveys within the proposed Hydro Biodiversity Stewardship Site. Refine the important habitat mapping based on the results of the field surveys and expert elicitation to determine the quantity of important Regent Honeyeater and Swift Parrot habitat contained within the proposed Biodiversity Stewardship Site.
- Undertake an assessment of serious and irreversible impacts of the proposed Hydro development on the Swift Parrot and Regent Honeyeater based on the results of the revised important habitat mapping for both species.

Results

- The proposed development will result in the loss of 47.55 Ha of important Swift Parrot habitat and 34.63 ha of important Regent Honeyeater habitat.
- These figures represent 0.042 % and 0.006 % of the mapped important habitat for the Swift Parrot and Regent Honeyeater in New South Wales, respectively.
- The proposed Hydro Biodiversity Stewardship Site will protect in perpetuity approximately 607.25 Ha of important Swift Parrot and Regent Honeyeater habitat.
- A serious and irreversible impact statement regarding the potential impact of the proposed Hydro development on both the Swift Parrot and Regent Honeyeater accompanies this document.

Caveats to the report.

- The expert advice in this report is provided on the understanding that all possible measures have already been taken in the planning process to first avoid and second to minimise potential impacts to Swift Parrot and Regent Honeyeater as is required under the NSW *Biodiversity Conservation Act 2016* and the *Local Land Services Act 2013*.
- Bird surveys were undertaken outside of the period Swift Parrots are present on mainland Australia. Bird survey data provided in this report cannot be used to infer absence of Swift Parrots from the site.
- Due to a lack of data availability and uncertainty surrounding future planning approvals, the report does not assess potential cumulative impacts of the loss of important Swift Parrot and Regent Honeyeater habitat that may occur as a result of multiple development approvals both within the Lower Hunter region or further afield. However, it is acknowledged that cumulative impacts arising from piecemeal loss of mapped Swift Parrot and Regent Honeyeater habitat should be taken into consideration.

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File S2: Hydro bird survey data

File S3: Shapefiles and .mxd file containing GIS layers detailed within the document.

1 Introduction

1.1 Swift Parrot and Regent Honeyeater population status and requirement for an expert report.

The Swift Parrot and Regent Honeyeater are listed as Critically Endangered under the *Environmental Protection and Biodiversity Conservation Act* (Department of the Environment 2015, 2016), having undergone rapid population decline in recent decades.

The Hydro site at Kurri Kurri contains mapped important habitat for both species, with 68.6 and 50.6 Ha of mapped important Swift Parrot and Regent Honeyeater habitat falling within the proposed development footprint, respectively. The important habitat mapping for both species is based on remotely-sensed vegetation data in New South Wales, and is constructed based on buffers of confirmed sighting/breeding locations. Therefore, the mapping potentially includes habitat that does not in reality constitute important habitat for either species, and also potentially omits habitat that does represent important habitat for either species.

Following a review of the draft Biodiversity Certification Assessment Report (BCAR), the Biodiversity Conservation Division (BCD) requested a recognised expert of both species undertake habitat assessments and surveys to quantify the condition, extent and relative importance of habitats within both the proposed Hydro development footprint and the proposed Biodiversity Stewardship Site, such that potential impacts of the proposed Hydro development can as much as possible avoid, minimise and offset any potential impacts on the Swift Parrot and Regent Honeyeater.

1.2 Background information- Swift Parrots and Regent Honeyeaters in the Tomalpin Woodlands near Kurri Kurri.

The woodlands of the lower Hunter Valley are one of the most important areas in the country for Swift Parrots and Regent Honeyeaters (Commonwealth of Australia 2011, 2016). Most records of both species within the locality occur to the south-west of the Hydro site (Figure 1), reflecting a higher proportion of wooded/forested habitat in that area. Although habitats of the Lower Hunter Valley are used in many years, they are particularly important for both species as drought refugia, when conditions are less suitable in more western parts of their ranges (Saunders & Heinsohn 2008).

There are four contemporary records of Swift Parrots within 2km of the proposed Hydro development boundary (Figure 1). The closest Regent Honeyeater record is approximately 2.8km away. Hydro is private property, so it is noted that a lack of Regent Honeyeater or Swift Parrot sightings within the development footprint could be in part due to low observer coverage in the area.

In 2020 and 2021, a total of 80 captive-bred Regent Honeyeaters have been released in the Lower Hunter valley, approximately 4.5km south-west of the Hydro site (SWIFFT 2021).

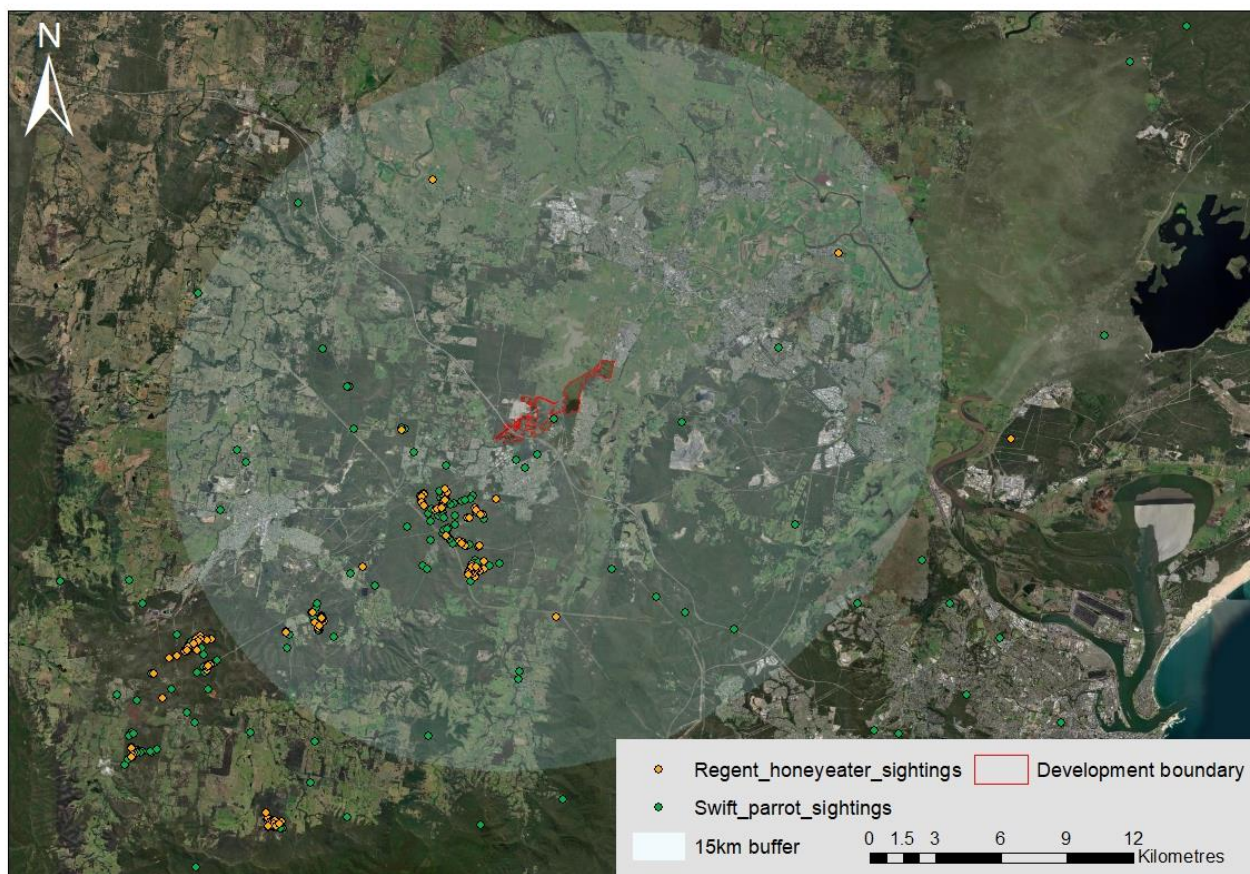


Figure 1: Location of Swift Parrot and Regent Honeyeater sightings since 2010 in the lower Hunter Valley with respect to the Hydro development footprint. Source: BirdLife Australia.

