JWA PTY LTD
Ecological Consultants
ABN 56 066 448 879

KINGS FOREST

FLORA AND FAUNA MONITORING REPORT

A Report Prepared for
Project 28 Pty Ltd

DECEMBER 2020

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TABLE OF CONTENTS

1 Introduction

1.1 Background

JWA Pty Ltd have been engaged by Project 28 Pty Ltd (Project 28) to prepare a Flora and Fauna Monitoring Report (FFMR) for the Kings Forest project site. The Kings Forest site is 846 hectares in area and is located in the coastal zone of the Tweed Shire Local Government Area (LGA). The Kings Forest site was zoned for residential and commercial development in the early 1990's and has been subject to a lengthy Commonwealth, State and Council approval process. Numerous ecological studies have been completed on the site over the last 30 years including detailed flora, fauna and hydrological surveys.

This FFMR provides a summary of the proposed flora and fauna monitoring strategies to be completed during the development of the Kings Forest site. Specific monitoring actions discussed in this FFMR will be triggered and completed over the Kings Forest site on a pre-construction, construction and operational phase basis.

1.2 Aim and Objectives

This FFMR is intended to assist Project 28 in monitoring the impacts that the proposed development may have on native fauna and flora species within Environmental Management Areas (EMAs) associated with the development of the Kings Forest site before, during and after development.

The aim of this FFMR is to develop an adaptive and responsive monitoring program, whereby information on the condition and distribution of flora and fauna (particularly threatened species) populations within and adjacent to the proposed Kings Forest development area will be used to guide future mitigation actions, test the success of mitigation measures and provide information for future monitoring.

1.3 Compliance with Relevant Approval Conditions

On the 19th January 2007, the NSW Minister for Planning authorised a Concept Plan (06_0318) for a proposed residential community at Kings Forest. The Minister for Planning granted part 3A approval (with conditions) for the Concept Plan for Kings Forest in August 2010. A FFMR was prepared in accordance with the Concept Plan approval conditions.

The Kings Forest Stage 1 Project Application (MP 08_0194) was lodged in November 2011. The Project Application was approved (with conditions) on the 11th August 2013. Conditions of this approval required that all environmental management plans be revised.

On the 21st May 2015 the Commonwealth Department of Environment approved (with conditions) the Kings Forest residential development (EPBC 2012/6328). The Commonwealth approval is confined to the mitigation of impacts of the proposed development on the koala and wallum sedge frog, both of which are listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). There are no EPBC Act approval conditions specifically relating to flora and fauna monitoring report on the Kings Forest development site.

Since the Commonwealth approval decision, Project 28 have been liaising with Tweed Shire Council (TSC) and the NSW Department of Planning, Industry and Environment (DPI&E) to reconcile all approval conditions.

The FFMR has been prepared to comply with all relevant Commonwealth, State and Local Government approval conditions. **APPENDIX 1** contains the details of the following relevant Consolidated Approval Conditions and also notes where they are addressed in this FFMR:

- Concept Plan 06_0318 Consolidated Approval Conditions incorporating the following:
    - Modification No. 1, approved on 22 December 2010;
    - Modification No. 2, approved on 11 August 2013;
    - Modification No. 3, approved on 16 May 2014;
    - Modification No. 4, approved on 20 November 2014;
    - Modification No. 5, approved on 10 November 2015;
    - Modification No. 8, approved on 24 May 2018;
- Project Approval 08_0194 Consolidated Approval Conditions incorporating the following:
    - Modification No. 1, approved on 16 May 2014;
    - Modification No. 2, approved on 20 November 2014;
    - Modification No. 3, approved on 20 February 2017;
    - Modification No. 6, approved on 21 December 2017; and
    - Modification No. 7, approved 24 May 2018.

JWA hereby certify that this FFMR has been prepared in accordance with the requirements of Condition B2 of Concept Plan Approval No. CP06_0318 (as modified) and generally in accordance with the requirements of Condition 47 of Major Project Approval No. MP08_0194 (as modified) for Kings Forest Stage 1.

1.4 Related Management Plans Prepared for the Kings Forest Site

A number of management plans were completed for the Kings Forest Stage 1 Project Application and approved under Project Approval 08_0194. Subsequent to their approval, significant work has been completed on the site. Several of these management plans have therefore been amended (and others will need to be amended) as required by Condition 39 of MP 08_0194.

This FFMR should be read in conjunction with the following documents prepared for the Kings Forest development:

- Kings Forest Koala Plan of Management (KPoM) (JWA 2019);
- Kings Forest Wallum Sedge Frog Management Plan (WSFMP) (JWA 2020a);

- Kings Forest Precincts 1- 5 and Precincts 6 – 14 Buffer Management Plan (BMP) (JWA 2020b, c);
- Kings Forest Precincts 1 – 5, Precincts 6 – 11 and Precincts 12 - 14 Threatened Species Management Plans (TSMP) (JWA 2020d, e, f);
- Kings Forest Precincts 1 – 5, Precincts 6 – 11 and Precincts 12 - 14 Vegetation and Weed Management Plan (VWMP) (JWA 2020g, h, i);
- Kings Forest Feral Animal Management Plan (FAMP) (JWA 2020j);
- Kings Forest Stage 1 Bushfire Risk Management Plan (BushfireSafe 2020);
- Construction Environmental Management Plan (CEMP) (MUS 2020);
- Kings Forest Summary of Management Plans (SOMP) (G&S 2020a);
- Kings Forest Overall Water Management Plan (OWMP) (G&S 2020b); and
- Kings Forest Drainage Maintenance Management Plan (DMMP) (G&S 2020c).

2 Site Description

2.1 Location

Kings Forest is located on the far north coast of NSW in the Tweed local government area (LGA) approximately 20 km south of the Queensland/NSW border, 5 km north-west of the village of Bogangar and 4 km south-west of Kingscliff (**FIGURE 1**).

2.2 Subject Site

The Kings Forest site is comprised of fourteen (14) land parcels with a total area of 846 hectares:

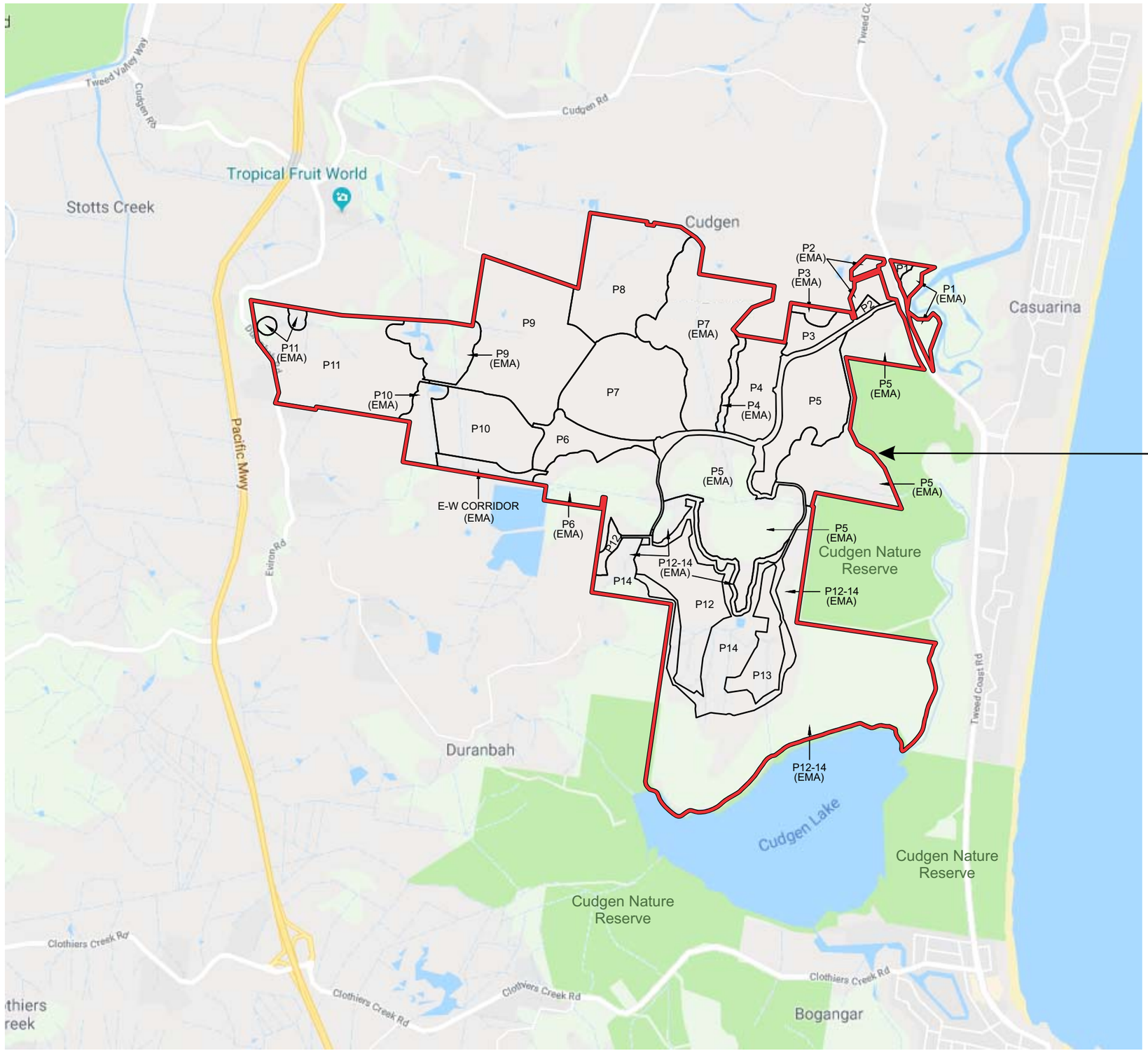
- Lot 76, 272, 323 and 326 in DP 755701;
- Lot 6 in DP 875446;
- Lot 2 in DP 819015;
- Lot 1 in DP 706497;
- Lot 40 in DP 7482;
- Lot 37A in DP 13727;
- Lot 38A in DP 13727;
- Lot 38B in DP 13727;
- Lot 1 in DP 129737;
- Lot 1 in DP 781633; and
- Lot 7 in DP 875447.

Project 28 Pty Ltd owns and manages the site which is currently used for cattle grazing and silviculture. The site consists of a mosaic of natural, partially natural, modified and regenerating plant communities including Heathland, Swamp sclerophyll (Paperbark) forest, Woodland, Pine plantation, Freshwater wetland and Pasture. The majority of the site is maintained as pasture for cattle grazing.

The Kings Forest site abuts agricultural and rural lands to the north, west and south west. Cudgen Nature Reserve (including Cudgen Lake and Cudgen Creek) abuts the site boundaries to the south and east. There are a small number of residential properties along Tweed Coast Road to the north of the site.

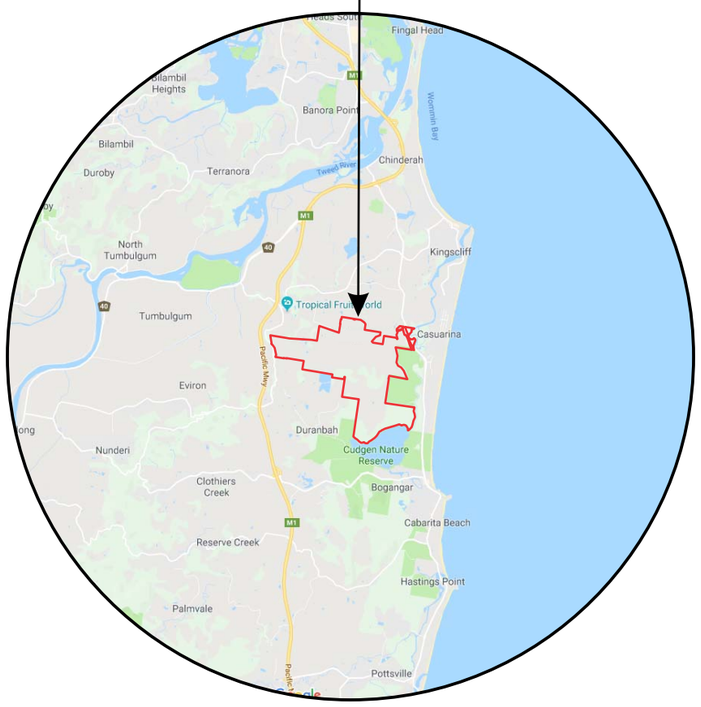
2.3 Conservation Reserves/Ecologically Significant Areas in the Locality

The Cudgen Nature Reserve adjoins the southern and (in part) eastern boundaries of the subject site (**FIGURE 2**). Stotts Island Nature Reserve is situated approximately 2 km to the north-west of the site.



LEGEND
Kings Forest Boundary

SUBJECT SITE



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SOURCE: Google Maps

SCALE: 1 : 30 000 @ A3

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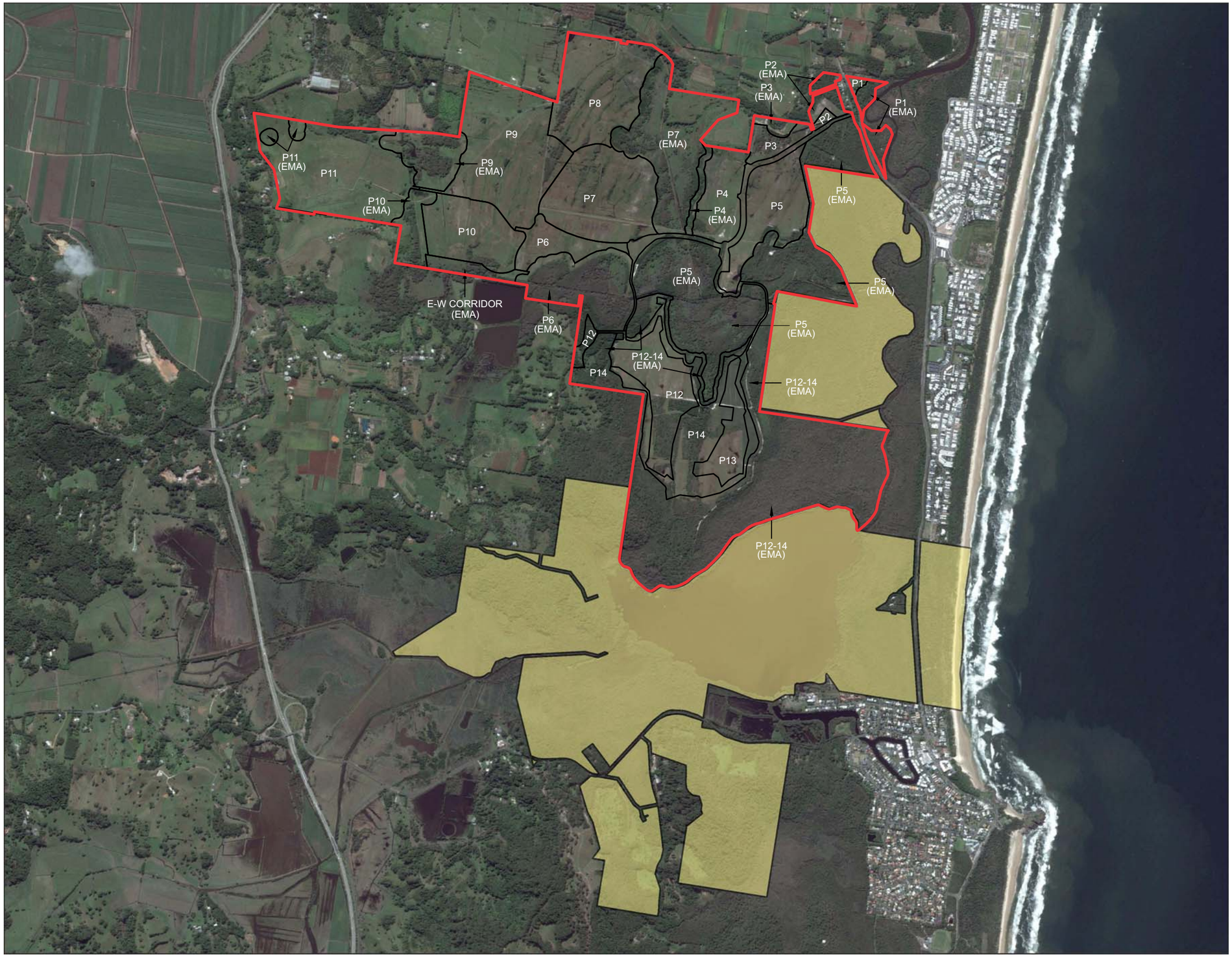
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 1

PREPARED: BW
DATE: 22 September 2020
FILE: N97017_Locality.cdr

TITLE
LOCALITY PLAN



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SOURCE: NSW DPI Cadastre
Google Earth Apr 2017 Aerial

SCALE: 1 : 30 000 @ A3

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FIGURE 2

PREPARED: BW
DATE: 22 September 2020
FILE: N97017_Cudgen NR.cdr

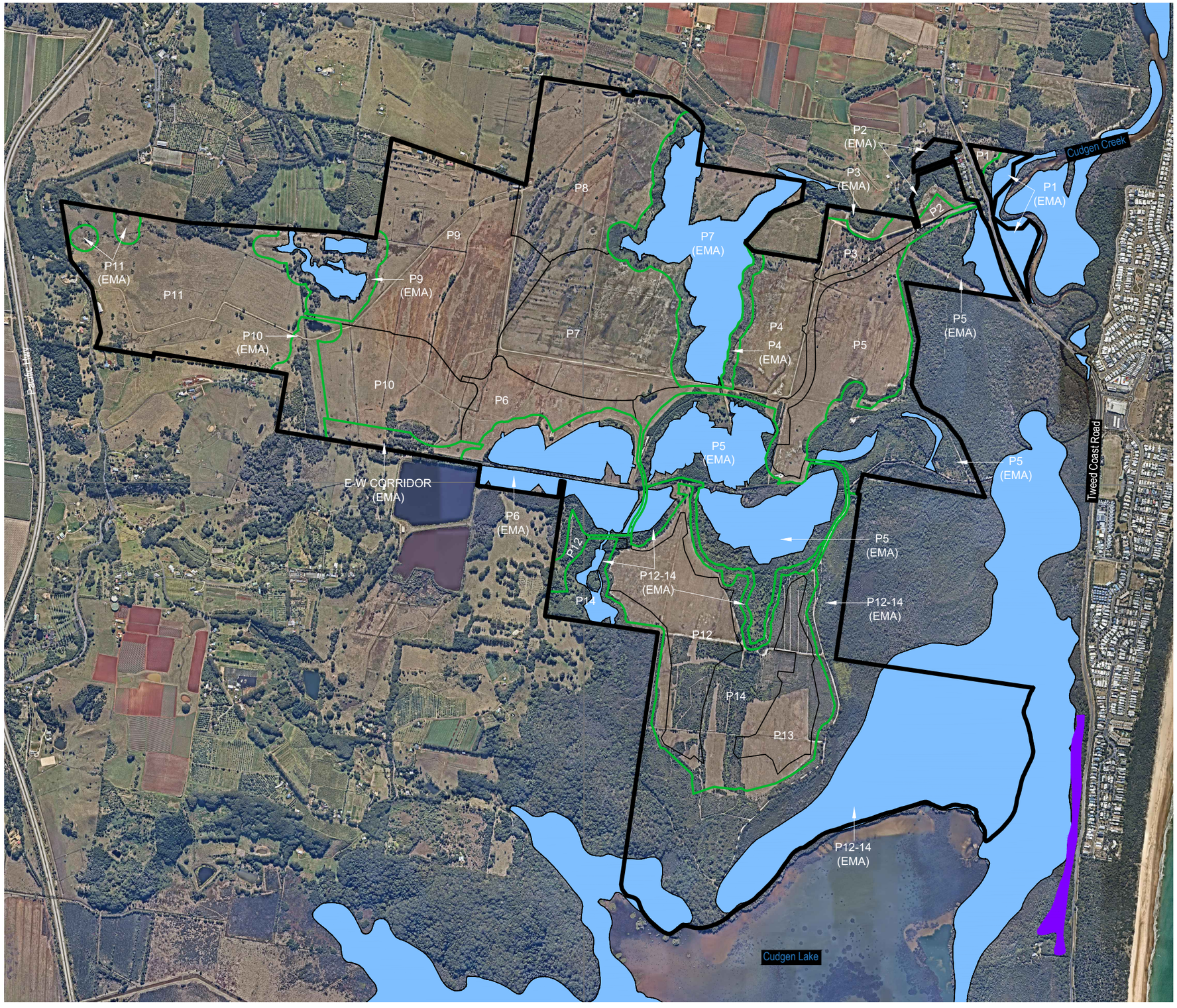
TITLE

CUDGEN NATURE RESERVE

Several Freshwater wetland and Littoral Rainforest areas protected under the (superseded) State Environmental Planning Policy (SEPP) 14 (Coastal Wetlands) and SEPP26 (Littoral Rainforests) exist within and near the site (**FIGURE 3**). These SEPP's have been superseded by State Environmental Planning Policy (SEPP) Coastal Management (2018). Whilst there are areas of discrepancy between the superseded and current SEPP wetland mapping on site, the wetlands generally occur in areas zoned for Environmental Protection on the NSW Planning SEPP Major Development 2005 – Kings Forest land zoning map (**FIGURE 4**). As all relevant approvals were granted prior to the gazettal of the Coastal Management SEPP reference to this mapping has not been shown to avoid confusion.