2: Assessments of mapped Swift Parrot and Regent Honeyeater habitat within the proposed Hydro development footprint

2.1 Methodology

2.1.1 Habitat assessments

Five days of field surveys, focussed on areas within the Hydro development footprint intersecting mapped important habitat for the Regent Honeyeater and/or Swift Parrot (Figure 2), were undertaken. A total of 74 habitat assessment sites were established within the proposed development footprint during this period (Figure 2). An additional three days of field surveys were conducted within the proposed Hydro Biodiversity Stewardship Site (BSS), where 45 habitat assessment sites were established. Further information on the methodology used within the BSS is provided in section 4 of this report.

The habitat assessments collected the same data as collected at survey sites for the National Regent Honeyeater and Swift Parrot Monitoring Programs (NRHMP & NSPMP, Crates et al., 2017) coordinated by the Australian National University and BirdLife Australia. The survey site is defined as a 50m radius surrounding the survey location. The data collected are outlined in Table 1. One to two photographs were taken at each habitat assessment site to provide a visual representation of the vegetation community, structure, composition and condition within the site. Of the habitat data collected, particular focus was paid to the habitat features outlined in Table 2 (Crates et al. 2017).

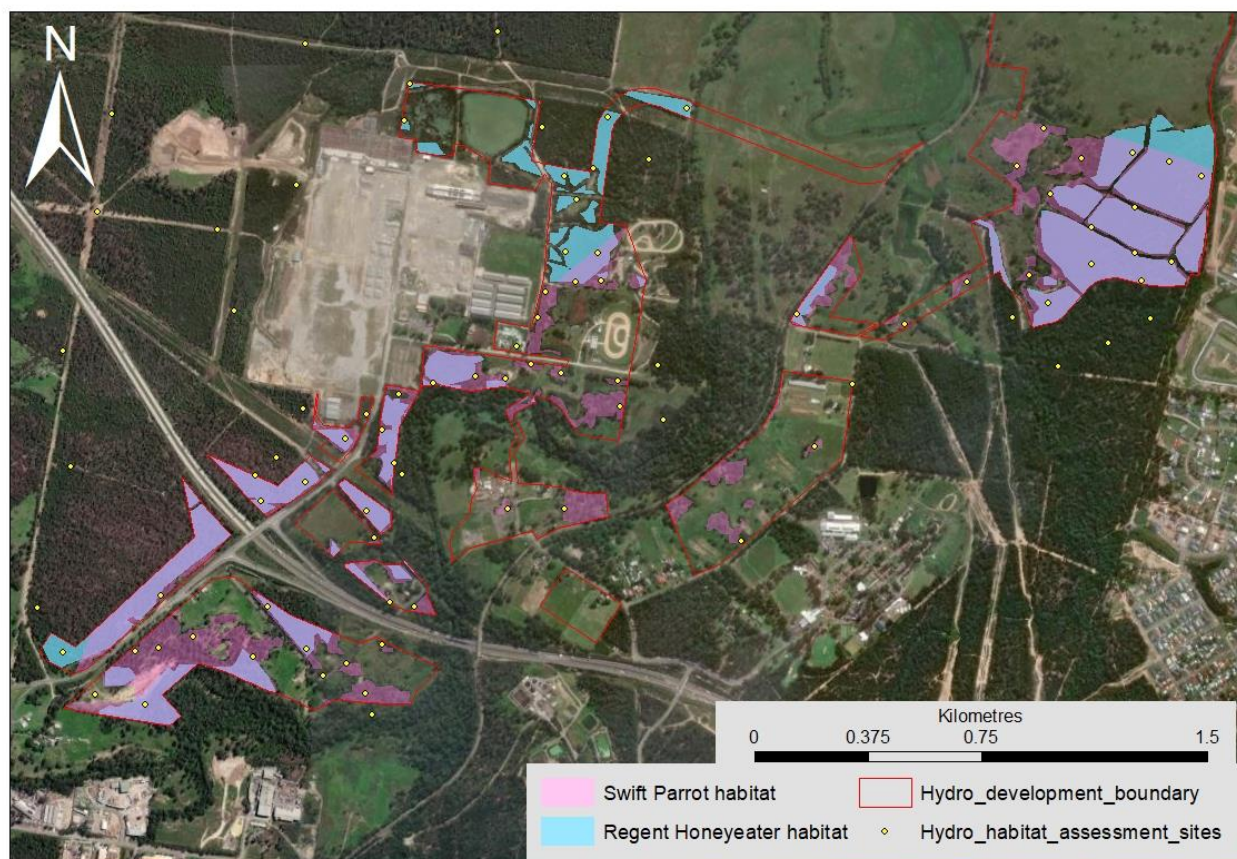


Figure 2: Location of habitat assessment sites with respect to BAM mapped important habitat for the Swift Parrot and Regent Honeyeater within the Hydro development proposal footprint, Kurri Kurri. Note that Regent Honeyeater mapped habitat overlapping with Swift Parrot mapped habitat appears as lilac colouring under semi-transparent Swift Parrot habitat, rather than light blue.

Table 1: Habitat covariates collected at each habitat assessment site within the Hydro development footprint.

Covariate	Description	Citation
Spatial location	WGS84 decimal latitude longitude to 2m accuracy	(Webb et al., 2014)
Canopy cover	Canopy cover to the nearest 5%.	(Mac Nally et al., 2000)
Tree species	Proportional contribution to total canopy cover of each tree species present.	(Downey, 1998)
Tree age	Proportion of trees present defined as young, immature, mature or old growth based on diameter and breast height (DBH).	(Downey, 1998; Griebel et al., 2017)
Tree health	Proportion of trees in the site that are: dead, dying, stressed, mildly stressed or healthy.	(Nolan et al., 2021)
Shrub cover	% shrub cover (vegetation height 30cm to 2m) to the nearest 5%	(Maron et al., 2011)
Live mistletoe	Total number of clumps of live mistletoe across all mistletoe species	(Watson & Herring, 2012)
Woody debris	4-level factor: 0 = no coarse woody debris, 3 = abundant woody debris	(Ford, 2011)
Distance to standing water	6-level factor: 0 = water present within site, 4 = water >300m away, 5 = unknown	(Crates et al., 2017)

Table 2: Habitat features of particular relevance when determining potential importance to Swift Parrots and Regent Honeyeaters.

Habitat feature	Justification	Relevant species	Citation
The proportion of mature or old growth trees*	Regent Honeyeaters and Swift Parrots tend to prefer to nest and forage in old growth trees where available. Larger trees flower more profusely or for longer periods, thus providing a reliable nectar resource for both species.	Both	Commonwealth of Australia 2016
Presence/absence of long-flowered mistletoe <i>Dendrothoe vitellina</i>	Long-flowered mistletoe is a key nectar resource and breeding substrate for Regent Honeyeaters in the Tomalpin woodlands. Most records of Regent Honeyeaters in the lower Hunter Valley are in areas with a relatively high abundance of <i>D. vitellina</i> .	Regent Honeyeater	Roderick et al., 2014
Proportion of key feed tree species (nectar-producing or lerp-hosting) within associated plant community types	Within associated plant community types, the proportion of key feed tree species may be relatively minor. Key feed tree species may be absent from some sections of mapped important habitat within the development footprint.	Both	NSW DPIE 2016
Tree health/vegetation condition.	Within associated plant community types, tree health may render habitat unviable if most trees are dead or dying.	Both	Nolan et al. 2021

*Old growth trees are defined here as those with a diameter at breast height exceeding 1 metre.

A total of 82 survey sites were assessed, throughout the mapped habitat for Regent Honeyeaters and Swift Parrots within and surrounding the proposed development footprint (Figures 2 & 11).

2.1.2 Bird surveys.

A total of 119 bird surveys were undertaken at 99 habitat assessment sites across the development footprint (n = 74 sites) and the Biodiversity Stewardship Site (n = 45 sites) between October and December 2021. Repeat

surveys were conducted at 20 sites within the proposed development footprint where blossom was found to be present. Surveys followed the methodology used for the NRHMP and NSPMP (Crates et al., 2017). Surveys lasted five minutes, with the abundance of all bird species detected visually or aurally within 50m of the site location recorded. A simple factorial score of local blossom abundance from zero (no blossom) to four (very heavy blossom) was also recorded. Bird surveys were repeated at some sites in November 2021 when key *Eucalyptus* or *Corymbia* feed trees were in blossom to increase the probability of detecting any Regent Honeyeaters present within the development footprint. Note that bird surveys were conducted outside of the period Swift Parrots are present on mainland Australia (i.e. May-September, Higgins 1999).

In addition to potentially determining the presence of Regent Honeyeaters within the development footprint, data from bird surveys can provide useful information on the presence of other specialist woodland bird species. The specialist woodland bird species considered as surrogates / indicators of important habitat for Swift Parrots or Regent Honeyeaters within the lower Hunter Valley were:

- Brown Treecreeper *Climacteris picumnus*,
- Black-chinned Honeyeater *Melithreptus gularis*
- Fuscous Honeyeater *Lichenostomus fuscus*
- Dusky Woodswallow *Artamus cyanopterus*
- Little Lorikeet *Glossopsitta pusilla*.

Presence of these surrogate species can indicate relatively high-quality habitat and provides indirect evidence that these habitats could at times be exploited by Regent Honeyeaters or Swift Parrots.

2.2 Refinement of mapped important Regent Honeyeater and Swift Parrot habitat.

Important habitat mapping for Swift Parrot in New South Wales is based on remote vegetation classification and buffering of the location of confirmed Swift Parrot sightings. A 2 km radial buffer is placed around areas with five or more Swift Parrot records, where observations have occurred over two or more years and are within 2 km of one another, or areas with a single record of 40 or more birds (NSW DPIE 2020). For Regent Honeyeaters, a 5 km buffer is placed around confirmed breeding records, and a 1 km buffer around foraging records of any number of individuals (NSW DPIE 2021).

This mapping methodology is necessary given the vast wintering and breeding range of the Swift Parrot and Regent Honeyeater, respectively within NSW. However, it means that at a finer scale, the mapping could include areas that in reality are very unlikely to represent potential foraging habitat for either species, or breeding habitat for the Regent Honeyeater. Conversely, other areas that do represent potential important habitat for either species may not be included within the mapping. Fine-scale field validation and refinement of the Swift Parrot and Regent Honeyeater important habitat mapping within the proposed Hydro development area by a species' expert is therefore an important step to ensure that 'the avoid, minimize and offset' procedure (NSW DPIE 2019) is implemented as effectively as possible.

The proposed Hydro development footprint contains 68.6 Ha of mapped important Swift Parrot habitat and 50.6 Ha of mapped important Regent Honeyeater habitat (Figure 2). The important habitat mapping for both species was refined based on the results of field habitat assessments, bird surveys and expert opinion.

The approach to refine the important habitat mapping was to construct new shapefile polygons of areas that were mapped as important habitat within the proposed development footprint for the Swift Parrot and/or Regent Honeyeater. These new numbered polygons (n = 57) outline areas that, in the expert opinion of the author, should not be included as important Swift Parrot or Regent Honeyeater habitat, with accompanying justification and supporting images.

The revised mapping shapefile accompanies this report, within the 'mapping' sub-folder under the name 'Hydro_mapped_important_swift_parrot_regent_honeyeater_habitat_to_remove_from_development_boundary.shp'. Note that the revised mapping does not account for any required buffers around mapped important habitat for either species.

3. Results

3.1 Bird surveys

Blossom was present at 52 of the 119 site surveys, with the majority of blossom occurring in either *E. fibrosa*, *E. parramattensis* or *Callistemon* sp.

No Regent Honeyeaters were detected during bird surveys. Only two indicator species (Little Lorikeet and Fuscous Honeyeater) were detected at five of 54 sites within the proposed development footprint and five sites within the proposed stewardship site (Table 3). The raw bird survey data is provided in supplementary file S2.

Table 3: Summary of Regent Honeyeater and other indicator species detected at bird monitoring sites within the Hydro development footprint and Stewardship site.

Species	Development footprint (54 sites, 74 surveys)	Stewardship Site (45 sites, 45 surveys)
Regent honeyeater	0	0
Little lorikeet	3	4
Fuscous honeyeater	2	1
Dusky woodswallow	0	0
Brown treecreeper	0	0
Black-chinned honeyeater	0	0

3.2 Swift Parrot and Regent Honeyeater habitat within the Hydro development footprint- Overview.

The former Hydro Aluminium site is located within one of the most important areas in the country for the Regent Honeyeater and Swift Parrot, with multiple records of both species occurring within 15km of the development footprint over the past decade (Figure 1). Vegetation communities within the Hydro development footprint are highly variable, however, and generally speaking the habitats within the Hydro development footprint are of low to moderate importance for both species, relative to other known important sites for both species within the lower Hunter Valley, such as Werakata National Park and the Hunter Economic Zone (Roderick et al. 2014). Variability in habitat quality within the Hydro development footprint is explained primarily by soil type, stand age, tree health and vegetation community type.

3.3 Areas to be removed from important habitat mapping.

Results of the field surveys led to the suggested removal of 57 vegetation polygons, totalling 27.3 Ha of mapped important habitat for the Swift Parrot and / or Regent Honeyeater (Figure 3). The polygons for removal intersected with 21.05 Ha of mapped Swift Parrot habitat and 15.97 Ha of mapped Regent Honeyeater important habitat. The proposed Hydro development footprint therefore intersects with 47.55 Ha of important Swift Parrot habitat and 34.63 Ha of important Regent Honeyeater habitat. Explanations as to reasons for removal from important habitat mapping are provided in Table 4.

The proposed revisions to the important habitat mapping for the Swift Parrot and Regent Honeyeater, described below, are based on field surveys of habitats within the development footprint. The primary reasons why some areas of mapped important habitat for both species are suggested to be removed from the mapping include:

- A lack of canopy cover: Some mapped habitat has been historically cleared, whilst in other areas there is no mature canopy cover present.
- Errors in the remote vegetation classification: Some mapped habitat contains non-native, planted vegetation, whilst in others key feed tree species within mapped important plant community types are absent or only form a very small proportion of the total canopy cover.
- Poor tree health: In some areas, trees are predominantly in poor health, are dead, or have been subject to historically high levels of disturbance.

- A lack of key habitat features or surrogate bird species: Long-flowered mistletoe is a key breeding resource for Regent Honeyeaters within the lower Hunter Valley (Roderick et al. 2014), however field surveys revealed that all mistletoe species are extremely scarce within the proposed Hydro development footprint. Bird surveys found that other threatened species that can serve as indicators of potential Regent Honeyeater or Swift Parrot habitat were either not detected or were sparsely-distributed at low abundances within the development footprint.