2.4 Land Use Zones

Land use zones over the Kings Forest development site are identified on the NSW Planning SEPP Major Development 2005 – Kings Forest land zoning map (**FIGURE 4**). SEPP 14 wetland areas, as well as a number of smaller wetland and Littoral rainforest parcels have been designated Environmental Protection (Wetlands and Littoral Rainforests) (7a) zones. Substantial buffer zones occur wherever the 2(c) lands abut neighbouring agricultural land (150 metres) and Environmental Protection zones (50 metre). Lands in the far south of the property are subject to clause 50b of the Tweed LEP, committing them to conservation. Apart from other smaller areas of Environmental Protection (Habitat) (7l), the remainder of the property is zoned Urban Expansion (2c).



N

LEGEND

- SEPP 14 Coastal Wetlands (#1)
- SEPP 26 Littoral Rainforest (#1)
- Environmental Management Area (EMA) Boundary (#2)
- Precinct Boundary
- Kings Forest Boundary

Note 1:
These SEPP's have been superseded by State Environmental Planning Policy (SEPP) Coastal Management (2018). As all relevant approvals were granted prior to the gazettal of the Coastal Management SEPP, reference to the revised mapping has not been shown to avoid confusion.

Note 2:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 500m
1 : 20 000

SOURCE: Landpartners - SEPP14 Wetlands (Amendment 15) & SEPP26 Littoral Rainforest; Near Map 08/08/18 Aerial

SCALE: 1 : 20 000 @ A3

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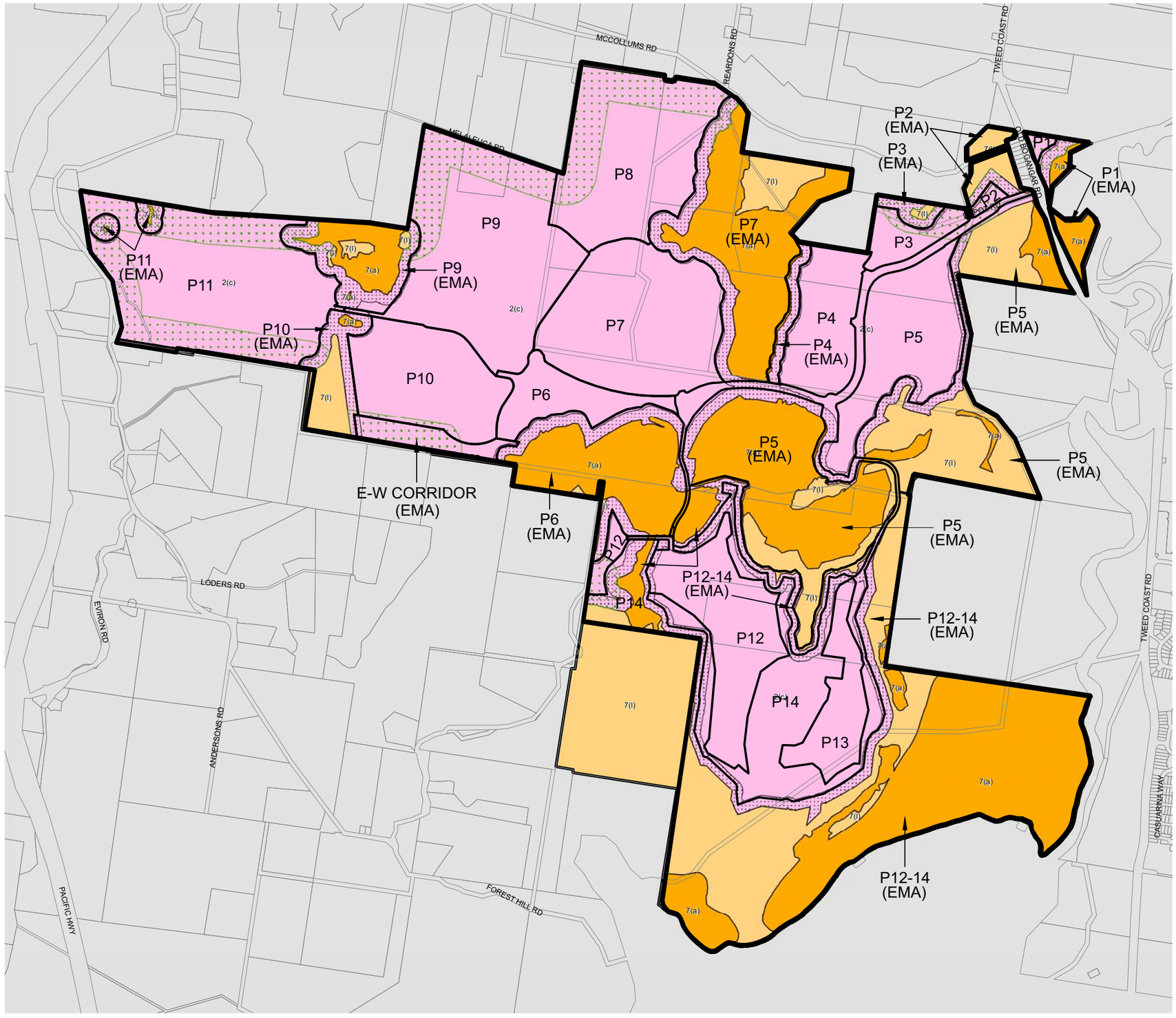
FIGURE 3

PREPARED: BW
DATE: 22 September 2020
FILE: N97017_FFMR_20200922.dwg

TITLE
SEPP No. 14
COASTAL WETLANDS
& SEPP No. 26
LITTORAL RAINFOREST



LEGEND

Kings Forest Boundary

ZONING

- 2(c) Urban Expansion
- 7(a) Environmental Protection (Wetlands & Littoral Rainforests)
- 7(l) Environmental Protection (Habitat)
- Agricultural Buffer (150m)
- Ecological Buffer (50m)

0 500m

1 : 20 000

SOURCE: NSW Planning SEPP (Major Development) 2005 - Kings Forest Land Zoning Map (Ref: SEPP_MD_KIF_LZN_001_20100201)
SCALE: 1 : 20 000 @ A3

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FIGURE 4

PREPARED: BW
DATE: 22 September 2020
FILE: N97017_Zoning.cdr

TITLE

ZONING PLAN

3 Proposed Development

3.1 Background

The Kings Forest project is a master planned residential community. The total area of the proposed development is 422.32 ha and will include the following in accordance with the Concept Plan Approval (as modified Mods 1 to 5):

- Residential development for approximately 4500 dwellings;
- Town centre and neighbourhood centre for future retail and commercial uses;
- Community and education facilities;
- Employment land;
- 18 hole Golf Course;
- Open space;
- Wildlife corridors;
- Protection and rehabilitation of environmentally sensitive land;
- Utility services infrastructure;
- Water management areas and lake; and
- Roads and pedestrian and bicycle paths.

The proposed development comprises a total of fourteen (14) separate precincts (**FIGURE 5**) and development of the site will be completed on a precinct-by-precinct basis.

Retained vegetation and habitat areas across the site generally occur within Environmental Protection Zones (EPZs) and associated buffers. To assist in identifying the staging of rehabilitation and management actions, these EPZ and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs). Works within EMAs will be completed in accordance with the staging of the associated Precinct.

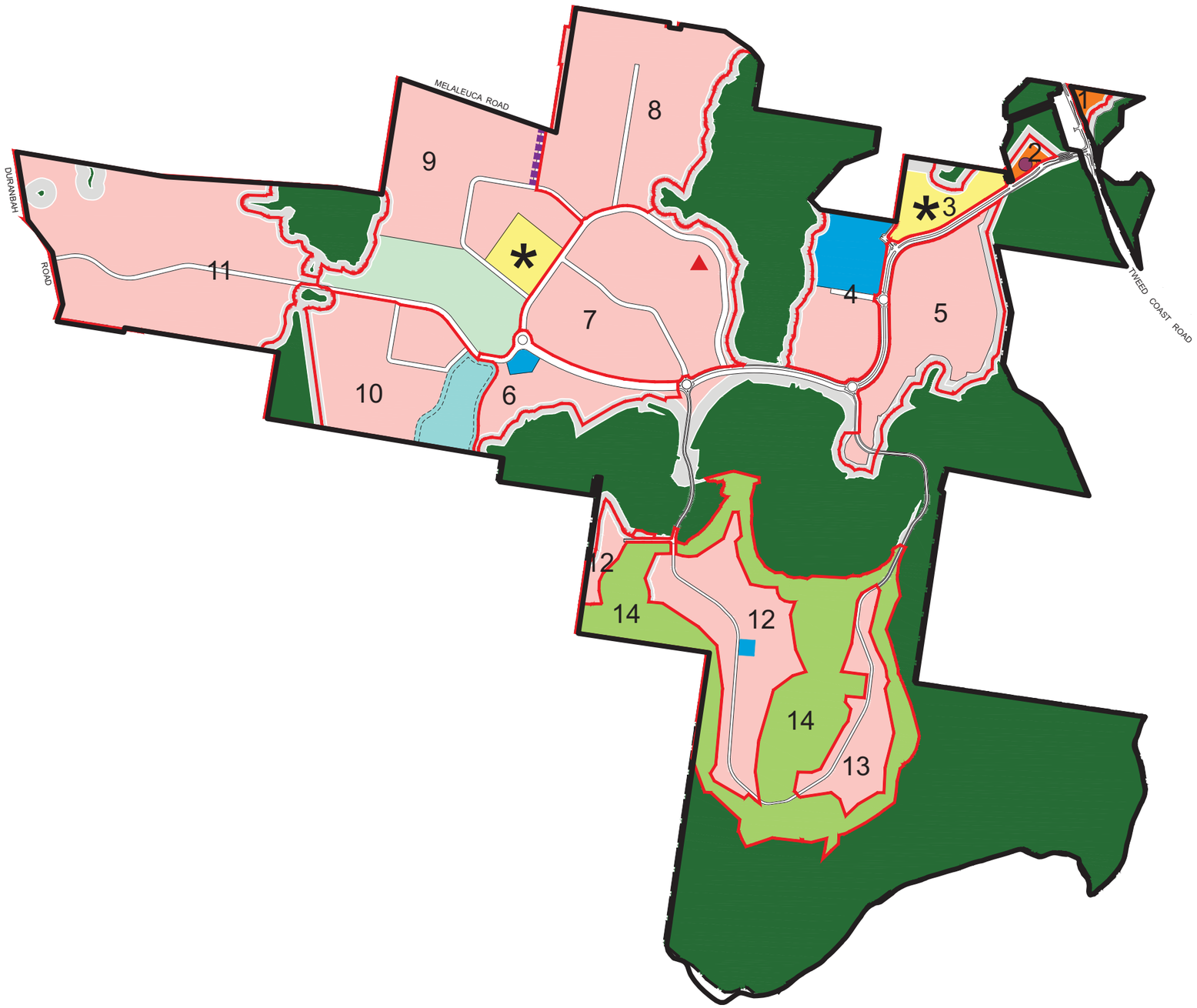
3.2 Precinct Descriptions

3.2.1 Precinct 1

Precinct 1 occurs in the far east of the Kings Forest site. Tweed Coast Road traverses the western boundary of Precinct 1 and Cudgen Creek occurs offsite to the east. Precinct 1 is proposed to be developed for the purposes of a Service Station. An EPZ and associated 50 m buffer zone occur to the south of Precinct 1 (collectively referred to as the Precinct 1 EMA) in which no development works are proposed.

3.2.2 Precinct 2

Precinct 2 is located at the entrance to the Kings Forest site, to the west of Tweed Coast Road and north of the proposed Kings Forest Parkway. Precinct 2 is proposed to be developed for employment purposes. An EPZ and associated 50 m buffer zone occur to the north of



N

LEGEND

- Precinct Boundary
- Kings Forest Boundary

PRECINCT PLAN

- Town Centre / Neighbourhood Centre
- Residential
- Community Facilities / Education
- Employment Land
- Structured Open Space (Active)
  (Passive open space to council standards, location subject to urban design)
- Environmental Protection Area
- 50m Ecological Buffer
  (Includes APZs & roads where approved)
- State School Site
- Proposed Zone Substation
  (Subject to Country Energy final approval)
- Potential Affordable Housing Location
- Potential Road Connection to Melaleuca Road

Private Open Space

- Golf Course Area
  (Encompassing ecological buffers where indicated)
- Private Open Space including lake

IMPORTANT NOTE

This plan was prepared as a preliminary concept plan for planning purposes only. As such all particulars, including lot design, areas and densities, are subject to detailed survey, site investigations and to the requirements of council and any other authority which may have requirements under any relevant legislation.
This note is an integral part of this plan.

0 500m
1 : 20 000

SOURCE: RPS Precinct Plan Rev B dated 05/12/13 (Ref: 113691-PSP-4b(PRECINCT PLAN).dwg)
SCALE: 1 : 20 000 @ A3

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FIGURE 5

PREPARED: BW
DATE: 12 June 2020
FILE: N97017_Precinct Plan.cdr

TITLE

PRECINCT PLAN

Precinct 2 (collectively referred to as the Precinct 2 EMA) in which no development works are proposed.

3.2.3 Precinct 3

Precinct 3 is proposed to be developed as a Community Facility/Education Precinct. A small EPZ and associated 50 m buffer occur adjacent to the central northern portion of the Precinct (collectively referred to as the Precinct 3 EMA) in which no development works are proposed.

3.2.4 Precinct 4

Precinct 4 is located in the central portion of the Kings Forest site, to the east of the northern SEPP and west of the proposed Kings Forest Parkway. The northern portion of Precinct 4 is proposed to be developed as a Town Centre precinct while the southern portion is proposed to be developed as a residential precinct. A large EPZ associated with Precinct 7 occurs to the west of Precinct 4. A 50 m buffer (referred to as the Precinct 4 EMA) occurs between the Precinct 7 EPZ and Precinct 4 in which no development works are proposed.

3.2.5 Precinct 5

Precinct 5 is located at the entrance to the Kings Forest site to the west of Tweed Coast Road and south of the proposed Kings Forest Parkway. Cudgen Nature Reserve occurs to the east of Precinct 5 and lacks Creek occurs to the south.

Precinct 5 is proposed to be developed as a residential precinct and will also include the construction of a significant portion of the proposed Kings Forest Parkway. Large areas adjacent to Precinct 5 will be retained within EPZs and associated 50 m buffer zones (collectively referred to as the Precinct 5 EMA). Where the 50 m buffer zones occur adjacent to development in Precinct 5, the outer 20 m zone will be utilised for stormwater conveyance and ancillary structures such as fauna exclusion fencing whilst the inner 30 m zone will be utilised for conservation purposes only such as revegetation and assisted regeneration works.

3.2.6 Precinct 6

Precinct 6 occurs in the central portion of the Kings Forest site at the western end of the proposed Kings Forest Parkway. A small area in the north of Precinct 6 is proposed to be developed as a Town/Neighbourhood Centre whilst the remainder of the precinct is proposed to be developed as a residential precinct. An EPZ and associated 50 m buffer zone occur to the south of Precinct 6 (collectively referred to as the Precinct 6 EMA) in which no development works are proposed.

3.2.7 Precinct 7

Precinct 7 is located in the central portion of the Kings Forest site, to the west of the northern SEPP wetland. Precinct 7 is proposed to be developed as a residential precinct. An EPZ and associated 50 m buffer zone occur to the east of Precinct 7 (containing the northern SEPP wetland and collectively referred to as the Precinct 7 EMA) within in which no development works are proposed.

3.2.8 Precinct 8

Precinct 8 is located in the central northern portion of the Kings Forest site, to the west of the northern SEPP wetlands. Precinct 8 is proposed to be developed as a residential precinct. A large EPZ and associated 50 m buffer occurs to the east of Precinct 8 in which no development works are proposed. It is noted that the EPZ and associated 50 m ecological buffer to the east of Precinct 8 are included in the EMA associated with Precinct 7.

3.2.9 Precinct 9

Precinct 9 occurs in the north-western portion of the Kings Forest site. The northern portion of Precinct 9 is proposed to be developed as a residential precinct while the southern portion is proposed to be developed as a Community Facility/Education precinct and Structure Open Space (Active) area. An EPZ and associated 50 m buffer zone occur to the west of Precinct 9 (collectively referred to as the Precinct 9 EMA) in which no development works are proposed.

3.2.10 Precinct 10

Precinct 10 is located in the western portion of the Kings Forest site. The western portion of Precinct 10 is proposed to be developed as a residential precinct whilst the eastern portion will contain a Private Open Space area including a lake. An EPZ and associated 50 m buffer zone occur to the west of Precinct 10 (collectively referred to as the Precinct 10 EMA) in which no development works are proposed.

It should be noted that an area to the immediate south of Precinct 10 has been allocated to the proposed East-West Corridor which will link the Precincts 6 and 10 EPZs and bolster movement/dispersal corridors in this portion of the Kings Forest site. The proposed East-West Corridor is designated as a koala compensatory habitat area.

3.2.11 Precinct 11

Precinct 11 occurs in the far west of the Kings Forest site and is proposed to be developed as a residential precinct. Two (2) small EPZs and associated 50 m buffer zones occur in the north west of the precinct (collectively referred to as the Precinct 11 EMAs) in which no development works are proposed.

3.2.12 Precincts 12-14

Precincts 12 - 14 occur in the southern portion of the Kings Forest site. Precincts 12 and 13 and are proposed to be developed as residential precincts. Precinct 14 contains the proposed Golf Course and will also act as an ecological buffer (minimum 50 m in width) between the residential precincts and retained and compensatory habitat areas.

3.2.13 East-West Corridor

The proposed East-West Corridor is located in the central west section of the Kings Forest site and extends along the southern boundary of Precinct 10. The proposed East-West Corridor will link the Precincts 6 and 10 EPZs and bolster movement/dispersal corridors in this portion

of the Kings Forest site. Works within the East-West Corridor will include compensatory koala habitat creation in accordance with Section 7.6 of the Kings Forest KPoM (JWA 2019).

3.3 Development Staging

The Kings Forest project will likely proceed over many years. The length of time will be dependent, to a certain degree, on the demand for land over time. The development of the site will be completed on a precinct-by-precinct basis in accordance with approved Precinct Plan (**FIGURE 5**). It is intended to developed Precincts 1, 2, 5 and majority of Precinct 4 as Stage 1. The staging of development of remaining precincts will be then proceed in accordance with the approved Precinct Plan, however this may be subject change. Indicative staging is shown in **TABLE 1.**

TABLE 1
INDICATIVE DEVELOPMENT STAGING

Development Stage	Precinct
Stage 1	Precinct 1
	Precinct 2
	Majority of Precinct 4
	Precinct 5
	East-West Corridor
Stage 2	Precinct 3
	Remainder of Precinct 4
Stage 3	Precinct 6
Stage 4	Precinct 7
Stage 5	Precinct 8
Stage 6	Precinct 9
Stage 7	Precinct 10
Stage 8	Precinct 11
Stage 9	Precincts 12-14

4 Existing Site Values

4.1 Introduction

The following sections detail the existing ecological values contained within the Kings Forest site and the feral animal species known to occur on the Kings Forest site and within the locality. An aerial photograph of the site is shown in **FIGURE 6.**

4.2 Vegetation

The Kings Forest site has a decades-long history of various land uses and land management practices, including pine plantation, sand mining, pasture improvement and turf production, dairy farming, small cropping and sugar cane production. It is presently used generally for cattle grazing. Over many years the land has been extensively cleared for these activities. There remain, however, large areas of undisturbed vegetation in the eastern and south-eastern portions of the property and within wetland areas throughout. These areas of the site are generally zoned for Environment Protection.