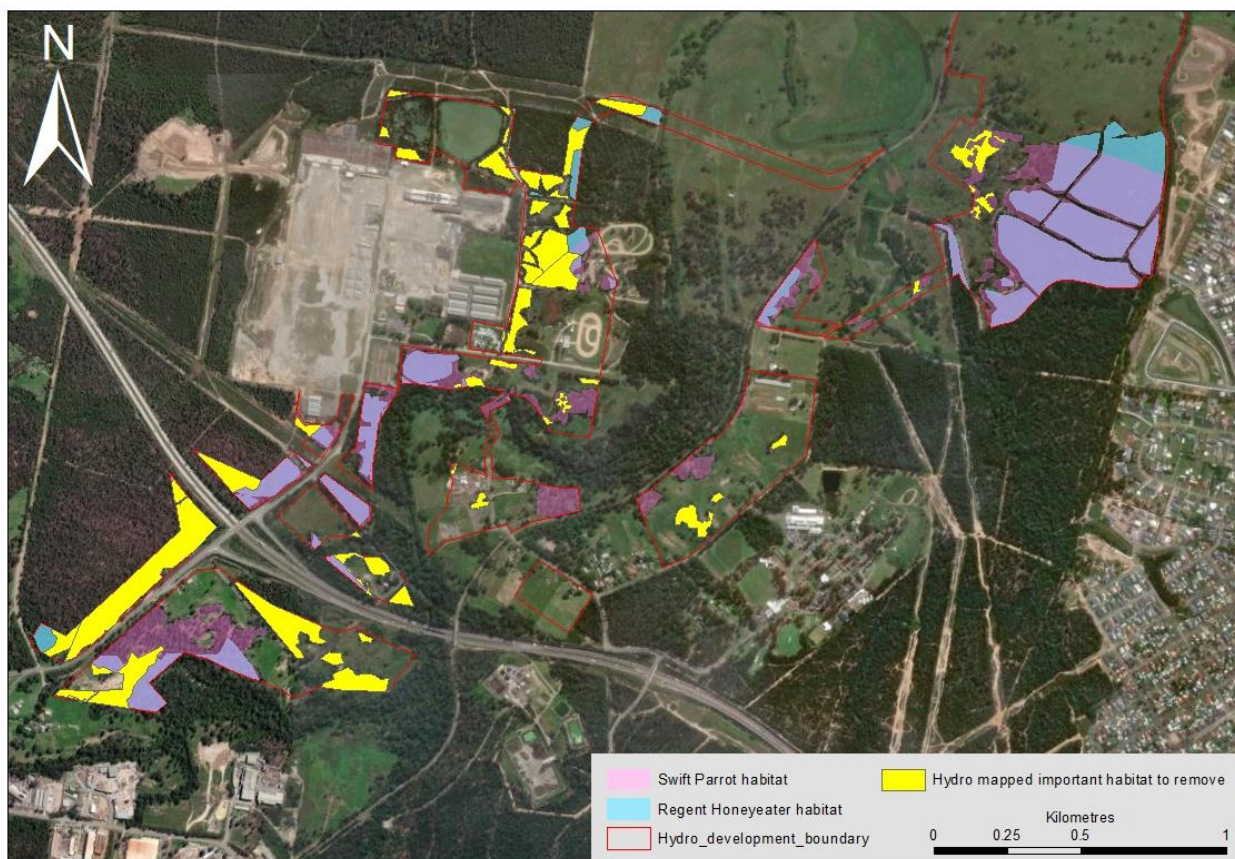


Figure 3: Proposed areas to be removed from Swift Parrot and / or Regent Honeyeater important habitat mapping within the proposed Hydro development footprint following field assessments. Note that Regent Honeyeater mapped habitat overlapping with Swift Parrot mapped habitat appears as lilac colouring under semi-transparent Swift Parrot habitat, rather than light blue.

Mapped important habitat for Regent Honeyeaters and/or Swift Parrots within the development footprint to be retained is shown in Figure 3. The areas include patches of mature woodland or forest, predominantly comprising the key Regent Honeyeater and Swift Parrot feed tree species of grey gum (*Eucalyptus punctata*), coastal grey box (*E. moluccana*), broad-leaved ironbark (*E. fibrosa*), cabbage gum (*E. amplifolia*) or stringybark spp (Figure 4). Spotted gum (*Corymbia maculata*) is only very sparsely distributed within the proposed development footprint. In addition to producing nectar when in blossom, *E. punctata*, *E. moluccana* and *E. amplifolia* are also known to host lerp (Psyllid spp.), infestations of which could provide both Swift Parrots and Regent Honeyeaters with additional food resources even when key feed tree species are not in blossom.



Figure 4: Areas of important mapped habitat for Swift Parrot and / or Regent Honeyeater within the Hydro proposed development footprint. Images obtained from habitat assessment sites HYD.001, HYD.043 and HYD.060.



Figure 5: Example polygons of mapped important Swift Parrot or Regent Honeyeater habitat that is suggested to be removed from the mapping. Top: Polygon #26, HYD.063. Habitat already cleared. Middle: Polygon 55, HYD.034. Largest trees dead, no mature canopy cover remaining. Bottom: Polygon 23, HYD.064. Primarily non-native vegetation.

Table 4: Polygons to be removed from the important habitat mapping for the Swift Parrot and Regent Honeyeater within the proposed Hydro development footprint.

Polygon No.	Species	Closest survey site	Canopy cover	Ppn. mature / old growth trees	Long-flowered mistletoe abundance	Ppn. Key feed tree species	Ppn healthy trees	No. surrogate Species detected	Comments
32	SP	HYD.048	5	0	0	0	100	0	This is young <i>Casuarina sp.</i> and does not constitute Swift Parrot foraging habitat.
33	SP	HYD.048	5	0	0	0	0	0	The small section has been previously cleared. There are no trees to the west of the track.
34	SP RH	HYD.028	35	30	0	40	90	0	Mapped as Swift Parrot habitat but the vegetation community is <i>E. parramattensis</i> and <i>A. bakeri</i> . Images from HYD.028 show this is primarily low-shrubby forest with a dense understorey of <i>Melaleuca sp.</i> on poor quality sandy soil. While this PCT is an EEC in and of itself, this polygon is not considered to represent important habitat for Swift Parrots or Regent Honeyeaters
35	SP	HYD.022	25	25	0	100	90	0	Aerial imagery shows there are no trees in this section.
36	SP	HYD.022	25	25	0	100	90	0	Aerial imagery shows there are no trees in this section.
37	SP	HYD.022	25	25	0	100	90	0	Aerial imagery shows there are no trees in this section.
38	SP	TBC			0				Aerial imagery shows there are no trees in this section.
39	SP	HYD.047	40	50	0	80	100	0	Aerial imagery shows there are no trees in this section.
40	SP	HYD.054	55	30	0	70	90	0	Aerial imagery shows there are no trees in this section.
41	SP	HYD.054	55	30	0	70	90	0	Aerial imagery shows there are no trees in this section.
42	SP	HYD.052	30	10	0	100	100	0	Trees in this strip have been planted. The proportion of grey gum is very small. There is a higher proportion of exotic pines. Does not constitute important Swift Parrot habitat.
43	SP	HYD.063	10	35	0	0	75	0	This area is a pure stand of fire-affected <i>A. floribunda</i> .
44	RH	HYD.030	30	35	0	70	80	0	Mapped as Regent Honeyeater habitat but see comment with FID 22: poor quality low shrubby woodland. The area of <i>E. parramattensis</i> – <i>A. bakeri</i> has been removed from this section of mapped Regent Honeyeater habitat. The area containing PCT 1600 has been retained- see image attached to HYD.030.

45	SP RH	HYD.027	10	20	0	50	70	0	Habitat transitions to low shrubby woodland on sandy soil, more similar to vegetation community in proximity to HYD.027. Not important Swift Parrot or Regent Honeyeater habitat.
46	SP	HYD.036	25	15	0	0	80	0	Vegetation within the development footprint here is 100% <i>A. floribunda</i> / <i>bakeri</i> . Not important Swift Parrot habitat.
47	SP RH	HYD.023	35	25	0	80	30	0	Small trees, mostly dead on poor sandy soils. Not Regent Honeyeater or Swift Parrot habitat.
48	SP	HYD.035	25	15	0	0	80	0	Pure stand of young <i>A. floribunda</i> . Not important Swift Parrot habitat
49	SP RH	HYD.032 HYD.033	20	80	0	40	80	0	Young, shrubby forest on poor sandy soil. Not important Swift Parrot or Regent Honeyeater habitat.
50	SP RH	HYD.050	15	30	0	90	90	0	This polygon contains a cleared area dominated by exotic shrubs. Remove from the mapping for both species.
51	SP	HYD.049	15	10	0	80	85	0	Appears to be planted roadside veg. Some exotic species including pines. Some bigger trees in poor health. Can be removed from mapping.
52	SP	HYD.058	10	100	0	20	80	0	Polygon removes 2 <i>E. crebra</i> and 2 <i>A. bakeri</i> . Single mature <i>E. tereticornis</i> retained.
53	SP	HYD.057	10	100	0	0	100	0	Stand is 100% <i>E. crebra</i> and can be removed from the Swift Parrot habitat mapping.
54	SP	HYD.057	30	40	0	50	80	0	Patch is mainly non-native vegetation. Definitely not thin-leaved apple / grey gum as mapped. Mainly narrow-leaved mahogany. Can be removed from Swift Parrot mapping.
55	SP	HYD.034	15	10	0	100	50	0	Trees are mostly dead. Can be removed from mapping.
56	SP	HYD.041	10	0	0	10	100	0	Mostly dense scrub. No mature trees. Remove from mapping.
57	SP RH	HYD.028	35	30	0	0	90	0	Mapped as Swift Parrot habitat but the vegetation community is <i>E. parramattensis</i> and <i>E. bakeri</i> . Images from HYD.028 show this is primarily low-shrubby forest with a dense understorey of <i>Melaleuca</i> sp. on poor quality sandy soil. While this PCT is an EEC in and of itself, it is not considered to represent important habitat for Swift Parrots or Regent Honeyeaters.
26	SP RH	HYD.063	0	0	0	0	0	0	Has been cleared- see images associated with HYD.063.
24	SP RH	HYD.058	15	70	0	80	70	0	Some large old trees to remain but some are dead.
30	SP RH	HYD.058	20	5	0	20	70	0	The north-western section contains no trees, trees present are in poor health and small.