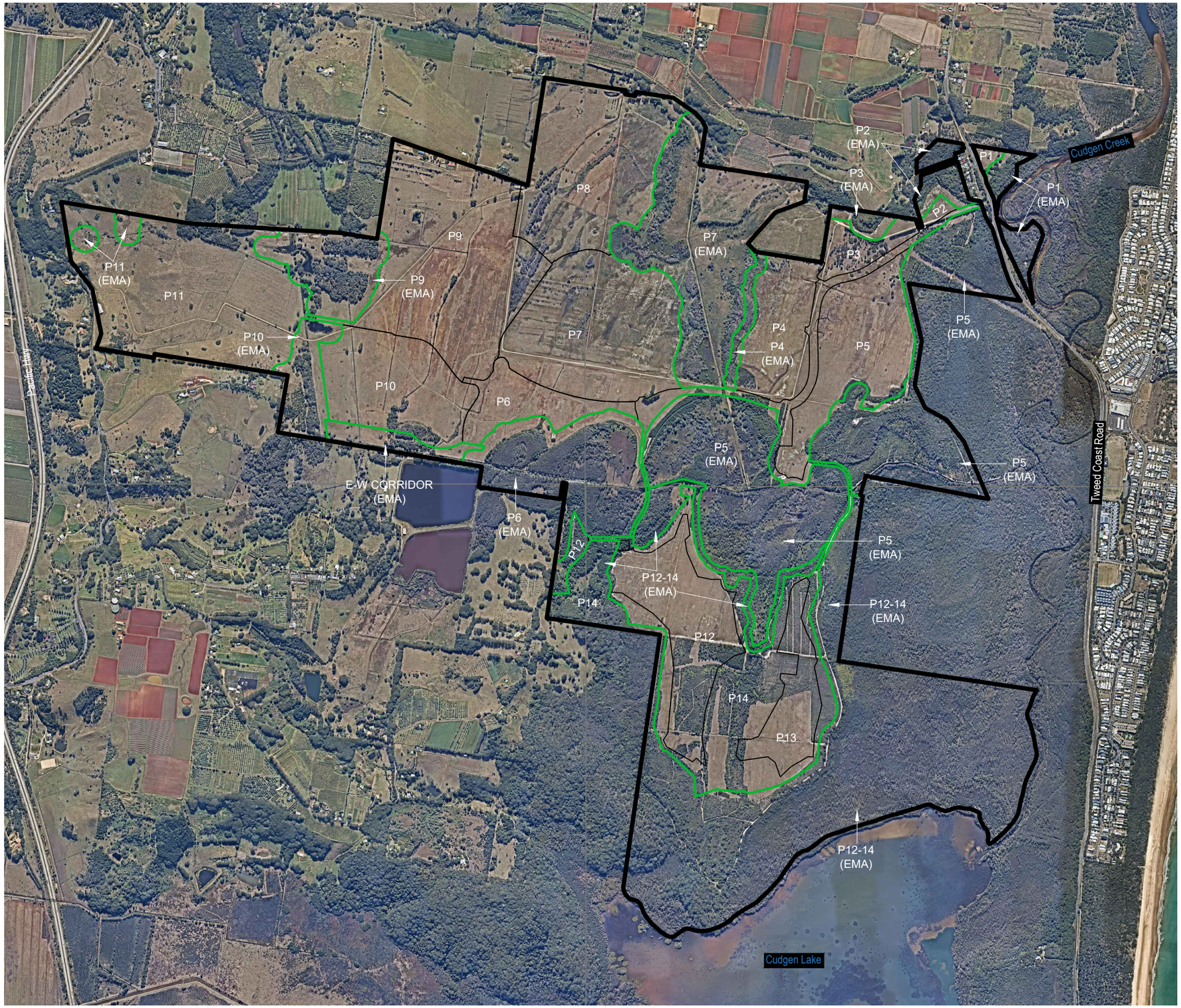
Vegetation on the Kings Forest subject site has been described in varying degrees of detail (Warren 2000, Kingston *et al*. 2004, Callaghan *et al*. 2005). The most comprehensive vegetation mapping over the Kings Forest site was completed by the Australian Koala Foundation (Callaghan *et al*. 2005). However, harvesting of areas of pine plantation, continued infestation of native vegetation with Slash pine wildings and areas of natural heath regeneration has occurred since the preparation of this map.

Vegetation mapping on the Kings Forest site (as of July 2018) has been adapted from the Callaghan *et al*. (2005) mapping combined with detailed re-mapping/ground-truthing surveys completed by JWA between 2010 – 2018. In total, six (6) broad vegetation types comprising forty-three (43) discrete vegetation communities have been identified over the Kings Forest site.

FIGURE 7 shows that the following broad vegetation types have been mapped within the Kings Forest land:

- Highly modified vegetation communities;
- Freshwater wetlands;
- Heathland and shrublands;
- Swamp sclerophyll floodplain forests;
- Dry to moist open forests; and
- Rainforest.

Vegetation community descriptions, including proposed offset/compensatory habitat areas, are discussed in relation to their closest Plant Community Type (PCT) descriptions which were accessed via the Biodiversity and Conservation Division (BCD) (formerly OEH) of the Environment, Energy and Science Group in the NSW DPI&E database (i.e. the BioNet Vegetation Classification System). PCTs are classified based on vegetation types occurring



N

LEGEND

- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 500m
1 : 20 000

SOURCE: Near Map 08/08/18 Aerial

SCALE: 1 : 20 000 @ A3

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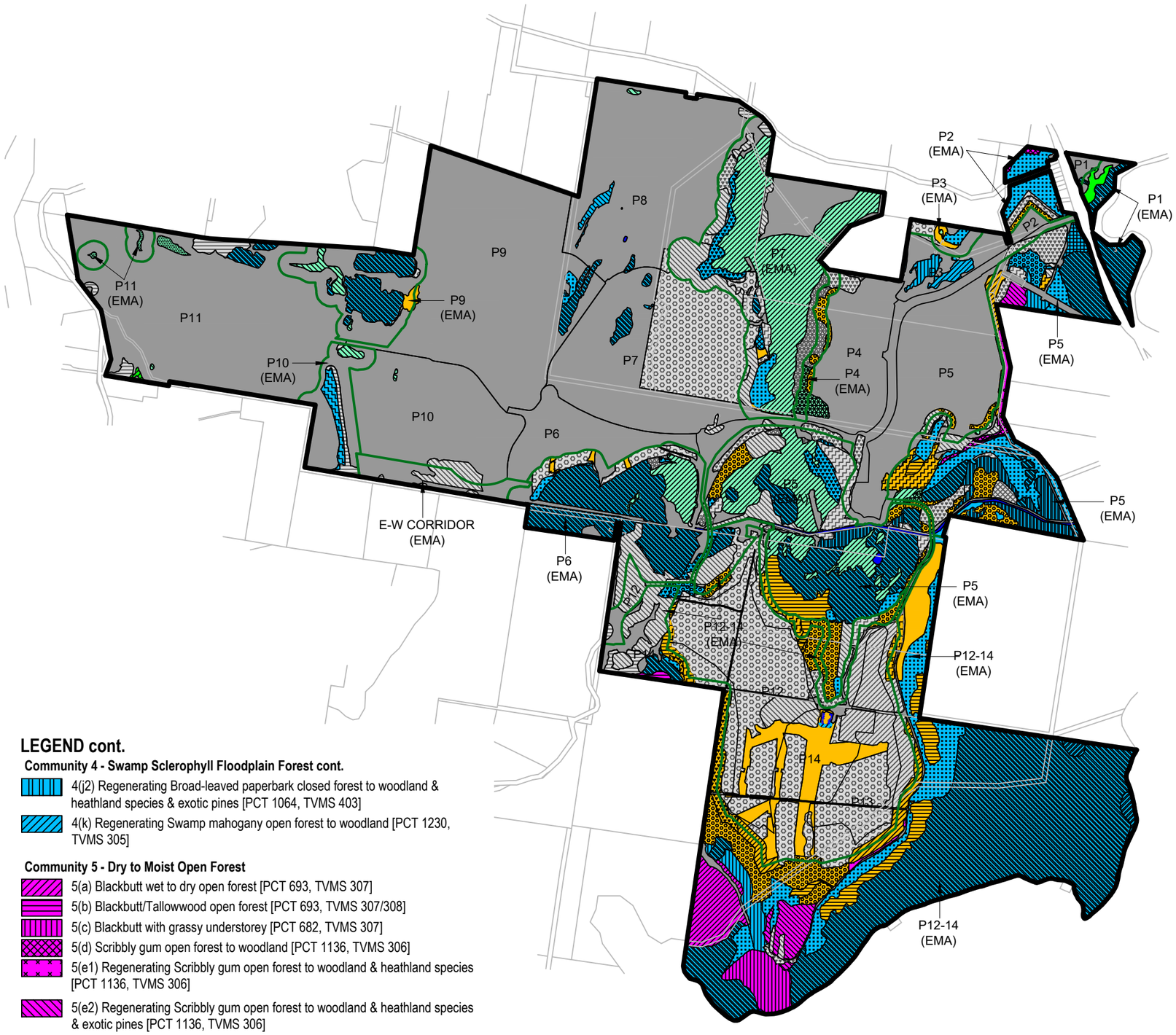
FIGURE 6

PREPARED: BW
DATE: 22 September 2020
FILE: N97017_FFMR_20200922.dwg

TITLE

AERIAL PHOTOGRAPH



LEGEND

- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary

Community 1 - Highly Modified

- 1(a) Substantially cleared of native vegetation
- 1(b) Camphor laurel dominant closed forest (with rainforest species)
- 1(c) Native plantation/plantings
- 1(d) *Leptospermum petersonii* plantation (with heathland species)
- 1(e1) Exotic pine plantation
- 1(e2) Exotic pine plantation (with heathland species)
- 1(f) Exotic grassland dominated (with heathland species)
- 1(g) Exotic grassland dominated (with regrowth Acacia & other native species)
- 1(h) Exotic pines with sedgeland/rushland/fernland
- 1(i) Exotic pines with swamp sclerophyll floodplain forest

Community 2 - Freshwater Wetland

- 2(a) Hillside seepage swamp (with *Eleocharis tetraquetra*) [PCT 1911, TVMS 701]
- 2(b) Ponds & fringing wetland [PCT 1911, TVMS 701]
- 2(c1) Sedgeland/rushland/fernland [PCT 1911, TVMS 701/702]
- 2(c2) Sedgeland/rushland/fernland (with exotic pines) [PCT 1911, TVMS 701/702]

Community 3 - Heathland & Shrubland

- 3(a1) Dry coastal heathland to shrubland [PCT 663, TVMS 501]
- 3(a2) Dry coastal heathland to shrubland (with exotic pines) [PCT 663, TVMS 501]
- 3(b1) Wet coastal heathland to shrubland [PCT 1297, TVMS 502]
- 3(b2) Wet coastal heathland to shrubland (with exotic pines) [PCT 1297, TVMS 502]
- 3(d) Regenerating wet/dry coastal heathland to shrubland [PCT 1297, TVMS 501/5022]
- 3(e) Regenerating wet/dry coastal heathland to shrubland (with exotic pines) [PCT 1297, TVMS 501/502]

Community 4 - Swamp Sclerophyll Floodplain Forest

- 4(a) Forest red gum open forest to woodland/Broad-leaved paperbark closed forest to woodland [PCT 1064, TVMS 403]
- 4(b) Swamp mahogany open forest to woodland & heathland species [PCT 1230, TVMS 305]
- 4(c) Scribbly gum/Swamp mahogany +/- Red mahogany, Swamp turpentine, Hard corkwood closed forest to woodland [PCT 1230, TVMS 305/306]
- 4(d) Swamp box open forest to woodland [PCT 1064, TVMS 309]
- 4(e) Broad-leaved paperbark closed forest to woodland [PCT 1064, TVMS 401]
- 4(f) Broad-leaved paperbark closed forest to woodland (with Scribbly gum) [PCT 1064, TVMS 401]
- 4(g1) Broad-leaved paperbark closed forest to woodland (with rainforest species) [PCT 1064, TVMS 401]
- 4(g2) Broad-leaved paperbark closed forest to woodland (with rainforest species & camphor laurel) [PCT 1064, TVMS 401]
- 4(h) Broad-leaved paperbark closed forest to woodland/Swamp mahogany open forest to woodland [PCT 1064, TVMS 403]
- 4(i) Swamp sclerophyll & heathland species (with exotic pines) [PCT 1064, TVMS 403]
- 4(j1) Regenerating Broad-leaved paperbark closed forest to woodland & heathland species [PCT 1064, TVMS 403]

LEGEND cont.

Community 4 - Swamp Sclerophyll Floodplain Forest cont.

- 4(j2) Regenerating Broad-leaved paperbark closed forest to woodland & heathland species & exotic pines [PCT 1064, TVMS 403]
- 4(k) Regenerating Swamp mahogany open forest to woodland [PCT 1230, TVMS 305]

Community 5 - Dry to Moist Open Forest

- 5(a) Blackbutt wet to dry open forest [PCT 693, TVMS 307]
- 5(b) Blackbutt/Tallowwood open forest [PCT 693, TVMS 307/308]
- 5(c) Blackbutt with grassy understorey [PCT 682, TVMS 307]
- 5(d) Scribbly gum open forest to woodland [PCT 1136, TVMS 306]
- 5(e1) Regenerating Scribbly gum open forest to woodland & heathland species [PCT 1136, TVMS 306]
- 5(e2) Regenerating Scribbly gum open forest to woodland & heathland species & exotic pines [PCT 1136, TVMS 306]

Community 6 - Rainforest

- 6(a) Littoral rainforest [PCT 751, TVMS 101]
- 6(b) Regenerating sub-tropical rainforest [PCT 1302, TVMS 102]
- Open water

NOTE: Vegetation mapping has been adapted from the Australian Koala Foundation (Callaghan *et al.* 2005) mapping combined with detailed re-mapping/ground-truthing surveys completed by JWA between 2010 - 2018.

SOURCE: JWA Site Investigations 2018; Near Map 08/08/18 Aerial

SCALE: 1 : 20 000 @ A3

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Flora & Fauna Monitoring Report
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 7

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TITLE

VEGETATION COMMUNITIES

within the Interim Biogeographic Regionalisation for Australia (IBRA) subregions, as developed by the Commonwealth government. The IBRA framework divides Australia landscapes into bioregions and subsequently subregions based on common features such as climate, geology, landform, and vegetation.

It is noted however that PCT descriptions are still undergoing revision and many remain undescribed for the SEQ03 – Burringbar-Conondale Ranges IBRA subregion. Therefore, corresponding Tweed Vegetation Management Strategy 2004 (TVMS) codes have also been provided.

4.3 Endangered Ecological Communities

Two (2) Endangered Ecological Communities (EECs) as defined by the NSW *Biodiversity Conservation Act 2016* (BC Act) have also been mapped within Kings Forest buffers and EPZs (**FIGURE 8**):

- Freshwater wetlands on coastal floodplains of the NSW North Coast; and
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast.

4.4 Threatened Flora and Fauna

A number of threatened flora and fauna species have been recorded on the Kings Forest site over the last 30 years. These threatened species are listed in **TABLE 2** and their locations shown in **FIGURE 8.** The conservation status of each species listed in **TABLE 2** is shown in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the BC Act.

TABLE 2
THREATENED SPECIES RECORDED WITHIN THE KINGS FOREST SITE

Scientific Name	Common Name	BC Act*	EPBC Act#
Threatened flora species			
Endiandra muelleri subsp. *bracteata*	Green-leaved rose walnut	E	-
Phaius australis	Southern swamp orchid	E	E
Cryptocarya foetida	Stinking cryptocarya	V	V
Archidendron hendersonii	White laceflower	V	-
Grevillea hilliana	White yiel yiel	E	-
Threatened fauna species			
Ixobrychus flavicollis	Black bittern	V	-
Ephippiorhynchus asiaticus	Black-necked stork	E	-
Calyptorhynchus lathami	Glossy-black cockatoo	V	-
Pteropus poliocephalus	Grey-headed flying fox	V	V
Phascolarctos cinereus^	Koala	V	V
Tyto novaehollandiae	Masked owl	V	-
Tyto longimembris	Grass owl	V	-

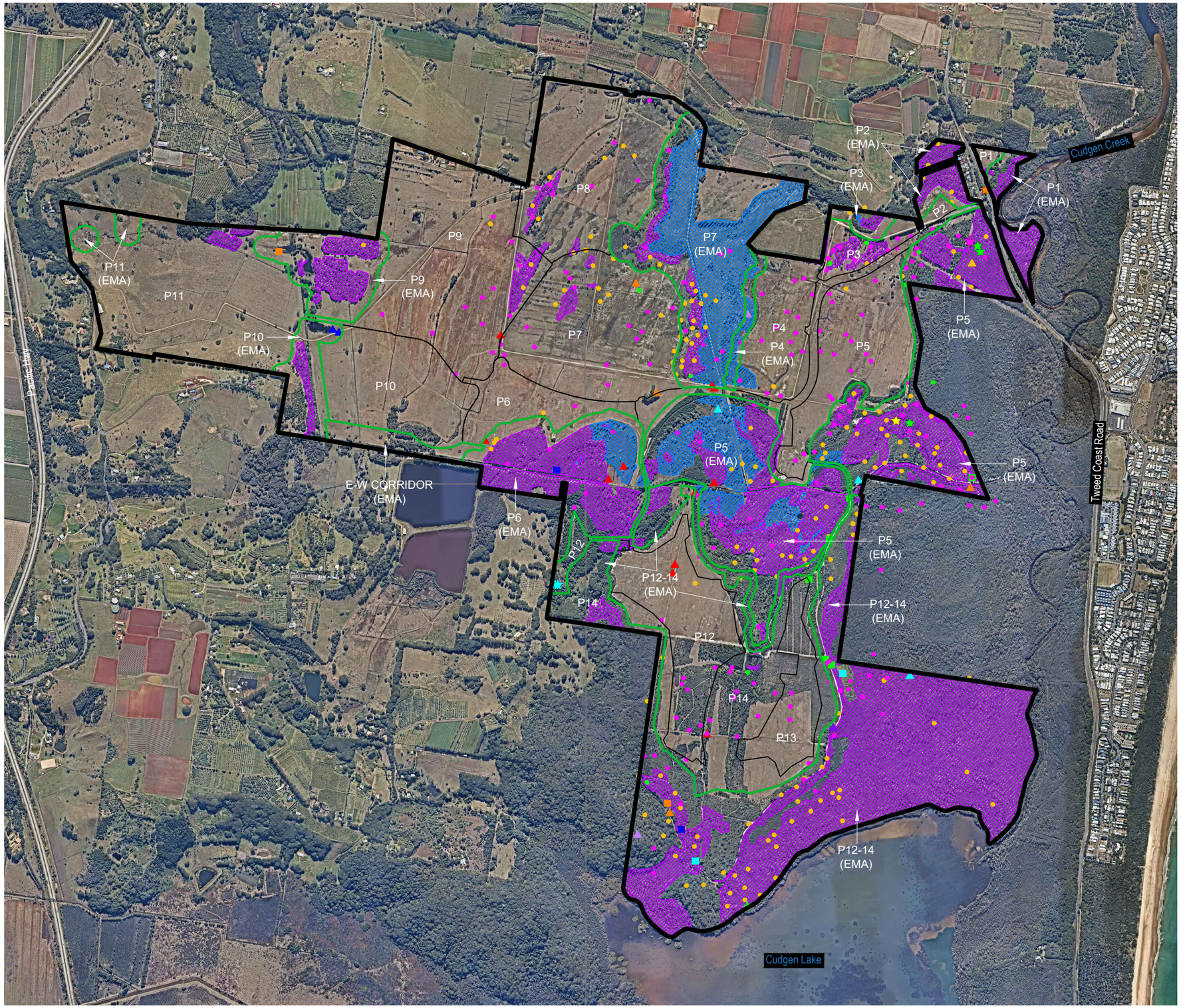
Scientific Name	Common Name	BC Act*	EPBC Act#
Pandion haliaetus	Osprey	V	-
Amauronis moluccana	Pale-vented Bush hen	V	-
Burhinus grallarius	Bush stone-curlew	E	-
Planigale maculate	Common planigale	V	-
Miniopterus australis	Little bent-wing bat	V	-
Saccolaimus flaviventris	Yellow-bellied sheathtail bat	V	-
Syconycteris australis	Common blossom bat	V	-
Ptilinopus regina	Rose-crowned fruit-dove	V	-
Crinia tinnula	Wallum froglet	V	-
Litoria olongburensis	Wallum sedge frog	V	V
Falsistrellus tasmaniensis	Eastern false pipistrelle**	V	-
Myotis macropus	Southern myotis**	V	-

* E - Endangered, V - Vulnerable as listed within schedules of the NSW *BC Act* (2016).

E – Endangered and V - Vulnerable as listed within schedules of the Commonwealth *EPBC Act* (1999).