11	SP	HYD.057	10	10	0	50	90	0	Mainly <i>Melaleuca</i> swamp/scrub with minimal eucalypt canopy. Not important Swift Parrot habitat.
20	SP	HYD.057	10	10	0	50	90	0	Mainly <i>Melaleuca</i> swamp/scrub with minimal eucalypt canopy. Not important Swift Parrot habitat.
23	SP	HYD.064	15	100	0	0	65	0	Primarily non-native vegetation including silky oak and pine. Not important Swift Parrot habitat.
21	RH	HYD.051, HYD.056	25	5	0	100	100	0	This section contains some planted Eucalypts. Native veg is young, generally sparse and shrubby. Although there are some key feed tree species present (including <i>E. sideroxylon</i> which is presumably planted), it does not constitute important Regent Honeyeater habitat.
22	SP RH	HYD.053- 055	15	5	0	40	100	0	No spotted gum present here, it is immature <i>E.fibrosa</i> and <i>Melaleuca</i> sp. The section containing mature <i>E. fibrosa</i> in proximity to the raceway has been retained, but the rest does not constitute important Swift Parrot or Regent Honeyeater habitat.
19	SP	HYD.019	0	0	0	0	0	0	No trees present in this segment of mapping
3	RH	HYD.053, HYD.066	15	0	0	60	100	0	The vegetation here is young and shrubby on poor quality sandy soils.
1	RH	HYD.066	15	0	0	60	100	0	The vegetation here is young and shrubby on poor quality sandy soils.
8	RH	HYD.066	15	0	0	60	100	0	The vegetation here is young and shrubby on poor quality sandy soils.
2	RH	HYD.066	15	0	0	60	100	0	The vegetation here is young and shrubby on poor quality sandy soils.
11	RH	HYD.067	10	10	0	0	95	0	Primarily <i>Melaleuca</i> and <i>Allocasuarina</i> swamp. Does not constitute important Regent Honeyeater habitat.
7	RH	HYD.067	10	10	0	50	100	0	
4	RH	HYD.067	40	40	0	60	100	0	Some key feed tree species present but soils are sandy, no mistletoe present. A proportion of the mapping containing mature stringybarks has been retained.
6	RH	HYD.069							
10	RH	HYD.068	35	30	0	70	85	0	Some mature grey gum/stringybark woodland in the gully to the eastern side of this polygon has been retained. The proportion removed is less mature with a smaller proportion of key feed tree species. No long-flowered mistletoe, or any other mistletoe species.

9	RH	HYD.073	40	0	0	40	100	0	The eastern (downslope, Creekside vegetation) containing grey box and cabbage gum has been retained. Higher up the slope the vegetation contains immature <i>E.fibrosa</i> and <i>E. parramattensis</i>
5	RH	HYD.069	40	0	0	20	100	0	Young, shrubby regrowth on poor-quality soils. Not important Regent Honeyeater habitat.
12	RH	HYD.070	15	0	0	50	100	0	Young, dense, scrubby woodland on sandy soils.
13	RH	HYD.070	15	0	0	50	100	0	Young, dense, scrubby woodland on sandy soils.
14	RH	HYD.070	15	0	0	50	100	0	Young, dense, scrubby woodland on sandy soils. Some grey gum present.
15	RH	HYD.070	30	10	0	50	100	0	Young, dense, scrubby woodland on sandy soils. Some grey gum present.
18	RH	HYD.071	20	0	0	40	100	0	Young, dense regrowth of <i>E. parramattensis</i> and narrow-leaved apple. Not important Regent Honeyeater habitat.
17	RH	HYD.072	20	10	0	20	100	0	Young, dense regrowth of <i>E. parramattensis</i> and narrow-leaved apple. Not important Regent Honeyeater habitat.
16	RH	HYD.072	20	10	0	20	100	0	Young, dense regrowth of <i>E. parramattensis</i> and narrow-leaved apple. Not important Regent Honeyeater habitat.

3.4 Areas to be included in the important habitat mapping.

Two polygons, totalling approximately 0.19 Ha, containing a single mature *E. fibrosa* and three mature *E. punctata* within the development footprint should be included within the important habitat mapping for both species (Figures 6 & 7).

Table 5: Important Regent Honeyeater and Swift Parrot habitat within the proposed Hydro development footprint to be included in the mapping.

Polygon No.	Species	Closest survey site	Canopy cover	Ppn. mature / old growth trees	Long-flowered mistletoe abundance	Ppn. Key feed tree species	Ppn healthy trees	No. surrogate Species detected	Index score	Comments
1	SP RH	HYD.045	100	100	0	100	100	1		Single mature <i>E. fibrosa</i> has been removed from the important habitat within a cleared area. This tree should be re-instated within the mapping.
2	SP RH	HYD.059	100	100	0	100	100	0		Three large old <i>E. punctata</i> currently not included in the mapping but should be.

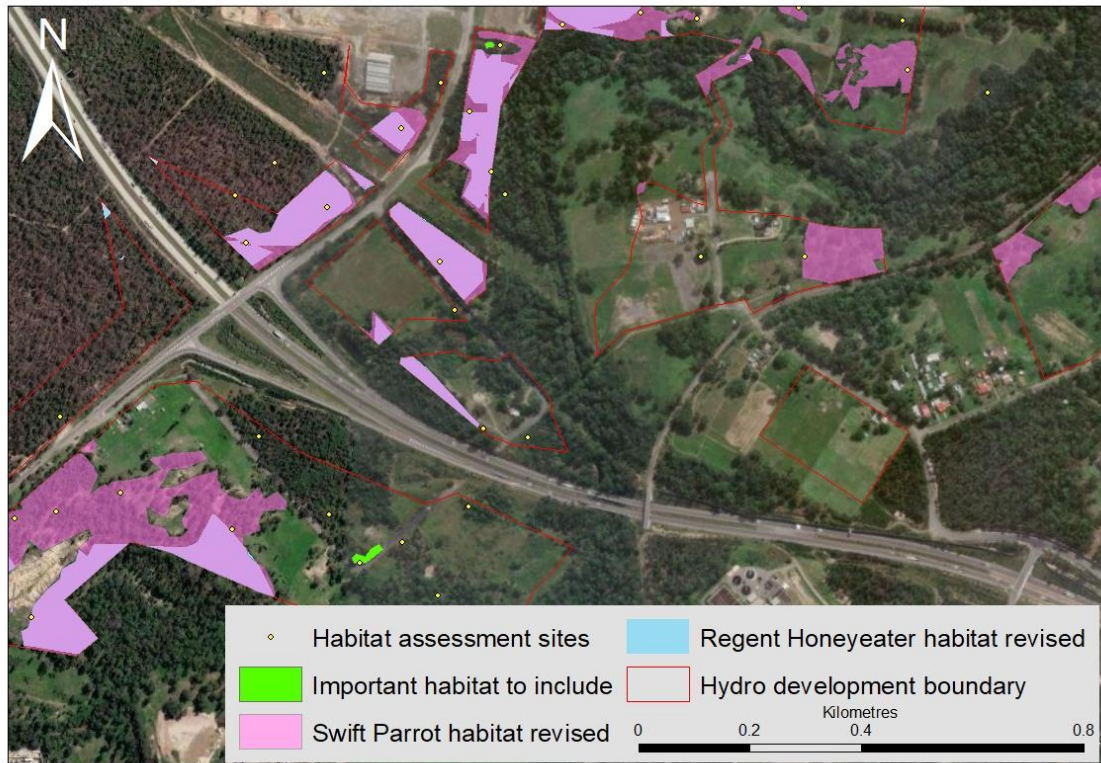


Figure 6: Locations of important Swift Parrot and Regent Honeyeater habitat within the proposed Hydro development footprint to be included within the important habitat mapping. Note that overlapping Regent Honeyeater and Swift Parrot important habitat appears lilac coloured in the figure.