** These species are highly mobile were recorded foraging over the site and are not included in **FIGURE 8.**

^ The koala (combined population in Queensland, New South Wales and the Australian Capital Territory) is listed as a vulnerable species within schedules of the EPBC Act. The koala, between the Tweed and Brunswick Rivers east of the Pacific Highway, is listed as an endangered population within schedules of the NSW *BC Act* (2016).



LEGEND

- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary

THREATENED FLORA RECORDS

- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*) - Endangered (BC Act 2016)
- Southern swamp orchid (*Phaius australis*) - Endangered (BC Act 2016 & EPBC Act 1999)
- Stinking cryptocarya (*Cryptocarya foetida*) - Vulnerable (BC Act 2016 & EPBC Act 1999)
- White laceflower (*Archidendron hendersonii*) - Vulnerable (BC Act 2016)
- White yiel yiel (*Grevillea hilliana*) - Endangered (EPBC Act 1999)

THREATENED FAUNA RECORDS

Birds

- Black bittern (*Ixobrychus flavicollis*) - Vulnerable (BC Act 2016)
- Black-necked stork (*Ephippiorhynchus asiaticus*) - Endangered (BC Act 2016)
- Bush stone-curlew (*Burhinus grallarius*) - Endangered (BC Act 2016)
- Glossy-black cockatoo (*Calyptorhynchus lathami*) - Vulnerable (BC Act 2016)
- Grass owl (*Tyto longimembris*) - Vulnerable (BC Act 2016)
- Masked owl (*Tyto novaehollandiae*) - Vulnerable (BC Act 2016)
- Osprey (*Pandion haliaetus*) - Vulnerable (BC Act 2016)
- Pale-vented bush hen (*Amouronis moluccana*) - Vulnerable (BC Act 2016)

Mammals

- Common blossom bat (*Syconycteris australis*) - Vulnerable (BC Act 2016)
- Common planigale (*Planigale maculata*) - Vulnerable (BC Act 2016)
- Grey-headed flying-fox (*Pteropus poliocephalus*) - Vulnerable (BC Act 2016 & EPBC Act 1999)
- Koala (*Phascolarctos cinereus*) - Vulnerable (BC Act 2016 & EPBC Act 1999)
- Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*) - Vulnerable (BC Act 2016)

Amphibians

- Wallum froglet (*Crinia tinnula*) - Vulnerable (BC Act 2016)
- Wallum sedge frog (*Litoria olongburensis*) - Vulnerable (BC Act 2016 & EPBC Act 1999)

ENDANGERED ECOLOCICAL COMMUNTIES

- Freshwater wetlands on coastal floodplains of the NSW North Coast
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 500m
1 : 20 000

SOURCE: Landpartners - SEPP14 Wetlands (Amendment 15) & SEPP26 Littoral Rainforest; Near Map 08/08/18 Aerial
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Flora & Fauna Monitoring Report
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 8

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TITLE THREATENED FLORA & FAUNA RECORDS & ENDANGERED ECOLOGICAL COMMUNITIES

5 Management Zones

5.1 Identification of Management Zones

The Kings Forest site has been divided into nine (9) zones based on the management intent for each area. These management zones are:

- Zone 1 – Construction zone;
- Zone 2 – Retained koala habitat;
- Zone 3 – Retained Wallum Sedge Frog (WSF) habitat;
- Zone 4 – Koala compensatory habitat;
- Zone 5 – WSF compensatory habitat;
- Zone 6 – Heath regeneration; and
- Zone 7 – Littoral rainforest regeneration/revegetation (Precinct 1);
- Zone 8 – Wetland regeneration; and
- Zone 9 - Residual lands e.g. tracks and easements.

FIGURE 9 shows the location of management zones applicable to this FFMR. A brief description of each management zone and details of the proposed management intent is provided in the sections below. Monitoring and reporting requirements are detailed in **SECTION 6**.

5.2 Zone 1 – Construction Zone

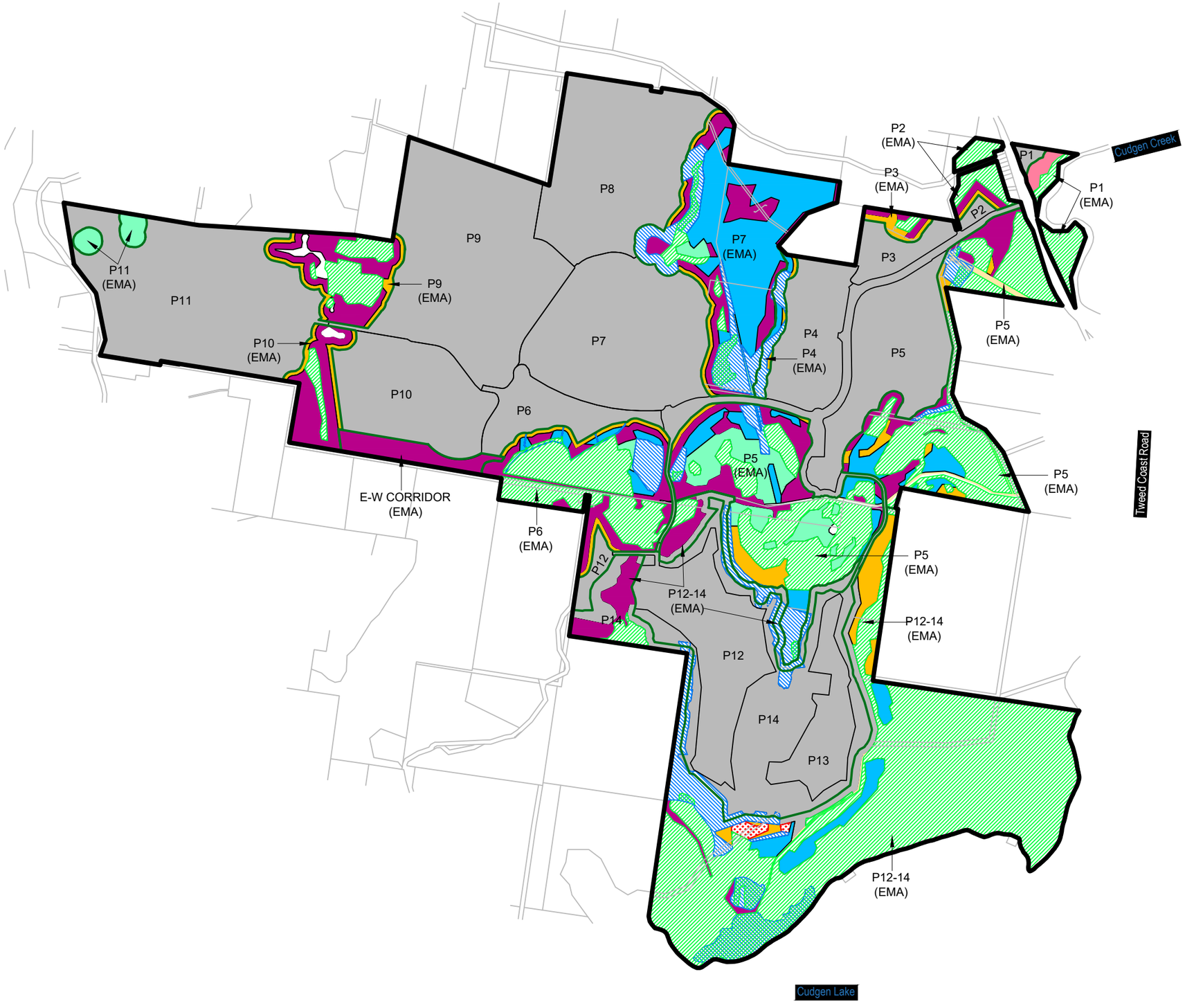
The construction zone consists of the development footprint. The management intent of this zone is:

- To remove all existing vegetation within the Construction Zone prior to bulk earthworks and disposal of cleared vegetation in an environmentally responsible manner;
- To undertake vegetation removal operations in a manner that provides maximum protection of the health and livelihood of native fauna;
- To limit human impacts on retained and compensatory habitat, threatened flora and fauna species or ecological communities; and
- To remove all noxious and environmental weeds in a manner that is environmentally sustainable.

5.3 Zone 2 – Retained Koala Habitat

Management Zone 2 consists of existing koala habitat to be retained within the EMAs in accordance with the Kings Forest KPoM (JWA 2019). The management intent of this zone is:

- To protect, restore (through assisted natural regeneration) and provide for the ongoing maintenance of retained koala habitat;



LEGEND

- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary
- Waterbodies & Drainage Lines
- Cobaki Scribbly gum offset area

MANAGEMENT ZONES

- Zone 1 - Construction zone
- Zone 2 - Retained Koala habitat
- Zone 3 - Retained WSF habitat
- Zone 4 - Koala compensatory habitat
- Zone 5 - WSF compensatory habitat
- Zone 6 - Heath regeneration/revegetation
- Zone 7 - Littoral rainforest regeneration/revegetation
- Zone 8 - Wetland regeneration
- Zone 9 - Residual land

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 500m
1 : 20 000

SOURCE: JWA Site Investigations 2018, Near Map 08/08/18 Aerial

SCALE: 1 : 20 000 @ A3

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Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 9

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FILE: N97017_FFMR_20200922.dwg

TITLE

MANAGEMENT ZONES

- To limit human impacts on retained koala habitat; and
- To remove all noxious and environmental weeds in a manner that is environmentally sustainable.

5.4 Zone 3 – Retained WSF Habitat

Management Zone 3 consists of existing WSF habitat to be retained within EMAs in accordance with the Kings Forest WSFMP (JWA 2020a). The management intent of this zone is:

- To protect, restore (through assisted natural regeneration) and provide for ongoing maintenance of retained WSF habitat;
- To limit human impacts on retained WSF habitat;
- To remove all noxious and environmental weeds in a manner that is environmentally sustainable; and
- To ensure the ongoing protection of water quality within retained WSF habitat.

5.5 Zone 4 – Koala Compensatory Habitat

Management Zone 4 consists of koala compensatory habitat areas within EMAs in accordance with the Kings Forest KPoM (JWA 2019). The management intent of this zone is:

- To create additional koala habitat through assisted regeneration and revegetation works;
- To limit human impacts on future koala habitat; and
- To remove all noxious and environmental weeds in a manner that is environmentally sustainable.

5.6 Zone 5 – WSF Compensatory Habitat

Management Zone 5 consists of WSF compensatory habitat areas within EMAs in accordance with the Kings Forest WSFMP (JWA 2020a). The management intent of this zone is:

- To create additional WSF habitat through assisted regeneration and revegetation works;
- Re-use topsoil (where appropriate) likely to contain a suitable topsoil seedbank;
- To limit human impacts on future WSF habitat; and
- To remove all noxious and environmental weeds in a manner that is environmentally sustainable.

5.7 Zone 6 – Heath Regeneration/Revegetation

Management Zone 6 consists of heath regeneration areas within EMAs. The management intent of this zone is:

- To protect and provide for ongoing maintenance of retained heath;

- To restore existing heath areas through assisted natural regeneration works;
- Revegetation utilising heath species and including re-use of topsoil (where appropriate) likely to contain a suitable seedbank;
- To limit human impacts on retained and restored heath areas; and
- To remove all noxious and environmental weeds in a manner that is environmentally sustainable.

5.8 Zone 7 - Littoral Rainforest Regeneration/Revegetation

Management Zone 7 consists of a littoral rainforest regeneration and revegetation area within the Precinct 1 EMAs. The management intent of this zone is:

- To protect, restore (through assisted natural regeneration) and provide for ongoing maintenance of retained littoral rainforest;
- To create additional littoral rainforest areas through assisted regeneration and revegetation works;
- To limit human impacts on retained and future littoral rainforest areas; and
- To remove all noxious and environmental weeds in a manner that is environmentally sustainable.

5.9 Zone 8 – Wetland Regeneration

Management Zone 8 consists of areas of wetland vegetation to be retained and restored within EMAs. The management intent of this zone is:

- To protect, restore (through assisted natural regeneration) and provide for ongoing maintenance of retained wetlands;
- To limit human impacts on retained wetlands;
- To remove all noxious and environmental weeds in a manner that is environmentally sustainable; and
- To ensure the ongoing protection of water quality within retained wetlands.

5.10 Zone 9 – Residual Lands

Management Zone 9 consists of residual lands within the EMAs. These areas include fire trails throughout EPZs and a power line easement in the northern section of Precinct 5. The management intent of this zone is:

- To maintain the areas in a serviceable condition for their intended purpose; and
- To remove all noxious and environmental weeds in a manner that is environmentally sustainable.

6 Monitoring and Reporting Program

6.1 Introduction

The following sections provide a summary of the proposed flora and fauna monitoring strategies to be completed during the development of the Kings Forest site. Monitoring will be required during the 'establishment period[1]' and 'maintenance period[2]' of the project as defined within the Project approval (MP08_0194).

The monitoring methods outlined in the following sections (**Sections 6.2 - 6.9**) are in accordance with the following plans as amended from time to time:

- Kings Forest Koala Plan of Management (KPoM) (JWA 2019);
- Kings Forest Wallum Sedge Frog Management Plan (WSFMP) (JWA 2020a);
- Kings Forest Precincts 1- 5 and Precincts 6 – 14 Buffer Management Plan (BMP) (JWA 2020b, c);
- Kings Forest Precincts 1 – 5, Precincts 6 – 11 and Precincts 12 - 14 Threatened Species Management Plans (TSMP) (JWA 2020d, e, f);
- Kings Forest Precincts 1 – 5, Precincts 6 – 11 and Precincts 12 - 14 Vegetation and Weed Management Plan (VWMP) (JWA 2020g, h, i); and
- Kings Forest Feral Animal Management Plan (FAMP) (JWA 2020j).

6.2 Vegetation Monitoring and Reporting

Monitoring is crucial in ensuring the continued suitability of retained habitat and the success of the rehabilitation program and will be carried out for the duration of this plan. Monitoring of EMAs has been separated into three (3) types:

- Baseline monitoring – completed in Management Zones 2 – 8;
- Monitoring of retained vegetation – completed in Management Zones 2 and 3; and
- Rehabilitation monitoring – completed in Management Zones 4 - 8.

The vegetation monitoring program for baseline, retained vegetation and rehabilitation areas have been summarised in **TABLE 3** below.

[1] means the period commencing with the implementation of the relevant approved environmental management plan(s) and ending when the works specified in that plan meet the establishment period performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary. The establishment period represents the time necessary to carry out initial environmental repair, restoration and monitoring prior to ongoing maintenance.

[2] means the period commencing immediately after the end of the establishment period during which environmental management and monitoring works specified in the relevant approved environmental management plan(s) are to be carried out in accordance with the maintenance period performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.

TABLE 3
RETAINED VEGETATION, REGENERATION AND REVEGETATION MONITORING AND REPORTING PROGRAM

Applies to	Retained vegetation, regeneration and revegetation areas (Management Zones 2 – 8)
Responsibility	Suitably qualified ecologist and bush regeneration team.
Purpose	To determine the health and composition of vegetation communities and assess impact of development on native vegetation and success of rehabilitation works.
Implementation Strategy/ Methodology	***Baseline Monitoring*** Monitoring Locations Baseline vegetation monitoring will be completed within retained habitat areas (Management Zones 2 and 3), compensatory habitat areas (Management Zones 4 and 5) and other proposed revegetation/regeneration areas (i.e. Management Zones 6 - 8) in accordance with the VWMPs (JWA 2020g-i). Vegetation assessments will be completed using transects and quadrats (plots). Where vegetation/habitat polygons are small in size or are not covered by transect and plot surveys, photo point monitoring will be completed. Additionally, the bush regeneration team will gather baseline data at each weed treatment site prior to commencement of weed control. The locations of baseline monitoring within Management Zones 2 – 5 will utilise field sites sampled in 2010 during the Tweed Coast Koala Habitat Study (Phillips *et al.* 2011) where appropriate. The methodology for the Habitat Study included the positioning of a 600 m x 600 m grid overlaid on the site so as to ensure uniform and unbiased coverage. Additional field sites have been identified to ensure representative sampling of all habitat types. The vegetation monitoring locations are shown in **FIGURES 10A-C.** Baseline data for other proposed revegetation/regeneration areas (i.e. Management Zones 6 - 8) will be collected from appropriate locations (i.e. suitable PCTs and/or TVMS communities) within the Cudgen Nature Reserve. To determine appropriate baseline survey locations within Cudgen Nature Reserve, the TVMS (2004) vegetation mapping was reviewed and vegetation types compared to those within Management Zones 6 - 8. Suitable locations for baseline surveys within Cudgen Nature Reserve (i.e. areas comprising the same PCTs/TVMS communities) are identified in **FIGURE 11** and listed below. • CNR01 – Littoral rainforest (PCT 751/TVMS 101);

LEGEND

- Area Subject to the Precincts 1 - 5 Vegetation & Weed Management Plan
- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary
- Waterbodies & Drainage Lines

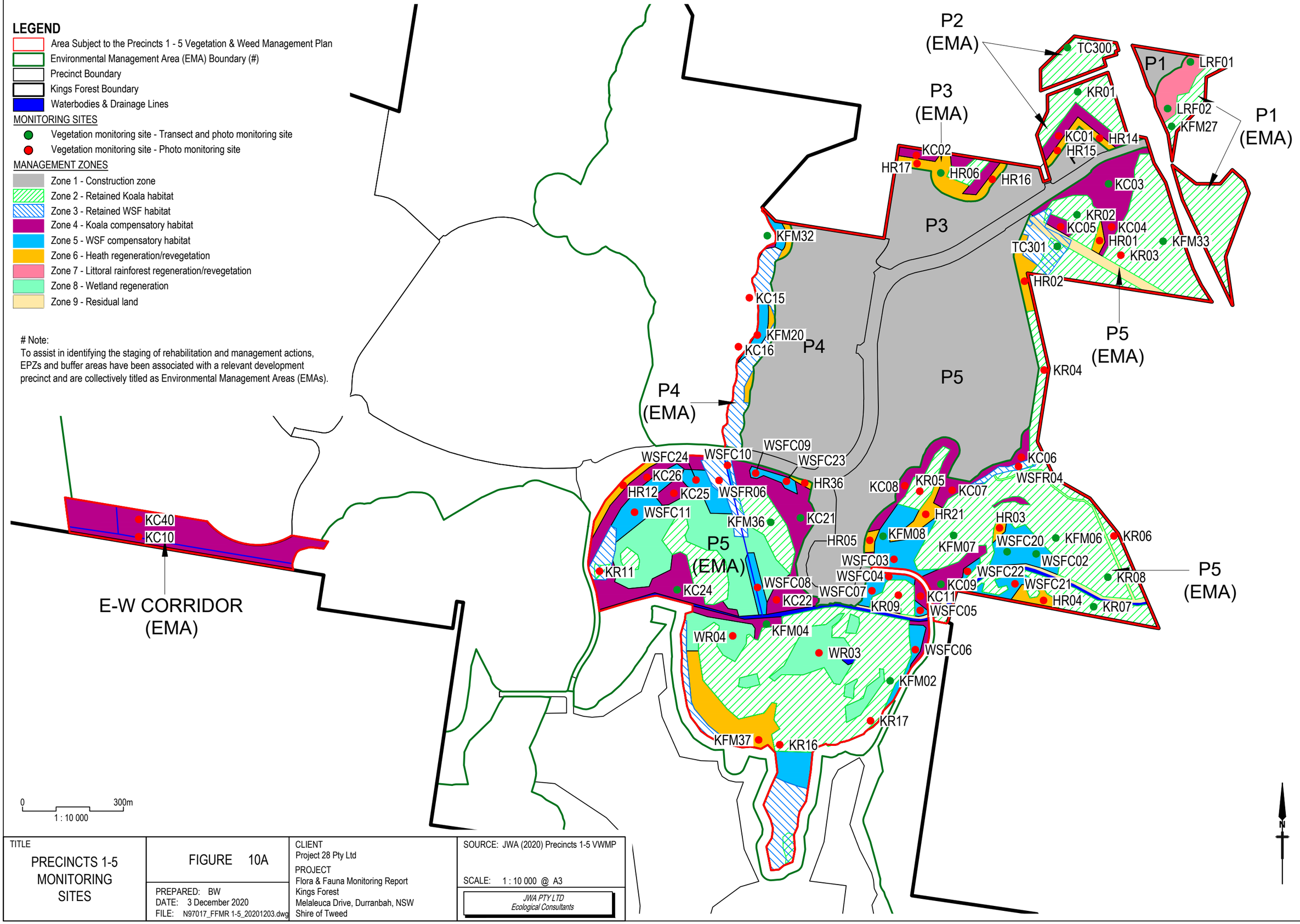
MONITORING SITES

- Vegetation monitoring site - Transect and photo monitoring site
- Vegetation monitoring site - Photo monitoring site

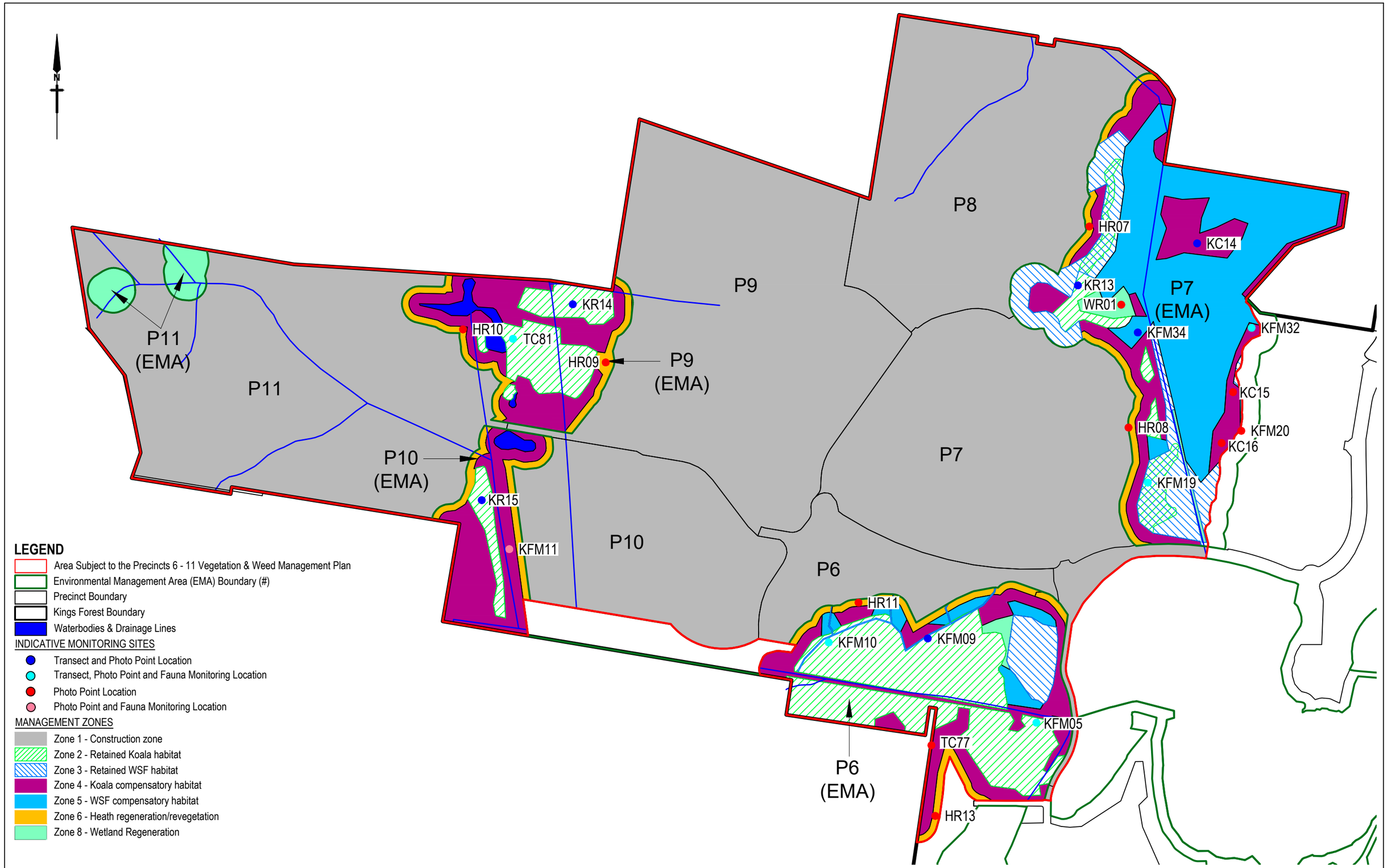
MANAGEMENT ZONES

- Zone 1 - Construction zone
- Zone 2 - Retained Koala habitat
- Zone 3 - Retained WSF habitat
- Zone 4 - Koala compensatory habitat
- Zone 5 - WSF compensatory habitat
- Zone 6 - Heath regeneration/revegetation
- Zone 7 - Littoral rainforest regeneration/revegetation
- Zone 8 - Wetland regeneration
- Zone 9 - Residual land

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).



TITLE PRECINCTS 1-5 MONITORING SITES	FIGURE 10A PREPARED: BW DATE: 3 December 2020 FILE: N97017_FFMR 1-5_20201203.dwg	CLIENT Project 28 Pty Ltd PROJECT Flora & Fauna Monitoring Report Kings Forest Melaleuca Drive, Durranbah, NSW Shire of Tweed	SOURCE: JWA (2020) Precincts 1-5 VWMP SCALE: 1 : 10 000 @ A3 *JWA PTY LTD* *Ecological Consultants*



LEGEND

- Area Subject to the Precincts 6 - 11 Vegetation & Weed Management Plan
- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary
- Waterbodies & Drainage Lines

INDICATIVE MONITORING SITES

- Transect and Photo Point Location
- Transect, Photo Point and Fauna Monitoring Location
- Photo Point Location
- Photo Point and Fauna Monitoring Location

MANAGEMENT ZONES

- Zone 1 - Construction zone
- Zone 2 - Retained Koala habitat
- Zone 3 - Retained WSF habitat
- Zone 4 - Koala compensatory habitat
- Zone 5 - WSF compensatory habitat
- Zone 6 - Heath regeneration/revegetation
- Zone 8 - Wetland Regeneration

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 300m
1 : 10 000

SOURCE: JWA (2020) Preicncts 6-11 VWMP

SCALE: 1 : 10 000 @ A3

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Kings Forest
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FIGURE 10B

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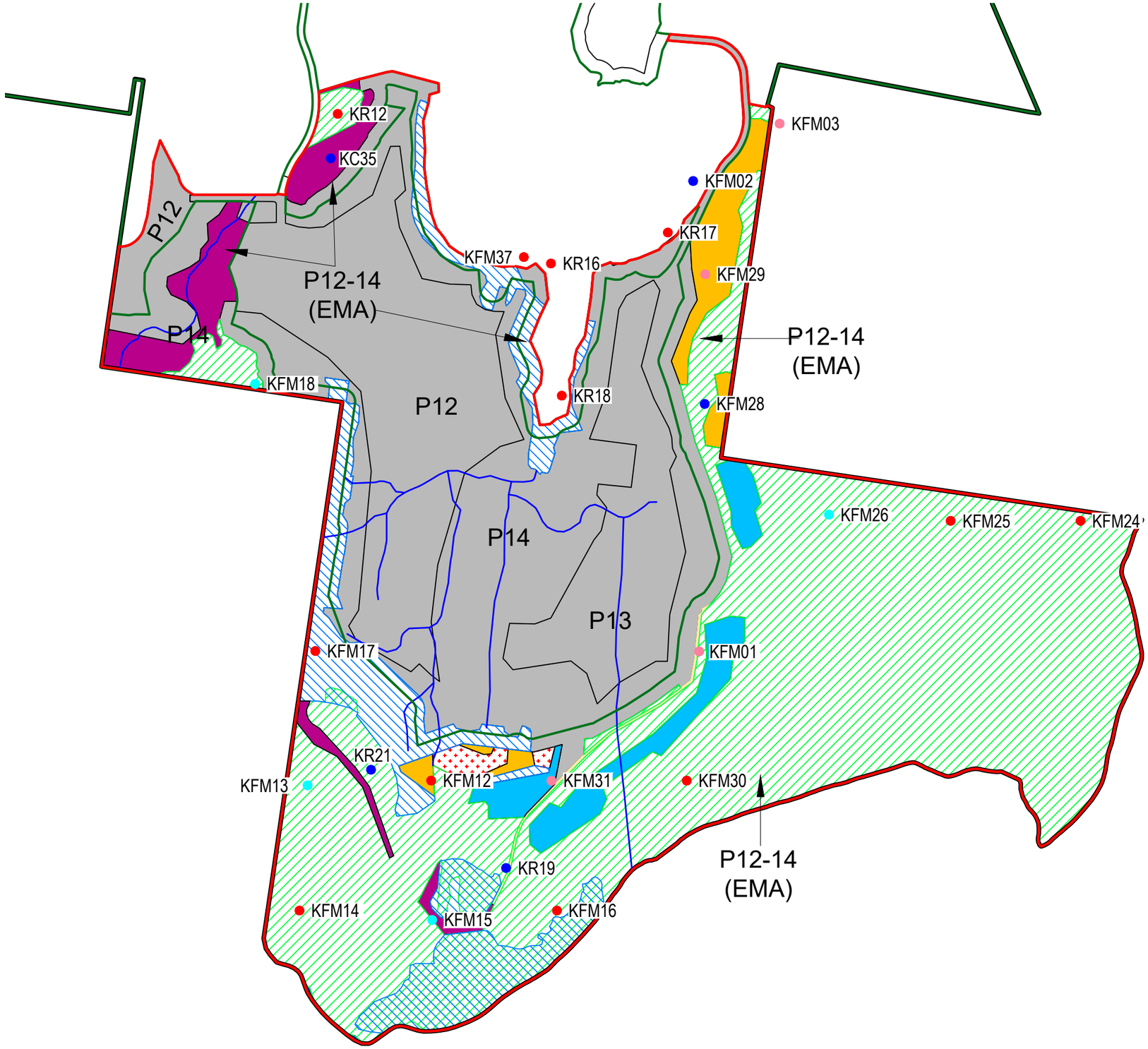
TITLE
PRECINCTS 6 - 11
INDICATIVE
MONITORING SITES



LEGEND

- Area Subject to the Precincts 12 - 14 Vegetation & Weed Management Plan
- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary
- Cobaki Scribbly gum offset area
- Drainage Lines

INDICATIVE MONITORING SITES

- Transect and Photo Point Location
- Transect, Photo Point and Fauna Monitoring Location
- Photo Point Location
- Photo Point and Fauna Monitoring Location

MANAGEMENT ZONES

- Zone 1 - Construction zone
- Zone 2 - Retained Koala habitat
- Zone 3 - Retained WSF habitat
- Zone 4 - Koala compensatory habitat
- Zone 5 - WSF compensatory habitat
- Zone 6 - Heath regeneration/revegetation
- Zone 9 - Residual land

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 300m
1 : 10 000

SOURCE: JWA (2020) Precincts 12-14 VWMP

SCALE: 1 : 10 000 @ A3

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Flora & Fauna Monitoring Report
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 10C

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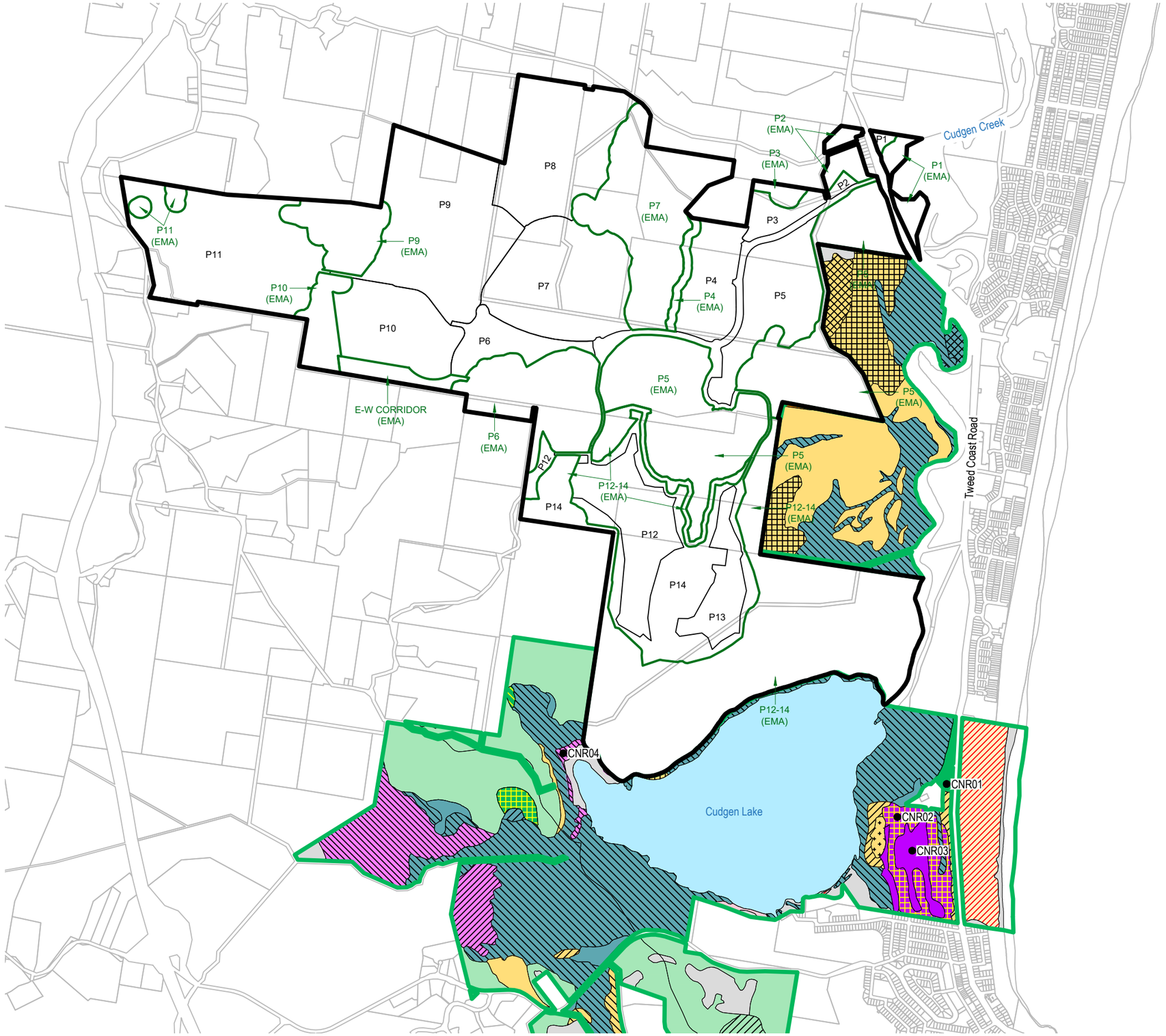
TITLE
PRECINCTS 12 - 14
INDICATIVE
MONITORING SITES



LEGEND

- Cudgen Nature Reserve Baseline Monitoring Site (CNR)
- Cudgen Nature Reserve Boundary
- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary

CUDGEN NATURE RESERVE VEGETATION COMMUNITIES (TSC 2004)

Rainforest and Riparian Communities

- 101 - Littoral Rainforest
- 102 - Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates
- 104 - Lowland Rainforest on Floodplain

Sclerophyll Open Forests on Bedrock Substrates

- 201 - Blackbutt Open Forest Complex
- 207 - Brush Box Open Forest

Sclerophyll Forests / Woodlands on Sand Substrates and Alluvium

- 301 - Coastal Pink Bloodwood Open Forest to Woodland
- 303 - Coastal Brush Box Open Forest to Woodland
- 305 - Coastal Swamp Mahogany Open Forest to Woodland
- 306 - Coastal Scribbly Gum Open Forest to Woodland
- 307 - Coastal Blackbutt Open Forest to Woodland
- 309 - Coastal Swamp Box Open Forest to Woodland
- 312 - Black She-oak Low Open Forest to Woodland

Melaleuca and Swamp She-oak Forests

- 401 - Broad-leaved Paperbark Closed Forest to Woodland
- 402 - Broad-leaved Paperbark / Swamp She-oak Closed Forest to Woodland
- 403 - Broad-leaved Paperbark + Eucalyptus spp. +/- Swamp Box Closed Forest to Woodland
- 601 - Swamp She-oak Closed Forest to Woodland

Heathlands

- 501 - Dry Coastal Heathland to Shrubland
- 502 - Wet Coastal Heathland to Shrubland

Sedgeland and Rushland Communities

- 701 - Sedgeland / Rushland (Murray & James 1998 Study Area Only)
- 702 - Fernland / Forbland (Murray & James 1998 Study Area Only)

Highly Modified / Disturbed

- 902 - Native Grasslands (Murray & James 1998 Study Area Only)
- 1006 - Exotic Plantation
- 1008 - Post-mining Regeneration
- 1099 - Substantially Cleared of Native Vegetation

Miscellaneous Map Units

- 903 - Open Water
- 998 - Not Assessed

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 500m
1 : 25 000

SOURCE: Tweed Vegetation Management Strategy 2004

SCALE: 1 : 25 000 @ A3

JWA PTY LTD
Ecological Consultants

CLIENT
Project 28 Pty Ltd

PROJECT
Flora & Fauna Monitoring Report
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 11

PREPARED: BW
DATE: 22 September 2020
FILE: N97017_FFMR 1-5_20200922.dwg

TITLE
CUDGEN NATURE RESERVE - BASELINE VEGETATION SURVEY SITES

- CNR02 – Dry coastal heathland to shrubland (PCT 663/TVMS 501);
- CNR03 – Wet coastal heathland to shrubland (PCT 1297/TVMS 502); and
- CNR04 – Sedgeland/rushland (PCT 1911/TVMS 701).

Plot-Based Vegetation Surveys

Plot-based vegetation surveys (transects) will be undertaken at each monitoring location. Vegetation survey sites will be permanently marked (i.e. star pickets or wooden stakes) and the end positions identified on a sitemap using a hand-held Global Positioning System (GPS). The plot-based vegetation survey will be based on a 20 m × 20 m plot (or 400 m^2 equivalent for linear areas). Survey plots should be established around a central 50 m transect as follows:

a) One (1) 400 m^2 plot (standard 20 m x 20 m) is used to assess all performance indicators as set out in **TABLE 3A** below.
b) Five (5) 1 m^2 sub-plots can be added to the program for the first monitoring event to assess groundcover recruitment for the plot. A decision as to the utility of these plots can be made after the first or second monitoring events.

The assessor will assess the plot for the information contained in **TABLE 3A**.

TABLE 3A
VEGETATION SURVEY DATA TO BE COLLECTED

Attribute	Survey Required
Native Canopy Cover	Native canopy cover will be measured via the 'line intercept method' along the 50 m transect. Key canopy species will be noted.
Weed Presence	Weed canopy cover will be measured via the 'line intercept method' along the 50 m transect. Individual canopy weed species should be assessed separately.
Native Midstorey Cover	Estimate the % foliage cover of each native species within the midstorey across the 400 m^2 plot. Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1, 2, 3…) or to the nearest 5% where greater than 5% cover (5, 10, 15,

	20, 25…).
Weed Presence in the Midstorey	Estimate the % foliage cover of each weed species within the midstorey across the 400 m^2 plot. Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1, 2, 3…) or to the nearest 5% where greater than 5% cover (5, 10, 15, 20, 25…).
Groundcover	Estimate percentage cover of native species vs. weeds within each of the five (5) 1 m^2 sub-plots. Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1, 2, 3…), or to the nearest 5% where greater than 5% cover (5, 10, 15, 20, 25…). Identify each native and weed groundcover species.

The full species name (genus species) must be recorded for all native species, unless insufficient diagnostic plant material is present, in which case the genus name followed by a species number must be used. Comments should also be included for all attributes (**TABLE 3A**) on any notable variations elsewhere in the relevant management polygon – e.g. weeds occurring in the management polygon that are not (or poorly) represented in the transect.

Photo Point Monitoring

Photo-monitoring points will be completed as a means of demonstrating compliance or otherwise with performance criteria. Permanent photo stations are to be located at each monitoring location. Where transects are to be established, photo points are to be located on each transect. Where selected vegetation/habitat polygons are too small in size and/or are not covered by transects, photo point monitoring points will be identified, mapped and included in the baseline monitoring report.

Four (4) photos are to be taken from each photo point. Photos are to be taken to the north, south, east and west. Photos should be labelled with the:

- Transect code or photo point code;
- Direction of view; and
- Date and time.