Figure 7: Habitat within polygons 1 and 2, Table 6, to be included within the important Regent Honeyeater and Swift Parrot mapping.

4. Assessments of Swift Parrot and Regent Honeyeater habitat within the proposed Hydro Biodiversity Stewardship Site.

4.1 Background.

The proposed Hydro Biodiversity Stewardship site contains 767.9 Ha of habitat within and surrounding the proposed Hydro development footprint (Figure 8).

Of this 767.9 Ha, 204.8 Ha is mapped as important Swift Parrot habitat (Figure 8). However, because of the methodology used to produce the Swift Parrot important habitat mapping (i.e. buffering of Swift Parrot sightings), there is potential for more important Swift Parrot habitat to be present within the proposed stewardship site that is currently not mapped because the habitat lies more than 2-5 km from a Swift Parrot sighting.

In contrast to Swift Parrots, 647.1 Ha of the proposed Hydro Biodiversity Stewardship Site is mapped as important Regent Honeyeater habitat, but some of this habitat may, in reality, not represent important habitat for the Regent Honeyeater (Figure 9).

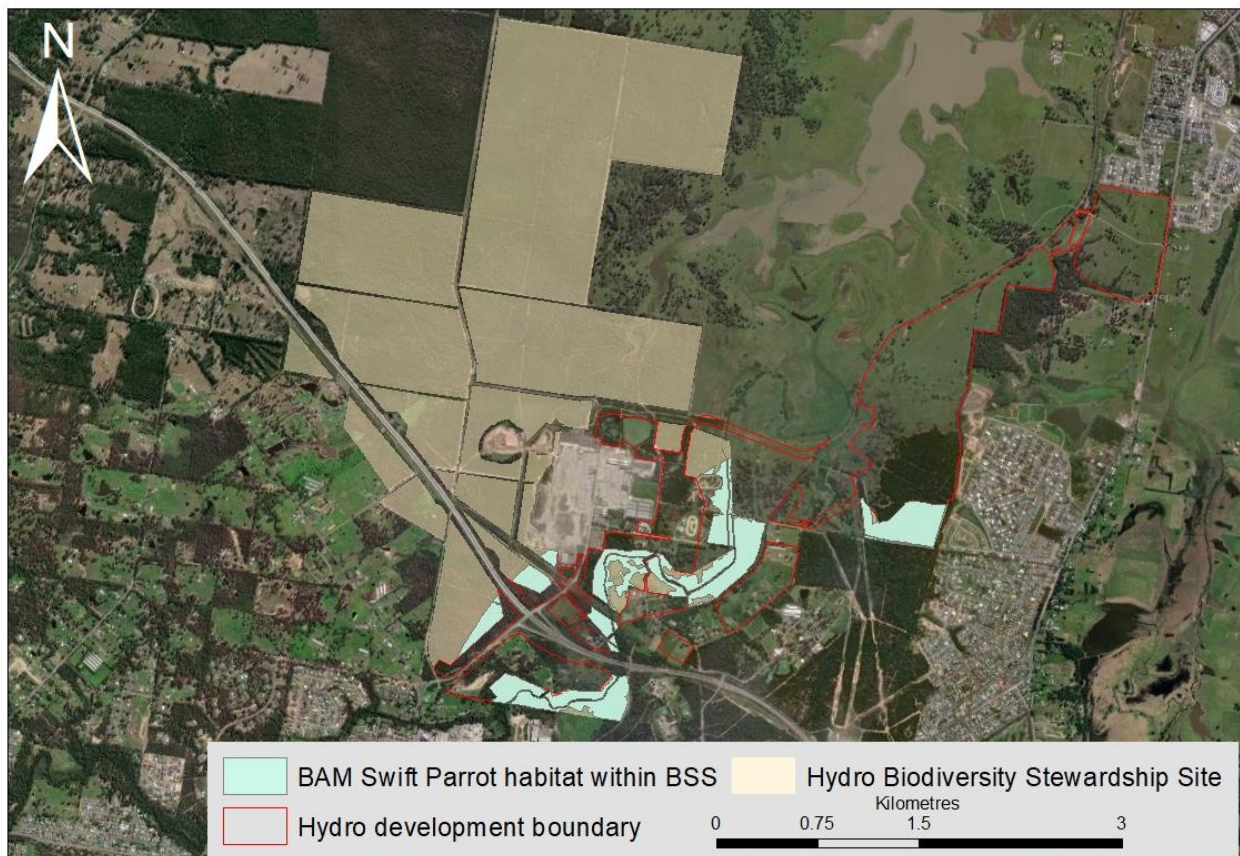


Figure 8: Distribution of the proposed Hydro Biodiversity Stewardship Site. Shown in blue is the current mapped important Swift Parrot habitat within the proposed stewardship boundary based on the original BAM mapping.

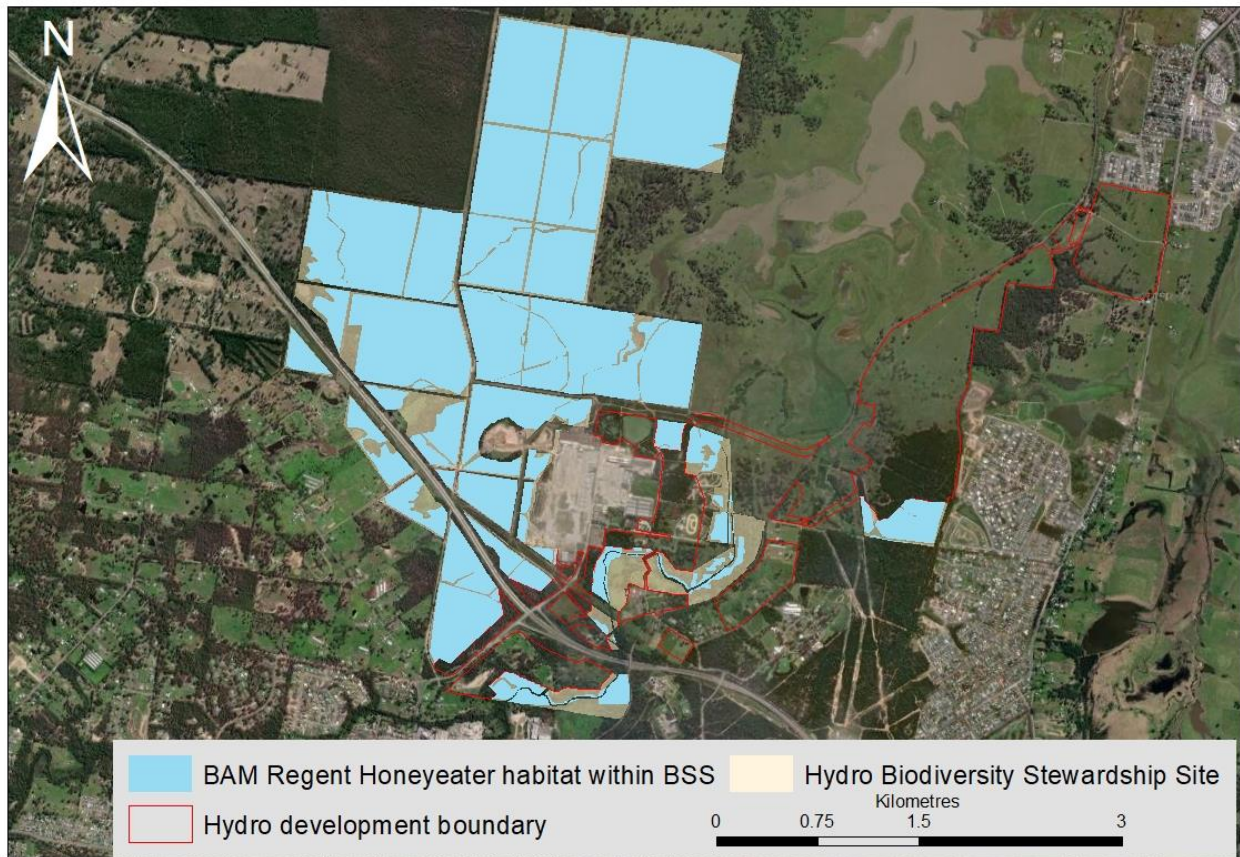


Figure 9: Distribution of the proposed Hydro biodiversity stewardship site. Shown in blue is current mapped important Regent Honeyeater habitat within the proposed stewardship boundary based on the original BAM mapping.

There is a requirement therefore, to refine the important habitat mapping for both the Swift Parrot and the Regent Honeyeater within the proposed Hydro Biodiversity Stewardship site based on field assessments of the vegetation communities and condition within the Stewardship Site by a species' expert.

4.2 Methodology

The same methodology used to assess habitat and conduct bird surveys within the proposed development footprint was used within the proposed stewardship sites (see section 2.1.1). All accessible tracks were driven within and surrounding the stewardship site. A total of 45 habitat and bird assessment sites were established within and surrounding the Stewardship Site (refer to Figure 10). Assessment sites were focussed as much as possible on areas where trees were in blossom.

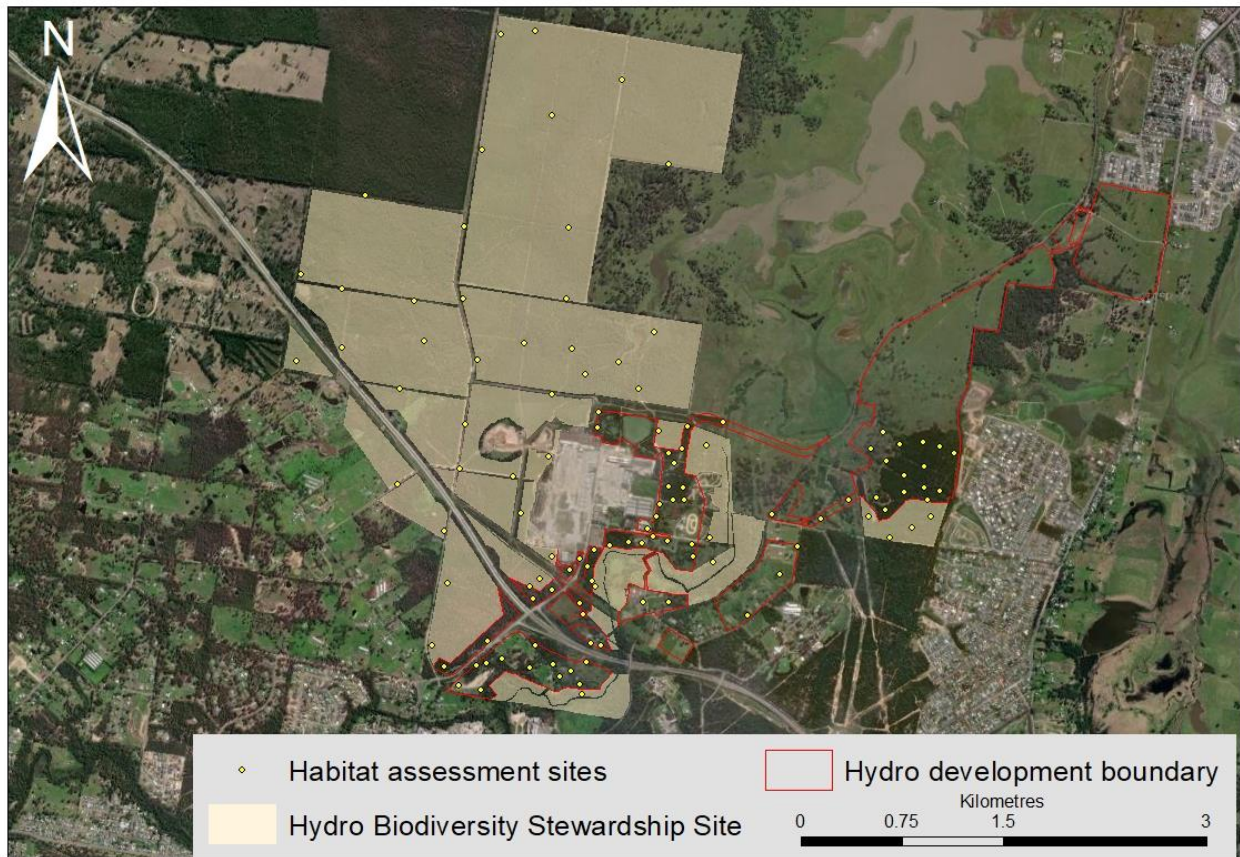


Figure 10: Distribution of habitat assessment and bird monitoring sites within and surrounding the Hydro Biodiversity Stewardship Site.

Based on visual assessments of the habitats encountered within the stewardship boundary and the results of the habitat assessments, the mapping for both species within the stewardship site was revised such that only important habitat for either species was included.

4.3 Results

Vegetation communities within the Hydro stewardship boundary were variable with respect to their importance to Regent Honeyeaters and Swift Parrots. Areas to the north and north-west of the Stewardship Site represent important habitat for both species, with large stands of *E. fibrosa* interspersed with patches of *C. maculata*. These areas represent the most important areas for both species within the stewardship site and development footprint. Other important areas for both species include the vegetation communities surrounding the creek line running through the south-eastern area of the stewardship boundary and the wetland area to the north of the industrial zone. These areas are dominated by *E. amplifolia* interspersed with *E. punctata*, *A. floribunda*, *E. moluccana* and stringybark spp. (Figure 11).

No Regent Honeyeaters were detected at any of the 45 survey sites within the Hydro Stewardship site. Two indicator species- Fuscous Honeyeater and Little Lorikeet- were detected at 1 and 4 sites, respectively (Table 3). The raw bird survey data is provided accompanying this report in the sub-folder 'Bird survey data.'



Figure 11: Examples of important Swift Parrot and Regent Honeyeater habitat within the Hydro Biodiversity Stewardship Site. Top and middle: *E. fibrosa* / *C. maculata* forest (HYD. 089 & HYD.092); Bottom: *E. amplifolia* woodland (HYD.075).

Other parts of the stewardship site, particularly those at slightly higher elevations on poorer quality, sandy soils do not represent potential habitat for Regent Honeyeaters or Swift Parrots. These areas are primarily near the centre of the stewardship area, to the west of the industrial area and are dominated by areas of *E. parramattensis* similar in structure and composition to areas that have been suggested to be removed from the Swift Parrot important habitat mapping within the proposed development footprint (Figure 12). It is noted that some parts of the stewardship site were affected badly by fire in 2016, most of which are not considered to represent important Swift Parrot or Regent Honeyeater habitat.

The areas considered to represent important Swift Parrot and Regent Honeyeater habitat within the Hydro stewardship site are shown in Figure 12. The revised mapping indicates there is 607.25 Ha of important Regent Honeyeater and Swift Parrot habitat within the Hydro Biodiversity Stewardship Site.