	Photos must be supplied in the Annual Monitoring Reports in a form of prints no smaller than 4" x 6" and must be colour.
	Bush Regeneration Team Monitoring The Bush Regeneration Team will gather baseline data at each weed treatment site prior to commencement of weed control to assist in documenting vegetation recovery in the long term. A baseline monitoring proforma is contained in **APPENDIX 2**. The bush regeneration team will also keep detailed work sheets for all works completed within retained habitat areas (Management Zones 2 and 3), compensatory habitat areas (Management Zones 4 and 5) and other proposed revegetation/regeneration areas (i.e. Management Zones 6-8), recording the following: - All works completed each day; - Site conditions; - Chemicals used; - Problems encountered; and - Future works required. A daily work sheet template is attached in **APPENDIX 3**. These records and general comments on progress will be provided to the Ecologist for consideration and inclusion in the annual vegetation monitoring reports.
	Retained Vegetation Monitoring Ongoing vegetation monitoring will be completed by an Ecologist within retained habitat areas (Management Zones 2 and 3), in accordance with the VWMP (JWA 2020g-i). In addition, in the event of a planned or unplanned bushfire occurring on the Kings Forest site, an additional vegetation monitoring event is to be completed in accordance with the VWMP (2020b). Ongoing vegetation monitoring within retained habitat areas (Management Zones 2 and 3) will utilise the same monitoring locations and same methodology (i.e. plot-based vegetation surveys and photo point monitoring) as the baseline monitoring as discussed above. In the event of a planned or unplanned bushfire on the Kings Forest site, an additional monitoring event is to be completed within the affected area at monitoring sites spaced no more than 100 m. Where possible, this should include any of the standard monitoring sites as shown in **FIGURES 10A-C**.

Rehabilitation Monitoring

Monitoring will be completed within revegetation/regeneration areas and compensatory habitat areas within EMAs (**FIGURES 10A-C**) as follows:

- Management Zone 4 – Compensatory Koala habitat: monitored in accordance with the KPoM (JWA 2019);
- Management Zone 5 – Compensatory WSF habitat: monitored in accordance with the WSFMP (JWA 2020a);
- Management Zone 6 – Heath regeneration: monitored in accordance with the VWMPs (JWA 2020g-i);
- Management Zone 7 – Littoral rainforest regeneration/revegetation: monitored in accordance with the VWMPs (JWA 2020g-i); and
- Management Zone 8 – Wetland regeneration: monitored in accordance with the VWMPs (JWA 2020g-i).

Ongoing rehabilitation monitoring within Management Zones 6 - 8 will occur in locations shown in **FIGURES 10A-C.** Field sites have been selected to ensure representative sampling of all rehabilitation areas within Management Zones 6 - 8 and to ensure uniform and unbiased coverage.

In the event of a planned or unplanned bushfire on the Kings Forest site, an additional monitoring event is to be completed within the affected area at monitoring sites spaced no more than 100 m. Where possible, this should include any of the standard monitoring sites as shown in **FIGURES 10A-C**.

Ongoing rehabilitation monitoring will utilise the same methodology (i.e. plot-based vegetation surveys and photo point monitoring) as discussed for the baseline monitoring above, however the assessor will assess the plot for the slightly expanded list of details/data contained in **TABLE 3B**.

TABLE 3B
VEGETATION SURVEY DATA TO BE COLLECTED

Attribute	Survey required
Seedling survival	The first monitoring event will require a count of the total number of seedlings, individual species counts and a count of the number of dead or dying seedlings of each species. Subsequent monitoring events will only require counts of dead or dying seedlings and their species identification.

		Native Canopy Cover	Native canopy cover will be measured via the 'line intercept method' along the 50 m transect. Key canopy species will be noted.
		Weed Canopy Cover	Weed canopy cover will be measured via the 'line intercept method' along the 50 m transect. Individual canopy weed species should be assessed separately.
		Native Midstorey Cover	Estimate the % foliage cover of each native species within the midstorey across the 400 m^2 plot. Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1, 2, 3…), or to the nearest 5% where greater than 5% cover (5, 10, 15, 20, 25…).
		Weed Presence in the Midstorey	Estimate the % foliage cover of each weed species within the midstorey across the 400 m^2 plot. Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1, 2, 3…), or to the nearest 5% where greater than 5% cover (5, 10, 15, 20, 25…).
		Groundcover species	Estimate percentage cover of native species vs. weeds within each of the five (5) 1 m^2 sub-plots. Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1, 2, 3…), or to the nearest 5% where greater than 5% cover (5, 10, 15, 20, 25…). Identify each native and weed groundcover species
		Shrub and Groundcover Recruitment	Identify the numbers of native shrub and groundcover species recruiting within each of the five (5) 1 m^2 sub-plots. The identification of individual recruits may not be possible when they first appear. These should be recorded as unidentified until the next or subsequent monitoring events.
	The full species name (genus species) must be recorded for all native species, unless insufficient diagnostic plant material is present, in which case the genus name followed by a species number must be used. Comments should also be included for all attributes (**TABLE 3B**) on any notable variations elsewhere in the relevant management polygon - e.g. weeds occurring in the management polygon that are not (or poorly) represented in the transect.		
Timing/ Frequency	***Baseline Monitoring*** Collection of baseline data will be completed prior to commencement of construction.		

	Retained Vegetation Monitoring Monitoring events should occur: • To set up monitoring transects and quadrats, and to collect the first round of monitoring data after 1st event of secondary weeding; • Six (6) monthly until the establishment period performance criteria are met; and • Then annually during the maintenance period. In the event of a planned or unplanned bushfire on the Kings Forest site an additional monitoring event will be completed three (3) to six (6) months after the bushfire to inform any additional maintenance and rehabilitation requirements. ***Rehabilitation Monitoring*** Monitoring events should occur: • To set up monitoring transects and quadrats, and to collect the first round of monitoring data after 1st event of secondary weeding; • Six (6) monthly until the establishment period performance criteria are met; and • Annually during the maintenance period. In the event of a planned or unplanned bushfire on the Kings Forest site an additional monitoring event will be completed three (3) to six (6) months after the bushfire to inform any additional maintenance and rehabilitation requirements
Performance Criteria	Specific performance criteria and corrective actions for retained habitat areas (i.e. Management Zones 2 and 3), compensatory habitat areas (i.e. Management Zones 4 and 5) and rehabilitation habitat areas (i.e. Management Zones 6 - 8) are provided in **APPENDIX 4**.
Reporting	***Baseline Vegetation Monitoring Report*** Subsequent to the completion of baseline vegetation monitoring, a report will be prepared outlining the results. The report will be provided to the Commonwealth DoE, NSW DPI&E, NSW BCD and TSC and form the baseline for future monitoring.

	The Baseline Monitoring Report will be available on the JWA website for twelve (12) months (www.jwaec.com.au/). ***Annual Vegetation Monitoring Report*** An annual Vegetation Monitoring Report will be prepared which discusses the results of the monitoring of retained vegetation and rehabilitation areas against the Monitoring Performance Criteria identified in the VWMPs (JWA 2020g-i). The information provided in the report should include, but not necessarily be limited to: • Works undertaken (i.e. A summary of bush regenerators daily reports); • A presentation of the results of the particular monitoring event/s; • A detailed discussion of the results of each particular monitoring event including additional monitoring completed after any planned or unplanned bushfire; • A detailed comparison with the baseline parameters and with previous survey data, as appropriate; • A statement of compliance with the Monitoring Performance Criteria identified in the VWMPs (JWA 2020g-i); • Any problems since the previous inspection (death of a significant number of seedlings, broken fences etc.) and what effects these issues have had on the regeneration area; • Success or failure of measures implemented to rectify previously identified problems; • Measures to be taken to rectify new problems; and • Adaptive management log to ensure that the management plan remains relevant and effective. Each Annual Vegetation Monitoring Report will be submitted to NSW DPI&E, NSW BCD and TSC within two (2) months of completion of the relevant monitoring. The Annual Vegetation Monitoring Report will be available on the JWA website for twelve (12) months (www.jwaec.com.au/). ***Koala Monitoring Reports*** Monitoring of koala retained and compensatory habitat (Management Zones 2 and 4) will be replicated in the following

	reports in accordance with the KPoM (JWA 2019): • Baseline Report - Subsequent to the completion of baseline monitoring, a report will be prepared outlining the results. • Annual Koala Monitoring Report - An annual Koala Monitoring Report will be prepared which discusses the results of the: o Retained koala habitat monitoring against the Monitoring Performance Criteria identified in the VWMPs (JWA 2020g-i) and provided in **APPENDIX 4**; and o Koala compensatory planting monitoring against the Monitoring Performance Criteria identified in the KPoM (JWA 2019) and provided in **APPENDIX 5**, and the successful implementation of management actions (with reference to the Criteria for Success, and Corrective Actions detailed in the KPoM [JWA 2019]). ***WSF Monitoring Reports*** Monitoring of WSF retained and compensatory habitat (Management Zone 3 and 5) will be replicated in the following reports in accordance with the WSFMP (JWA 2020a): • Baseline Report - Subsequent to the completion of baseline monitoring, a report will be prepared outlining the results. • Annual WSF Monitoring Report - An Annual WSF Monitoring Report will be prepared which discusses the results of the: o Retained WSF habitat monitoring against the Monitoring Performance Criteria identified in the VWMPs (JWA 2020g-i) and provided in **APPENDIX 4**; and o WSF compensatory planting monitoring against the Monitoring Performance Criteria identified in the WSFMP (JWA 2020a) and provided in **APPENDIX 6**, and the successful implementation of management actions (with reference to the Criteria for Success and Corrective Actions detailed in the WSFMP [JWA 2020a]).

6.3 EEC Monitoring and Reporting

Two (2) EEC's as listed within schedules of the NSW *BC Act* (2016) occur throughout the Kings Forest site (**FIGURE 8**):

- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast; and
- Freshwater wetlands on coastal floodplains of the NSW North Coast.

Baseline and annual vegetation monitoring will be completed within areas of retained EECs in accordance with the VWMPs (JWA 2020g-i). **TABLE 4** provides a summary of the program for monitoring of EECs.

TABLE 4
EEC MONITORING AND REPORTING PROGRAM

Applies to	EECs – refer to TSMPs (JWA 2020d-f)
Responsibility	Suitably qualified ecologist and bush regeneration team
Purpose	Manage and protect EECs from site activities.
Implementation Strategy/ Methodology	EEC monitoring will be completed as part of the retained vegetation, regeneration and revegetation monitoring program in accordance with the VWMPs (JWA 2020g-i) and outlined in **TABLE 3**.
Timing/ Frequency	As outlined in **TABLE 3.**
Performance Criteria	Specific performance criteria and corrective actions for EECs are provided in **APPENDIX 4**.
Reporting	As outlined in **TABLE 3**.

6.4 Threatened Flora Monitoring & Reporting

TABLE 5 provides a summary of the threatened flora monitoring program.

TABLE 5
THREATENED FLORA MONITORING AND REPORTING PROGRAM

Applies to	Threatened flora species – refer to TSMPs (JWA 2020d-f)
Responsibility	Suitably qualified ecologist and bush regeneration team.
Purpose	Manage and protect existing Threatened flora species and their habitat from site activities and to maintain and increase the presence of Threatened flora species on the Kings Forest site over time.
Implementation Strategy/ Methodology	***Baseline Threatened Flora Monitoring*** • Baseline monitoring will involve identifying and clearly marking any threatened flora specimens located within the EMAs of each Precinct (**FIGURE 8**). • The random meander technique (Cropper 1993) will be used to complete targeted searches for threatened flora specimens in EMAs where historical records and/or suitable habitat occurs. • All Threatened species specimens will have the following details recorded: o GPS location; o Height; o Diameter at breast height (DBH); o Flowering/fruiting status; o Condition; and o Potential threats (i.e. weeds, recent bushfires etc.). ***Ongoing Threatened Flora Monitoring*** • All threatened plant species will be monitored as follows: o Survival;

	○ Height; ○ Flowering; ○ Fruiting; ○ Signs of natural recruitment; and ○ Potential threats (i.e. weeds, recent bushfires etc.). • Any additional Threatened flora species located during monitoring surveys will be marked and monitored as part of an adaptive management strategy.
Timing/ Frequency	***Baseline Threatened Flora Monitoring*** Baseline Threatened flora monitoring will be completed across the EMAs prior to the commencement of works on the site by suitably qualified and/or accredited persons. ***Ongoing Threatened Flora Monitoring*** Threatened flora within EMAs will be monitored on an annual basis by the proponent and then by Council pending the proposed dedication of land under Concept Plan 06_0318 Condition B7.
Performance Criteria	Specific performance criteria and corrective actions for Threatened flora are provided in **APPENDIX 4**.
Reporting	***Baseline Threatened Flora Monitoring*** Subsequent to the completion of baseline monitoring, a Baseline Threatened Species Monitoring Report will be prepared outlining the results. ***Ongoing Threatened Flora Monitoring*** An Annual Threatened Species Monitoring Report will be prepared which discusses the results of the monitoring against the Monitoring Performance Criteria identified in **APPENDIX 4**.

6.5 Weed Monitoring and Reporting

TABLE 6 provides a summary of the weed monitoring program.

TABLE 6
WEED MONITORING AND REPORTING PROGRAM

Applies to	Introduced flora species – refer to VWMPs (JWA 2020g-i)
Responsibility	Suitably qualified ecologist and bush regeneration team.
Purpose	To monitor weed species cover on the site with the goal to reduce the opportunity for weed species to become established.
Implementation strategy/ monitoring	***Baseline Weed Monitoring*** • Baseline data will be gathered by the Bush Regeneration Team at each weed treatment site prior to commencement of weed control using the Baseline Data Proforma provided in **APPENDIX 2** to assist in documenting vegetation recovery in the long term. • Baseline monitoring will also be completed within retained habitat areas (Management Zones 2 and 3), compensatory habitat areas (Management Zones 4 and 5) and other proposed revegetation/regeneration areas (i.e. Management Zones 6 - 8) in accordance with the VWMPs (JWA 2020g-i). Plot-based vegetation surveys will be undertaken at each monitoring location and will include: - Weed Canopy Cover: Weed canopy cover will be measured via the 'line intercept method' along the 50 m transect. Individual canopy weed species should be assessed separately.; - Weed Presence in the Midstorey; Estimate the % foliage cover of each weed species within the midstorey across the 400 m^2 plot. - Groundcover: Estimate percentage cover of native species vs. weeds within each of the five (5) 1 m^2 sub-plots. ***Retained Vegetation Monitoring:*** Ongoing weed monitoring within retained vegetation (Management Zones 2 and 3) will be completed using the same methodology as the baseline monitoring above.

	In addition to the ongoing retained monitoring, the bush regeneration team will keep detailed work sheets for all works completed within retained habitat areas (Management Zones 2 – 3) recording: • All work completed each day; • Site conditions; • Chemicals used; • Problems encountered; and • Future works required. A daily work sheet template is attached in **APPENDIX 3**. These records and general comments on progress will be provided to the Ecologist for consideration and inclusion in the annual monitoring reports. ***Rehabilitation Monitoring:*** Rehabilitation monitoring will be completed within the following revegetation/regeneration areas of the EMAs and the proposed East-West Corridor: • Management Zone 4 – Compensatory koala habitat: monitored in accordance with the Kings Forest KPoM (JWA 2019); • Management Zone 5 – Compensatory WSF habitat: monitored in accordance with the Kings Forest WSFMP (JWA 2020a); • Management Zone 6 – Heath regeneration: monitored in accordance with the VWMPs (JWA 2020g-i); • Management Zone 7 – Littoral rainforest regeneration/ revegetation: monitored in accordance with the VWMPs (JWA 2020g-i); and • Management Zone 8 – Wetland regeneration: monitored in accordance with Section 8.4 of the VWMPs (JWA 2020g-i). In addition to the ongoing rehabilitation monitoring, the bush regeneration team will keep detailed work sheets for all works completed within Management Zones 6 - 8 recording: • All work completed each day; • Site conditions;

	• Chemicals used; • Problems encountered; and • Future works required. A daily work sheet template is attached in **APPENDIX 3**. These records and general comments on progress will be provided to the Ecologist for consideration and inclusion in the annual monitoring reports.
Timing/ Frequency	***Baseline Monitoring*** Collection of baseline data will be completed prior to commencement of weed control. ***Retained Vegetation Monitoring*** Monitoring events should occur: • To set up monitoring transects and quadrats, and to collect the first round of monitoring data after 1st event of secondary weeding; • Six (6) monthly until the establishment period performance criteria are met; and • Then annually during the maintenance period. ***Rehabilitation Monitoring*** Monitoring events should occur: • To set up monitoring transects and quadrats, and to collect the first round of monitoring data after 1st event of secondary weeding; • Six (6) monthly until the establishment period performance criteria are met; and • Then annually during the maintenance period.
Performance criteria	Specific performance criteria and corrective actions for retained habitat areas (i.e. Management Zones 2 and 3), compensatory habitat areas (i.e. Management Zones 4 and 5) and rehabilitation habitat areas (i.e. Management Zones 6 - 8) including weed control are contained within the VWMPs (JWA 2020g-i) and provided in **APPENDIX 4**.
Reporting	***Baseline Vegetation Monitoring Report*** Subsequent to the completion of baseline vegetation monitoring in accordance with the requirements of the VWMPs (JWA

	2020g-i), a Baseline Vegetation Monitoring Report will be prepared outlining the results. ***Annual Vegetation Monitoring Report*** An annual Vegetation Monitoring Report will be prepared in accordance with the requirements of the VWMPs (JWA 2020g-i) and will discuss the results of the monitoring of retained vegetation and rehabilitation areas against the Monitoring Performance Criteria identified in the VWMPs (JWA 2020g-i) and provided in **APPENDIX 4**. The results of the weed control monitoring visits and all information provided by the Bush Regenerator will be included in the Annual Monitoring Report.

6.6 Koala Monitoring and Reporting

Koala monitoring will be completed over the Kings Forest site following the methodology described in the KPoM (JWA 2019). **TABLE 7** provides a summary of the proposed monitoring program for Koalas.

TABLE 7
KOALA MONITORING AND REPORTING PROGRAM

Applies to	Koalas (*Phascolarctos cinereus*) – refer to KPoM (JWA 2019)
Responsibility	Suitably qualified ecologist.
Purpose	Monitoring will be undertaken to determine the effectiveness of mitigation measures implemented.
Implementation strategy/ monitoring	***Baseline Monitoring*** • Completed in accordance with the methodology discussed in the KPoM (JWA 2019), which has been reproduced in **APPENDIX 5.** • Monitoring will include: • Diurnal searches of Kings Forest Koala habitat; • A full measure of Koala activity (i.e. application of Spot Assessment Technique (SAT) methodology [Phillips and Callaghan 2011]); • Assessment of the condition of available Koala habitat; and • Permanent photo monitoring points. ***Biennial Koala Monitoring*** • Completed in accordance with the methodology described in KPoM (JWA 2019), which has been reproduced in **APPENDIX 5.** • Biennial monitoring will include: • Diurnal searches of Kings Forest Koala habitat; • A full measure of Koala activity (i.e. SAT methodology [Phillips and Callaghan 2011]);

	• Assessment of the condition of available Koala habitat; • Continued monitoring of permanent photo monitoring points; • Sand tray monitoring and/or camera traps installed to assess the usage of underpasses. • In the event that a suspected diseased koala is observed during monitoring, the time, date and location of the sighting must be recorded. These details should be passed on to an appropriate wildlife care organization as soon as practicable. If required, the observer should remain at the location until the wildlife rescuer attends. ***Retained Koala Habitat*** The monitoring of retained koala habitat will be completed in accordance with performance criteria contained in the approved Kings Forest VWMPs (JWA 2020g-i). ***Koala Compensatory Planting Monitoring*** • Completed in accordance with the methodology described in KPoM (JWA 2019), which has been reproduced in **APPENDIX 5.** The monitoring program will comprise the following components: • Identification of Performance Indicators; • Survey site and plot selection; • Plot based survey; • Photo-point monitoring; • Targets for the Performance indicators during the Establishment and Maintenance periods, including Corrective actions if required. • ***Koala Monitoring After Fire*** • Completed in accordance with the methodology described in KPoM (JWA 2019), which has been reproduced in

	APPENDIX 5 to monitor the impacts of fire on the local Koala population. ***Koala Infrastructure, Construction and Operational Management Monitoring*** • Monitoring activities during the construction/installation of temporary and/or permanent fences, fauna underpasses, grids and signage will be completed by the Environmental Officer in accordance with Section 8.5.2 of the KPoM (JWA 2019)
Timing/ Frequency	***Baseline Monitoring*** Collection of baseline data will be completed across the entire site prior to commencement of works on the site. ***Biennial Koala Monitoring*** Completed on a biennial basis from the date of commencement of works and will continue for a period extending to five (5) years after completion of the final precinct or until all the retained habitat is dedicated, whichever is sooner. ***Retained Koala Habitat*** Completed in accordance with the VWMPs (JWA 2020g-i). ***Koala Compensatory Planting Monitoring*** Monitoring events should occur: • To set up monitoring transects and quadrats and collect baseline data after 1st event of secondary weeding; and • Six (6) monthly until the establishment period performance criteria are met; and • Then annually during the maintenance period. **Koala Monitoring After Fire** In the event of an uncontrolled bushfire occurring on the Kings Forest site, an additional koala activity monitoring event will be completed by a suitably qualified ecologist.

	Koala Infrastructure, Construction and Operational Management Monitoring Visual inspections of koala infrastructure by the Environmental Officer will be completed on a monthly basis until the land occupied by the infrastructure is dedicated to either TSC or BCD.
Performance criteria	**Koala Monitoring Performance Criteria:** • Specific performance criteria and corrective actions for Koala management across the Kings Forest site are provided in **APPENDIX 5.** ***Koala Compensatory Planting Monitoring*** • **APPENDIX 5** provides the performance indicators and targets for the proposed koala habitat rehabilitation strategy. ***Koala Infrastructure, Construction and Operational Management Monitoring*** **APPENDIX 5** provides the performance crideria and corrective actions.
Reporting	***Baseline Koala Activity Monitoring Report*** Subsequent to the completion of baseline monitoring, a Baseline Koala Activity Monitoring Report will be prepared outlining the results. ***Annual KPoM Monitoring Report*** An Annual KPoM Monitoring Report is to be prepared and will include the results of monitoring of the following items: • Koala Activity (Biennially); • Retained koala habitat monitoring (to be completed as part of the approved Kings Forest VWMPs [JWA 2020g-i); • Compensatory Planting; and • Koala Infrastructure, Construction and Operational Management; and • Reconciliation against all relevant State and Commonwealth conditions of approval, and a discussion of findings and any recommendations for corrective actions.

6.7 Wallum Sedge Frog Monitoring and Reporting

WSF monitoring will be completed over the Kings Forest site following the methodology described in the WSFMP (JWA 2020a). **TABLE 8** provides a summary of the proposed monitoring program for Wallum sedge frogs.

TABLE 8
WALLUM SEDGE FROG / WALLUM FROGLET MONITORING AND REPORTING PROGRAM

Applies to	Wallum sedge frogs (*Littoria olongburensis)* - Refer to WSFMP (JWA 2020a)
Responsibility	Suitably qualified ecologist.
Purpose	Monitoring will be undertaken to determine the effectiveness of mitigation measures implemented.
Implementation strategy/ monitoring	***WSF and WSF Habitat Monitoring*** • Detailed WSF and WSF Habitat survey methods are provided in **APPENDIX 6** (in accordance with the WSFMP [JWA 2020a]) and include: o Water quality monitoring; o Retained WSF habitat; o Compensatory habitat; o WSF occupancy rates; and o o Infrastructure, construction and operational management. ***WSF Monitoring After Fire*** • In the event of an uncontrolled bushfire occurring on the Kings Forest site, an additional WSF monitoring event will be completed by a suitably qualified ecologist. Completed in accordance with the methodology provided in **APPENDIX 6** to monitor the impacts of fire on the local WSF population (in accordance with the WSFMP [JWA 2020a]).
Timing / Frequency	***Baseline WSF Monitoring*** Collection of baseline data will be completed during breeding season (i.e. between late September and early March) during appropriate weather conditions prior to commencement of construction in each precinct. Monitoring surveys will be

	completed following rainfall events greater than 25 mm in 24 hours. ***WSF Monitoring*** • WSF monitoring shall be completed in association with each relevant stage of the Kings Forest development on an annual basis as a responsibility of the Proponent, from the date of "commencement" of works in each relevant development stage, and will continue for a period extending to five (5) years after completion of the relevant development stage or until the retained habitat associated with the relevant development stage is dedicated, whichever is sooner. • Annual monitoring will comprise three (3) sampling events undertaken per WSF breeding season (i.e. between late September and early March) during appropriate weather conditions. • All monitoring surveys will be completed following rainfall events greater than 25 mm in 24 hours and approximately half an hour after dark. ***Baseline Water Quality Monitoring*** Baseline water quality monitoring will be completed prior to construction to establish appropriate discharge criteria for the construction phase. Performance criteria will be set by monitoring parameters for a minimum of eight (8) monitoring rounds prior to commencement of construction works (in accordance with the WSFMP [JWA 2020a]). ***Ongoing Water Quality Monitoring*** To be completed during the WSF monitoring (3 sampling events during September - March) and on an episodic basis i.e. during a very wet period and also during a very dry period. Surface water monitoring will be completed within the construction site monthly during the construction phase and following the first monthly rainfall event (defined as >25mm in 24 hours). ***Retained WSF Habitat Monitoring*** Monitored in accordance with the VWMPs (JWA 2020g-i).

	WSF Compensatory Habitat Monitoring Monitoring events should occur: • To set up monitoring transects and quadrats and collect baseline data after 1st event of secondary weeding; and • Six (6) monthly until the establishment period performance criteria are met; and • Then annually during the maintenance period. ***Infrastructure, Construction and Operational Management Monitoring*** Monitoring activities during the construction/installation of temporary and/or permanent fences and signage should be completed by the Environmental Officer in accordance with the WSFMP (JWA 2020a). ***WSF Monitoring After Fire*** Completed after any bush fire on the Kings Forest site.
Performance criteria	Performance indicators, targets and corrective actions for the proposed WSF monitoring and WSF compensatory habitat monitoring are contained within the WSFMP (JWA 2020a) and provided in **APPENDIX 6**.
Reporting	***Baseline WSF Monitoring Report*** Subsequent to the completion of baseline monitoring, a Baseline WSF Monitoring Report will be prepared outlining the results. ***Annual WSF Monitoring Report*** An Annual WSF Monitoring Report will be prepared and will include the results of the following items: • Water quality; • WSF occupancy; • Retained WSF habitat monitoring (to be completed as part of the approved Kings Forest Vegetation Management Plans); • Compensatory planting; • Infrastructure, construction and operational management; and

	• Reconciliation against all relevant State and Commonwealth conditions of approval, and a discussion of findings and any recommendations for corrective actions.

6.8 Threatened Fauna Monitoring and Reporting

Monitoring of Threatened fauna species for species other than the koala and WSF will be completed within EMAs to determine the effectiveness of mitigation measures implemented. The fauna surveys will target Threatened species previously recorded or predicted to occur on the site. **TABLE 9** provides a summary of the threatened fauna monitoring program.

TABLE 9
THREATENED FAUNA MONITORING AND REPORTING PROGRAM

Applies to	Black bittern (*Ixobrychus flavicollis*); Black-necked stork (*Ephippiorhynchus asiaticus*); Bush stone-curlew (*Burhinus grallarius*); Common blossom bat (*Synconycteris australis*); Common planigale (*Planigale maculata*); Glossy black-cockatoo (*Calyptorhynchus lathami*); Grass Owl (*Tyto longimembris*); Grey-headed flying fox (*Pteropus poliocephalus*); Masked owl (*Tyto novaehollandiae*); Eastern osprey (*Pandion cristatus*); Little bent-wing bat (*Miniopterus australis*); Eastern false pipistrelle (*Falsistrellus tasmaniensis*); Southern myotis (*Myotis macropus*); Yellow-bellied sheathtail bat (*Saccolaimus flaviventris*); Pale-vented bush hen (*Amaurornis moluccana*); Rose-crowned fruit-dove (*Ptilinopus regina*); and Any additional threatened species identified during previous monitoring surveys.
Responsibility	Suitably qualified ecologist

Purpose	Monitoring of threatened fauna populations to determine the effectiveness of mitigation measures implemented. To determine fauna species presence / abundance to assess population trends and the impact of development on native fauna.

Implementation Strategy/ Monitoring	***Baseline Threatened Fauna Monitoring***
	• Detailed monitoring methodologies can be found in the TSMPs (JWA 2020d-f).
	• The locations of survey sites within Management Zones 2 - 8 will utilise the field sites sampled in 2010 during the Tweed Coast Koala Habitat Study (Phillips *et al*. 2011) where appropriate. Additional field sites have been identified to ensure representative sampling of all habitat types. The location of survey sites within the Precincts 1 – 5 EMAs is shown in **FIGURE 12**. The locations of survey sites within Precincts 6 – 11 and Precincts 12 – 14 will be identified at a later date and will generally occur at the locations shown in **FIGURES 10B & C** respectively.
	• At each survey site a permanent 100 m transect line will be setup. Transect lines will be permanently marked (i.e. star pickets or wooden stakes) and the end positions located using a hand held Global Positioning System (GPS). Five (5) trap stations will be installed approx. 20 m apart along each transect line for four (4) consecutive nights with each trap station containing:
	  o An Elliott trap on the ground;
	  o An arboreal Elliott trap on a permanently installed wooden platform attached to a suitable tree; and
	  o A hair tube.
	• The following additional survey techniques will also be employed at each survey transect line (where appropriate):
	  o A pitfall trap line incorporating three (3) 20L buckets and four (4) funnel traps (installed only where ground/water table conditions are appropriate);
	  o Installation of three (3) remote camera traps;
	  o Active searching;
	  o Bat echolocation call detection; and
	  o Dawn and dusk bird surveys.
	• In addition to the above transect surveys:
	  o Spotlighting/stag watching;
	  o Call playback;
	  o Wetland census at dawn and dusk; and

LEGEND

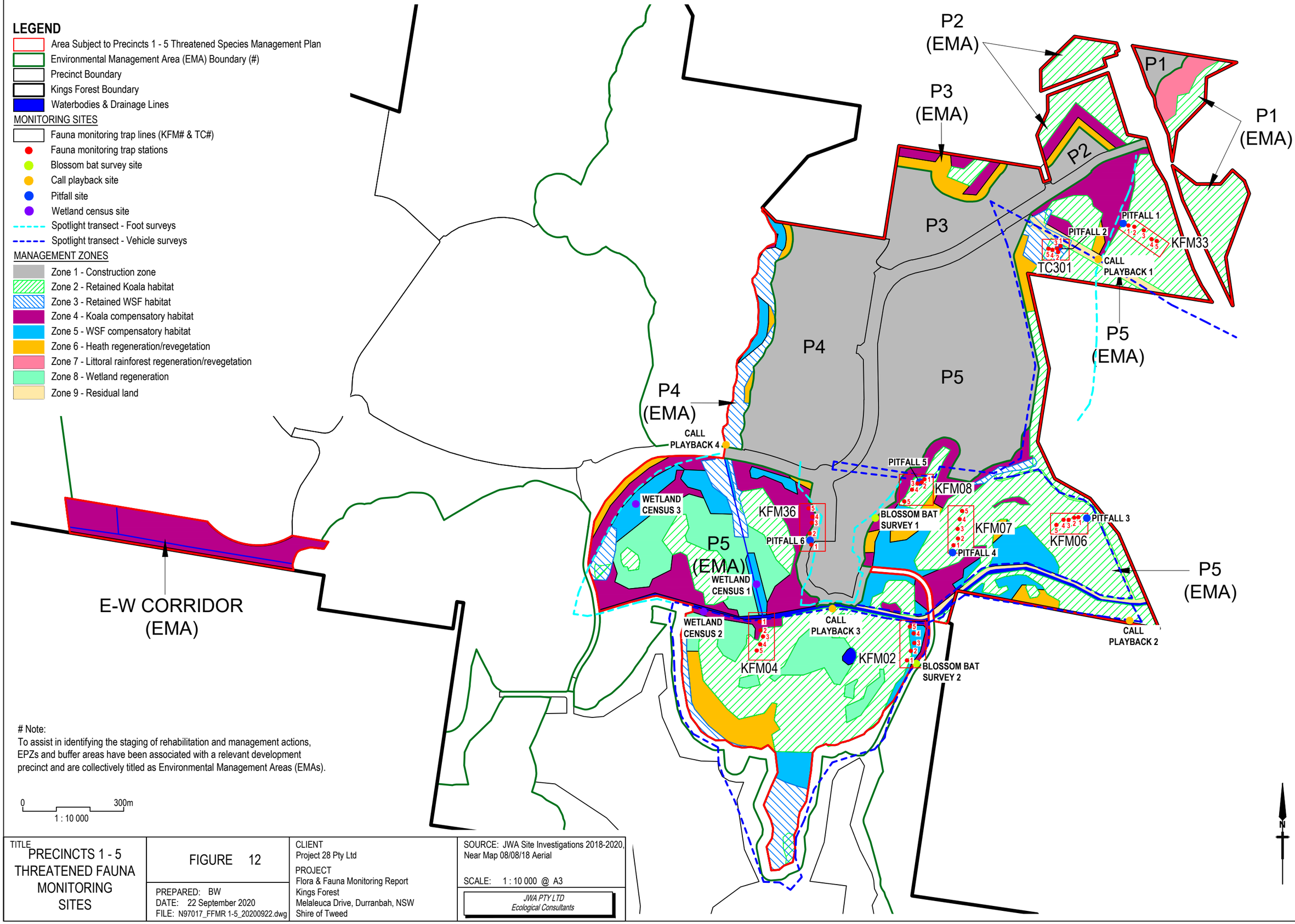
- Area Subject to Precincts 1 - 5 Threatened Species Management Plan
- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary
- Waterbodies & Drainage Lines

MONITORING SITES

- Fauna monitoring trap lines (KFM# & TC#)
- Fauna monitoring trap stations
- Blossom bat survey site
- Call playback site
- Pitfall site
- Wetland census site
- Spotlight transect - Foot surveys
- Spotlight transect - Vehicle surveys

MANAGEMENT ZONES

- Zone 1 - Construction zone
- Zone 2 - Retained Koala habitat
- Zone 3 - Retained WSF habitat
- Zone 4 - Koala compensatory habitat
- Zone 5 - WSF compensatory habitat
- Zone 6 - Heath regeneration/revegetation
- Zone 7 - Littoral rainforest regeneration/revegetation
- Zone 8 - Wetland regeneration
- Zone 9 - Residual land



Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 300m
1 : 10 000

TITLE PRECINCTS 1 - 5 THREATENED FAUNA MONITORING SITES	FIGURE 12 PREPARED: BW DATE: 22 September 2020 FILE: N97017_FFMR 1-5_20200922.dwg	CLIENT Project 28 Pty Ltd PROJECT Flora & Fauna Monitoring Report Kings Forest Melaleuca Drive, Durranbah, NSW Shire of Tweed	SOURCE: JWA Site Investigations 2018-2020, Near Map 08/08/18 Aerial SCALE: 1 : 10 000 @ A3 *JWA PTY LTD* *Ecological Consultants*

	○ Targeted surveys for the Common blossom bat (*Syconycteris australis*) at specific locations. ***Ongoing Threatened Fauna Monitoring*** • The methodology used for the Baseline monitoring described above will be utilised for the annual fauna monitoring.
Timing/ Frequency	***Baseline Threatened Fauna Monitoring*** • Prior to clearing and construction for baseline data ***Ongoing Threatened Fauna Monitoring*** Threatened flora within EMAs will be monitored on an annual basis by the proponent and then by Council pending the proposed dedication of land under Concept Plan 06_0318 Condition B7.
Performance Criteria	Specific performance criteria and corrective actions are provided in **APPENDIX 4**.
Reporting	***Baseline Threatened Fauna Monitoring*** Subsequent to the completion of baseline monitoring, a Baseline Threatened Species Monitoring Report will be prepared outlining the results. ***Ongoing Threatened Fauna Monitoring*** An annual Threatened Species Monitoring Report will be prepared which discusses the results of the ongoing monitoring against the Monitoring Performance Criteria identified in **APPENDIX 4**.

6.9 Feral Animals Monitoring and Reporting

TABLE 10 provides a summary of the feral animal monitoring program.

TABLE 10
FERAL ANIMAL MONITORING AND REPORTING PROGRAM

Applies to	Feral animal species - refer FAMP (JWA 2020j)
Responsibility	Trained staff employed by proponent for all other monitoring.
Purpose	To monitor feral species activity and abundance on the site with the goal to reduce feral animal numbers.
Implementation strategy/ monitoring	A targeted monitoring program for feral animals will be undertaken by a suitably qualified ecologist and where possible should be completed in conjunction with other monitoring activities (i.e. threatened fauna monitoring) as outlined in the following management plans: • Kings Forest Koala Plan of Management (JWA 2019); • Kings Forest Wallum Sedge Frog Management Plan (JWA 2020a); • Kings Forest Precincts 1 – 5 Threatened Species Management Plan (JWA 2020d); • Kings Forest Precincts 6-11 Threatened Species Management Plan (JWA 2020e); and • Kings Forest Precincts 12-14 Threatened Species Management Plan (JWA 2020f). The monitoring program will use one or more of the following methods depending on the species: • Heat and motion cameras (infrared and white flash) - targeting wide ranging landscape species such as feral dogs, foxes and feral cats; • Detection dog searches - targeting potential fox den sites and hotspots of fox and cat activity (to guide trapping sites); • Targeted searches for feral animals;

<table>
<tr><td></td><td>

- Sampling for biting insects during mosquito breeding season; and
- Opportunistic records from site workers/community and other monitoring programs.

</td></tr>
<tr><td>Timing / Frequency</td><td>

Year One Targeted Monitoring Program

<table>
<tr><th>Monitoring Requirement</th><th>Target Species</th><th>Timing</th></tr>
<tr><td>Heat and Motion Cameras</td><td>Feral dogs / Feral cats / Red Fox

Incidental sightings of Cane toads, Common myna, European rabbit/Brown hare to inform target searches.</td><td>Full time with cameras checked fortnightly (data downloaded, batteries checked and all vegetation in front of the camera removed or trimmed to minimize false triggers) for the first year.</td></tr>
<tr><td>Detection Dog Searches</td><td>Feral cats / Red Fox</td><td>Annually in August.</td></tr>
<tr><td rowspan="5">Targeted Searches</td><td>Feral dogs / Feral cats / Red Fox</td><td>Four (4) times per year</td></tr>
<tr><td>Cane toad</td><td>To be carried out at the same time as WSF surveys (i.e. three (3) times per breeding season (spring/ summer) and after a storm events and opportunistically.</td></tr>
<tr><td>Common myna</td><td>Four (4) times per year.</td></tr>
<tr><td>European rabbit / Brown hare</td><td>Four (4) times per year.</td></tr>
<tr><td>Mosquito fish</td><td>Three (3) times per breeding</td></tr>
</table>

</td></tr>
</table>

			season (i.e. during spring/ summer).
	Biting Insect Sampling	Mosquitoes and biting midges	Weekly for the duration of the mosquito breeding season (i.e. late August to April). After treatment to establish effectiveness of treatment. Opportunistically after a storm event (over 25 mm of rain within a 24 hour period) but only if the sampling point had been dry prior to the storm event.
	Opportunistic Searches	All species	Ongoing

Post Fire Monitoring

Planned and unplanned bushfire can provide significant opportunity for incursions of feral animals (and weeds). Monitoring for priority species shall be carried out after any bushfire and will include additional targeted searches - refer SECTION 6.5.5 of the FAMP (JWA 2020j) for vertebrate predators (dogs, foxes and cats). Additional targeted searches for cane toads and mosquito fish - refer SECTION 6.5.5 of the FAMP (JWA 2020j) will also be completed where fire occurs in wetlands and around open water.

Management Objectives

- Feral Dogs - To minimise the impact of dogs on key ecological assets such as Koalas, Bush stone curlews recognising the ecological role that Dingos have in the landscape.
- Red Fox - To minimise the impact of foxes on key ecological assets such as small terrestrial and arboreal mammals, frogs, reptiles and birds.
- Feral Cat - To minimise the impact of cats on key ecological assets such as small terrestrial and arboreal mammals, frogs, reptiles and birds.
- Cane toad - To minimise the presence of Cane toads in the development envelope and prevent their spread into

	adjacent natural habitat areas. • Common mynah - To minimise the presence of common mynas in the development envelope and prevent their spread into adjacent natural habitats. • European rabbit and Brown hare - To minimise the impacts of European rabbits and Brown hares on protected vegetation and habitats. • Mosquito fish - To minimise the impacts of Mosquito fish on key ecological assets such as frogs and native fish and prevent their spread into adjacent natural habitats.
Reporting	An Annual Feral Animal Monitoring Report will be prepared by a suitably qualified ecologist which discusses the results of the targeted monitoring program. The information provided in the report should include, but not necessarily be limited to: • A summary of monitoring activities undertaken over the previous 12 months; • The details of any feral animals detected for the previous 12 month monitoring period; • A summary of control actions taken in response to monitoring; and • Any recommendations made for future control and management. Each Annual Feral Animal Monitoring Report will be submitted to NSW BCD and TSC within two (2) months of completion of the relevant monitoring.

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Cropper S.C. (1993) *Management of Endangered Plants*. CSIRO, East Melbourne, Victoria.

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Gilbert and Sutherland (G&S) (2020b) *Overall Water Management Plan, Kings Forest New South Wales*. Report prepared for Project 28.

Gilbert and Sutherland (G&S) (2020c) *Kings Forest Drainage Maintenance Management Plan*. Report prepared for Project 28 by Gilbert and Sutherland.