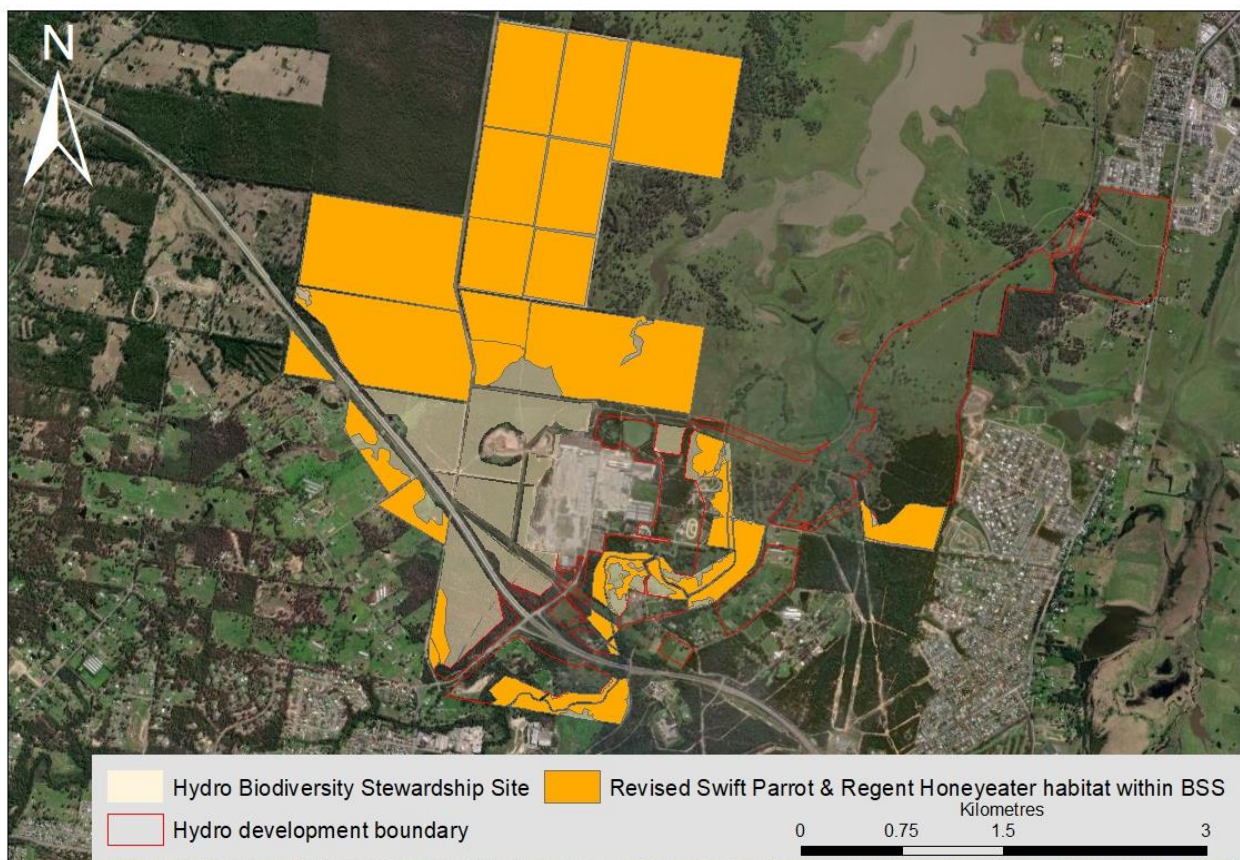


Figure 12: Revised mapping showing the distribution of important habitat for the Swift Parrot and Regent Honeyeater within the Hydro Biodiversity Stewardship Site.

5. Conclusion

Following extensive field-based habitat and bird surveys, an assessment by a recognised species expert, Dr Ross Crates, has concluded that the quantity of mapped important habitat for the Swift Parrot and Regent Honeyeater within the Hydro development footprint is 47.55 Ha and 34.63 Ha, respectively. These values represent a reduction of 21.05 Ha and 15.97 Ha on previous estimates of important habitat for both species, respectively. The remaining mapped important habitat within the proposed Hydro development footprint is considered to be of low to moderate quality, relative to other areas of mapped important habitat for the Swift Parrot and Regent Honeyeater within the lower Hunter Valley, such as parts of Werakata National Park and the Hunter Economic Zone (Roderick et al. 2014). It is considered unlikely that Swift Parrots or Regent Honeyeaters would utilise mapped habitats within the proposed Hydro development footprint, and none of the remaining mapped important habitat within the Hydro development footprint is considered critical habitat for either species. See the serious and irreversible impact assessment accompanying this report for further details on the likely impacts of the proposed development on both species.

The most important habitat for the Swift Parrot and Regent Honeyeater within the Hydro estate is contained within the proposed Hydro Biodiversity Stewardship Site. In particular, the areas of (i) *E.fibrosa* / *C.maculata* forest in the north of the BSS, and (ii) *E.amplifolia* / *E.punctata* woodlands surrounding the wetlands north of the industrial zone (Figure 11) are most similar to those habitats that Swift Parrots and Regent Honeyeaters are known to occupy within the lower Hunter Valley. Water is a key habitat feature for both species, and most of the important habitat for Swift Parrots and Regent Honeyeaters in close proximity to water bodies that could be used for drinking or bathing is already contained within the BSS. This includes the creek line running through the south-east section of the Hydro estate, as well as the larger wetland area to the north of the proposed development footprint and to the east of the main BSS. Similarly, areas of highest soil fertility adjacent to waterbodies on which key Swift Parrot and Regent Honeyeater feed tree species grow are principally located within the BSS, unless they have been retained in the revised important habitat mapping within the development footprint.

Since Swift Parrots and Regent Honeyeaters are both highly mobile species, potential impacts of the loss of mapped important habitat on the dispersal capacity of both species through habitat corridors are considered to be low. See the SAIL assessment for further assessment of risks of habitat fragmentation and barriers to dispersal associated with habitat loss.

Field surveys revealed that some mapped important Regent Honeyeater habitat within the proposed Hydro BSS does not represent important habitat for this species. The area of important Regent Honeyeater habitat within the BSS has been revised down from 647.1 Ha to 602.75 Ha. Areas removed from the BSS mapping are primarily ridge top plant community types on poorer-quality, sandy soils. The area of important Swift Parrot habitat within the BSS has been revised up from 204.8 Ha to 602.75 Ha.

Further changes to the proposed development footprint to avoid and minimise impacts on Regent Honeyeaters and Swift Parrots are beyond the scope of this expert assessment. However, additional ways in which potential impacts of the proposed Hydro development on the Swift Parrot and Regent Honeyeater could be reduced or mitigated include:

- Seeding of Long-flowered Mistletoe within the BSS, particularly within *E. fibrosa* - *C. maculata* forests. This would require a rigorous study to assess the efficacy of seeding as a viable conservation strategy, but if successful could substantially increase the value of the BSS for Regent Honeyeaters.
- Noisy Miner management. Suppression of Noisy Miners within the BSS could reduce the impact of Noisy Miners on any Swift Parrots and Regent Honeyeaters that may look to utilise habitats within the BSS. This would also require monitoring to assess the efficacy of noisy miner management within the Hydro BSS as a long-term conservation strategy and ensure that rapid recolonisation by Noisy Miners does not occur.

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7. Author Curriculum Vitae

Dr Ross Crates

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Selected employment history:

- October '21 – present: **Owner, FutureFauna-** Ecological consulting, research and conservation.
- September '18 – present: **Postdoctoral Fellow, Australian National University-** Designing, implementing and managing national monitoring programs for the regent honeyeater and swift parrot. Publication of peer-reviewed articles pertaining to woodland bird conservation. Student supervision, teaching.
- September '10 – November '13: **Edward Grey Institute, University of Oxford- Graduate research assistant.** RA to professor Ben Sheldon, on a major ERC grant to study the social ecology and dispersal of wild birds.

Academic history:

- 2015-2018 - Australian National University, Australia. PhD, conservation biology.
- 2006-2010 - University of East Anglia. BSc (1st class Hons) Ecology with a year in Australasia.
- 1999-2006 - Barton Court Grammar School, Canterbury. 4 A-levels grade A and 8 GCSEs grade A* - A.

Academic awards:

- Michael Graham prizes for best performance in Ecology & best conservation project, University of East Anglia.
- Australian National University, Australian Postgraduate Award Research Scholarship.

Selected publications:

- Heinsohn, R, Crates, R. et al. (2022). Population viability in data deficient nomadic species: What it will take to save regent honeyeaters from extinction. *Biological Conservation* **266**: 109430.
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Selected Grants:

- NSW Local Land Services: Regent honeyeater population monitoring program. \$300,000
- CWP renewables: Sapphire Wind Farm swift parrot and regent honeyeater biodiversity offset. \$250,000
- Commonwealth of Australia Department of Agriculture, Water & Environment: Noisy miner management assessment. \$70,000
- Commonwealth of Australia Department of Agriculture, Water & Environment: King Island scrubtit and brown thornbill population genetics \$70,000
- BirdLife Australia: Regent honeyeater monitoring, nest protection and noisy miner management. \$60,000
- Bin Zayed Species Conservation Fund: Ecology and conservation of the regent honeyeater. \$28,000