JWA (2019) *Koala Plan of Management, Kings Forest (Volume 1 and 2)*. Report prepared for Project 28 Pty Ltd.

JWA (2020a) *Wallum Sedge Frog Management Plan, Kings Forest*. Report prepared for Project 28 Pty Ltd.

JWA (2020b) *Kings Forest Precincts 1 - 5 Buffer Management Plan*. Report prepared for Project 28 Pty Ltd.

JWA (2020c) *Kings Forest Precincts 6 – 14 Buffer Management Plan*. Report prepared for Project 28 Pty Ltd.

JWA (2020d) *Kings Forest Precincts 1 - 5 Threatened Species Management Plan*. Report prepared for Project 28 Pty Ltd.

JWA (2020e) *Kings Forest Precincts 6 - 11 Threatened Species Management Plan*. Report prepared for Project 28 Pty Ltd.

JWA (2020f) *Kings Forest Precincts 12 - 14 Threatened Species Management Plan*. Report prepared for Project 28 Pty Ltd.

JWA (2020g) *Kings Forest Precincts 1 - 5 Vegetation and Weed Management Plan*. Report prepared for Project 28 Pty Ltd.

JWA (2020h) *Kings Forest Precincts 6 - 11 Vegetation and Weed Management Plan*. Report prepared for Project 28 Pty Ltd.

JWA (2020i) *Kings Forest Precincts 12 - 14 Vegetation and Weed Management Plan*. Report prepared for Project 28 Pty Ltd.

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NSW Office of Environment and Heritage (NSW OEH) (2017) *Biodiversity Assessment Method*. Accessed online: http://www.environment.nsw.gov.au/resources/bcact/biodiversity-assessment-method-170206.pdf

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Thom R.M. (1997) System-development matrix for adaptive management of coastal ecosystem restoration projects. *Ecological Engineering* **8**:219–232.

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APPENDIX 1 – Compliance with Relevant Approval Conditions

CONDITION	SECTION OF TSMP
Concept Plan Approval (CP06_0318)– Condition B2 Flora and Fauna Monitoring Report "A draft outline of a flora and fauna monitoring report will be prepared within 12 months of concept plan approval".	A draft flora and fauna monitoring report was prepared and has now been replaced by this FFMR.
Major Project Approval (MP08_0194) – Condition 47 The Flora and Fauna Monitoring Report (FFMR) should be revised to the satisfaction of OEH as follows: 1) The FFMR framework should be revised to ensure that monitoring of impacts in relation to threatened wetland bird species (black-necked stork, black bittern) takes suitable account of any measures proposed in relation to drainage maintenance of Blacks Creek. 2) Table 4 – Threatened Fauna shall include the requirement to report fauna monitoring results to Council and OEH. 3) The discussion of methodology in relation to monitoring of Koala should be more fully developed than that provided in Table 5 and Section 5.3, to the satisfaction of OEH. 4) The monitoring of impacts in relation to threatened wetland bird species (Table 12) should take suitable account of any measures proposed in relation to drainage maintenance of Blacks Creek, and be consistent with actions specified in the Drain Maintenance Management Plan and Threatened Species Management Plans. 5) The results of all monitoring of feral animals (Table 13) shall be additionally reported to OEH to assist in efforts to co-manage any feral animal problems on and adjacent to the site.	1) Threats and mitigation measures to wetland bird species and associated monitoring are provided in the TSMPs (JWA 2020d-f) and summarised in **SECTION 6.8**. 2) The TSMPs (JWA 2020d-f) have been updated to include the requirement to report monitoring results to Council and OEH – this has been reflected in the Monitoring of Fauna section (**SECTION 6.8**). 3) A separate KPoM (JWA 2019) has been prepared that details the Koala monitoring methodology. **SECTION 6.6** of this report summarises the Koala monitoring requirements of the KPoM (JWA 2019). 4) Monitoring of impacts to threatened wetland bird species has been considered in the TSMPs (JWA 2020d-f). **SECTION 6.8** summarises the monitoring requirements. 5) The FAMP has been updated to include reporting feral animal monitoring results to OEH.

CONDITION	SECTION OF TSMP
6) The final Flora and Fauna Monitoring Report shall be prepared in consultation with Council and submitted to the Secretary for approval within 6 months of the date of determination of the application (No. 2012/2328) made under sections 130(1) and 133 of the Commonwealth Environment Protection and Biodiversity Conservation Actor prior to issue of any construction certificate, whichever occurs first.	6) Noted

APPENDIX 2 - Baseline Data Proforma

Work Area Number:	**Date:**
Climatic Condition:	
Vegetation type: ☐ **Rainforest** ☐ **Sclerophyll Forest** ☐ **Wetland** ☐ **Woodland** ☐ **Heath** ☐ **Riparian Veg**	
Native Regeneration Scoring at Time of Assessment: ☐ **Negligible** ☐ **Poor** ☐ **Moderate** ☐ **Good** ☐ **Exceptional**	

NATIVE PLANT SPECIES LIST ***Details of native plant species present and their abundance within the work area***			
Stratum	**Native Plants**		**Abundance**
	Common Name	**Scientific Name**	
Lower			
Mid			
Upper			

THREATENED PLANT SPECIES/ENDANGERED ECOLOGICAL COMMUNITIES LIST *List of threatened plant species/Endangered Ecological Communities found at the work area*		
Species and Conservation Status	**Number of Plants**	**Management Implications**

Endangered Ecological Community	**Management Implications**

HABITAT FEATURES	
Fauna observed: *e.g. Turkey mound present on site.*	
Fauna habitat features present on site:	
☐ Hollows in trees	☐ Wet or damp areas (including soaks / springs)
☐ Mature or over-mature trees	☐ Leaf litter
☐ Dead standing trees	☐ Native grasses, rushes and sedges
☐ Rocks and boulders	☐ Fleshy fruited trees and shrubs
☐ Fallen logs	☐ Nectar bearing trees and shrubs
☐ Caves, mineshafts or overhangs	☐ Dense understorey shrubs
☐ Springs	☐ Prickly understorey shrubs
☐ Lagoons	☐ Seasonal cracks in the soil
☐ Pools	☐ Other (please specify):
☐ Watercourses / gullies	
☐ Riparian areas	

Comments:

ENVIRONMENTAL WEED SPECIES LIST
Details of weed species present and their abundance within the work area

Stratum	Major Environmental Weeds		Percentage Cover %
	Common Name	Scientific Name	
Lower			
Mid			
Upper			

OTHER THREATS OR IMPACTS			
Feral Animal Presence:	**Area of Most Disturbance**	**Impact**	**Management Implications**
EXAMPLE: Cane Toad	*Open disturbed area*	*On native fauna*	*Monitor presence*
Possible Negative Impacts	**Impact**	**Management Implications**	
EXAMPLE: Stock intrusion	*On regenerating native plants*	*Stock intrusion is unlikely, however if evidence of significant negative impact of regenerating native vegetation is detected, then fencing of stock may be required.*	
EXAMPLE: Herbicide drift	*On threatened XXXX plant and on native plants*	*Use of herbicides to control weeds around the threatened plants will have to be done with utmost care and only by experienced bush regenerators. In any case weed control using herbicides must comply with current Best Management Practice*	

ENVIRONMENTAL RESTORATION ISSUES	
Weaknesses	
EXAMPLES: Exposed, no canopy, high light. Copious weed regeneration following disturbance. Sloping site difficult to work in. XXX threatened species present in abundance.	
Strengths	
EXAMPLES: Good seed source for native recruitment. Some native regeneration occurring.	

Restoration Objectives for Work Area	
EXAMPLE: To undertake all enhancement plantings and the first stage weed control program by the release of the subdivision certificate, and to achieve an 80% native species canopy cover in all areas by November 2009.	

APPENDIX 3 - Daily Work Record Proformas

Work Record and Observation Pro Forma

This form is to be filled by the team leader for each workday. The team leader will need to allow 15 minutes each day to gather any relevant information for team members and to fill in this form.

Name of Team Leader:	**Date:**
Vegetation Type:	**Site Number:**
Weather Conditions:	
Specific Work Zone/s:	

Work Team Details

Name	Zone No	Time Started	Time Finished	Hours Worked
Total No of Workers:		**Total No of Hours:**		

Description of Work Undertaken
(e.g. spraying, hand weeding, replanting, etc.). Mark work progress on project map.

Weed Control Undertaken	Weed Species	Material Used (tools/machinery)	Chemical Application (type/ratio/volume)	Zone No(s)	Area Worked (m^2)	No of People	Total Hours Worked
Spraying							
Tree injections							
Cut and paint							
Hand weeding							
Other (specify)							

Replanting Undertaken	Material Used (tools/machinery)	Fertilizer, Mulch, Tree Protection Used (type/ratio/volume)	Zone No(s)	No trees Planted	No of People	Total Hours Worked

Fencing Undertaken	Type of Fence	Material Used (tools/machinery)	Zone No(s)	Km of Fence	No of People	Total Hours Worked

Other Work (describe activity)	Material Used (tools/machinery)	Zone No(s)	Quantity	No of People	Total Hours Worked

Observations:

New native species or native species not previously recorded in work zone (please note date and zone no):

Name and date of any native plant species in flower or fruit, sudden and abundant regeneration of a particular species, or other relevant observations:

New weed species or weed species not previously recorded in work zone (please note date and zone no):

Any animal sightings (please indicate if by visual identification, called, nests, footprints, scats, clawmarks, shed skin, diggings, smell, feeding etc.):

Blank Project Map:

Use map to indicate work undertaken for each day (e.g. hatching weed control progress).

Signature:

Chemical Operators Data Sheet

This form is to be filled by the team leader for each workday. The team leader will need to allow 15 minutes each day to gather any relevant information for team members and to fill in this form.

Location:	Date:	Time:
Operators:		

Herbicide	Batch No	Dilution Rate	Total	Operator	Equipment
Glyphosate:					
☐ RoundupBioactive®					
☐ Weedmaster Duo®					
Metsulfuron Methyl:					
☐ Brushkiller®					
☐ Brushoff®					
Glyphosate *PLUS* Metsulfuron Methyl:					
☐ RoundupBioactive®					
☐ Weedmaster Duo®					
☐ Brushoff®					
Triclopyr & Picloram:					
☐ Grazon®					
☐ Tordon T/C®					
Marker Dye:					
☐ White field marker					
☐ Red marker					
☐ Other					
Additive:					
☐ LI 700®					
☐ Agral®					
Other:					

Growing Conditions	Temperature	Weather Conditions	Wind Strength	Wind Direction
☐ Very Good	☐ Cool <20º	☐ Showers	☐ Strong	
☐ Good	☐ Warm 21º – 25º	☐ Overcast	☐ Gusty	
☐ Poor	☐ V/Warm 26º – 30º	☐ Clear Sky	☐ Light	
☐ Very Poor	☐ Hot >30º	☐ Variable	☐ Calm	

Zone/Area:
Comments:

Signature:

APPENDIX 4 – Vegetation, EEC, Flora and Fauna Performance Targets and Corrective Actions

The success of management actions will be assessed through monitoring against the performance indicators and targets outlined in the following tables:

- **TABLE 1 -** performance indicators and targets for retained vegetation/habitat within Management Zones 2 and 3 in accordance with the VWMPs (JWA 2020g-i);
- **TABLE 2 -** performance indicators and targets for the rehabilitation works within Management Zones 6 - 8 in accordance with the VWMPs (JWA 2020g-i);
- **TABLES 3 -** performance indicators and targets for EEC vegetation in accordance with the TSMPs (JWA 2020d-f); and
- **TABLES 4 and 5 -** performance indicators and targets for threatened species in accordance with the TSMPs (JWA 2020d-f).

Corrective actions are provided that are to be implemented if performance targets are not met.

TABLE 1
PERFORMANCE TARGETS AND CORRECTIVE ACTIONS FOR RETAINED VEGETATION (MANAGEMENT ZONES 2 - 3)

Performance Indicator	Target – Establishment period[1]	Target – Maintenance period[2]	Corrective Actions
Natural recruitment of native species	Evidence of natural recruitment of shrub and ground cover species.	Increasing natural recruitment of shrub and groundcover species.	Where natural recruitment fails to meet performance targets discussions with BCD and TSC shall be initiated by the proponent or their consultants to consider adjustments to the assisted regeneration strategy being used to improve natural recruitment.
All identified weeds controlled to an acceptable level within retained vegetation areas in accordance with the VWMPs (JWA 2020g-i)	Foliage Projective Cover (FPC) (%) assessed using eye estimates or photo points reduced to <10% within first year.	Foliage Projective Cover (FPC) (%) assessed using eye estimates or photo points: • reduced to <10% within first year; • <10% in second year; • <5% in the third year and consecutive years.	Weed control as necessary.
Infrastructure (e.g. protection fencing, signage, erosion and sediment control devices) functional and well-maintained	Relevant infrastructure maintained.	Relevant infrastructure in condition suitable for hand over to Tweed Shire Council.	Maintenance as necessary.

Notes:

[1] "Establishment period" means the period during which initial environmental repair, restoration and monitoring works required by the relevant approved environmental management plan(s) are undertaken. The establishment period ends when the works meet the establishment period performance criteria, as defined by the relevant approved environmental management plans, to the satisfaction of the Secretary.

[2] "Maintenance period" means the period of environmental management and monitoring works commencing immediately after the end of the establishment period. Maintenance period works are to be carried out in accordance with the relevant performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.

[3] "Substantial establishment" of the koala habitat plantings means "the plantings have progressed beyond the need for intensive maintenance e.g. weed control, watering etc. and are clearly established by way of persisting through a recognised growth period and a suitably qualified horticultural/ environmental specialist has provided a short report confirming that the plantings are established."

TABLE 2
PERFORMANCE TARGETS AND CORRECTIVE ACTIONS FOR REHABILITATION WORKS (MANAGEMENT ZONES 6 - 8)

Performance Indicator	Target – Establishment period[1]	Target – Maintenance period[2]	Corrective Actions
Survival and continued growth of seedlings (i.e. planted stock)	>90% survival of plantings during all monitoring events	>90% survival of plantings during all monitoring events	Irrigation if required. Additional planting if required.
Establishment of native ground cover within revegetation areas	Planted ground covers substantially established[3]	• >60% after three (3) years • >80% after five (5) years	Supplementary planting
Establishment of native canopy cover (where applicable) within revegetation areas	Planted trees substantially established[3]	• >60% canopy cover of native tree species >1.5 m in height after three (3) years • >80% canopy cover of native tree species >2.5m in height after five (5) years	Monitoring and maintenance period must be extended until the targets are met.
Natural recruitment of native species throughout rehabilitation areas	Evidence of natural recruitment of shrub and ground cover species.	Increasing natural recruitment of shrub and groundcover species.	Where natural recruitment fails to meet performance targets discussions with BCD and TSC shall be initiated by the proponent or their consultants to consider adjustments to the assisted regeneration strategy being used to improve natural recruitment.
All identified weeds controlled to an acceptable level within retained vegetation areas in accordance with the VWMPs (JWA 2020g-i)	Foliage Projective Cover (FPC) (%) assessed using eye estimates or photo points reduced to <10% within first year.	Foliage Projective Cover (FPC) (%) assessed using eye estimates or photo points: • reduced to <10% within first year; • <10% in second year; • <5% in the third year and consecutive years.	Weed control as necessary

Performance Indicator	Target – Establishment period[1]	Target – Maintenance period[2]	Corrective Actions
Infrastructure (e.g. protection fencing, signage, erosion and sediment control devices) functional and well-maintained	Relevant infrastructure maintained	Relevant infrastructure in condition suitable for hand over to Tweed Shire Council	Maintenance as necessary

Notes:

[1] "Establishment period" means the period during which initial environmental repair, restoration and monitoring works required by the relevant approved environmental management plan(s) are undertaken. The establishment period ends when the works meet the establishment period performance criteria, as defined by the relevant approved environmental management plans, to the satisfaction of the Secretary.

[2] "Maintenance period" means the period of environmental management and monitoring works commencing immediately after the end of the establishment period. Maintenance period works are to be carried out in accordance with the relevant performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.

[3] "Substantial establishment" of the koala habitat plantings means "the plantings have progressed beyond the need for intensive maintenance e.g. weed control, watering etc. and are clearly established by way of persisting through a recognised growth period and a suitably qualified horticultural/environmental specialist has provided a short report confirming that the plantings are established."

TABLE 3
PERFORMANCE TARGETS AND CORRECTIVE ACTIONS FOR EECS

Performance Indicator	Target – Establishment Period[1]	Target – Maintenance Period[2]	Corrective Actions
Natural recruitment of native species throughout retained vegetation areas	Evidence of natural recruitment occurring in all rehabilitation areas	Increasing natural recruitment occurring in all rehabilitation areas	Where natural recruitment fails to meet performance targets discussions with BCD and TSC shall be initiated by the proponent or their consultants to consider adjustments to the assisted regeneration strategy being used to improve natural recruitment.
All identified weeds controlled to an acceptable level within retained vegetation areas in accordance with the VWMPs (JWA 2020g-i)	Foliage Projective Cover (FPC) (%) assessed using eye estimates or photo points reduced to <10% within first year.	Foliage Projective Cover (FPC) (%) assessed using eye estimates or photo points: • reduced to <10% within first year; • <10% in second year; • <5% in the third year and consecutive years.	Weed control as necessary
Infrastructure (e.g. protection fencing, signage, erosion and sediment control devices) functional and well-maintained	Relevant infrastructure maintained	Relevant infrastructure in condition suitable for hand over to Tweed Shire Council	Maintenance as necessary

Notes:

[1] "Establishment period" means the period during which initial environmental repair, restoration and monitoring works required by the relevant approved environmental management plan(s) are undertaken. The establishment period ends when the works meet the establishment period performance criteria, as defined by the relevant approved environmental management plans, to the satisfaction of the Secretary.

[2] "Maintenance period" means the period of environmental management and monitoring works commencing immediately after the end of the establishment period. Maintenance period works are to be carried out in accordance with the relevant performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.

TABLE 4
PERFORMANCE TARGETS AND CORRECTIVE ACTIONS FOR THREATENED FLORA

Performance Indicator	Target – Establishment Period[1]	Target – Maintenance Period[2]	Corrective Actions
Erect protective and high visibility temporary fencing	No disturbance to existing threatened plant species	No disturbance to existing threatened plant species	Maintenance as necessary
No detrimental impacts to existing threatened plant species from spraying/ weeding	Protection from management activities	Protection from management activities	Weed control in accordance with the VWMPs (JWA 2020g-i)
No disturbance to existing threatened species from fire	Protection from wildfires. Bushfire management carried out in accordance with the Kings Forest Koala Fire Management Plan (Wildsite 2020).	Protection from wildfires. Bushfire management carried out in accordance with the Kings Forest Koala Fire Management Plan (Wildsite 2020).	Review approach to fire management.
All identified weeds controlled to an acceptable level within retained vegetation areas in accordance with the VWMPs (JWA 2020g-i)	Foliage Projective Cover (%) assessed using eye estimates or photo points reduced to <10% within first year.	Foliage Projective Cover (%) assessed using eye estimates or photo points: • reduced to <10% within first year; • <10% in second year; and • <5% in the third year and consecutive years.	Weed control as necessary
Natural recruitment occurring (Species composition targets, based on accepted benchmarks for the specific vegetation communities are met)	Evidence of natural recruitment occurring	Increasing natural recruitment occurring	Habitat enhancement
Regular (annual) searches of any threatened plant species occurring on the site indicates the continued presence of threatened plant species	Protection of naturally regenerating threatened flora species	Protection of naturally regenerating threatened flora species	Habitat enhancement

Performance Indicator	Target – Establishment Period[1]	Target – Maintenance Period[2]	Corrective Actions
Successful propagation and establishment of cuttings/ seedlings of threatened flora	Propagate seeds and/or cuttings from threatened plant species for use in rehabilitation plantings	Propagated and planted specimens substantially established[3]	Supplementary planting

Notes:

[1] "Establishment period" means the period during which initial environmental repair, restoration and monitoring works required by the relevant approved environmental management plan(s) are undertaken. The establishment period ends when the works meet the establishment period performance criteria, as defined by the relevant approved environmental management plans, to the satisfaction of the Secretary.

[2] "Maintenance period" means the period of environmental management and monitoring works commencing immediately after the end of the establishment period. Maintenance period works are to be carried out in accordance with the relevant performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.

[3] "Substantial establishment" of the koala habitat plantings means "the plantings have progressed beyond the need for intensive maintenance e.g. weed control, watering etc. and are clearly established by way of persisting through a recognised growth period and a suitably qualified horticultural/environmental specialist has provided a short report confirming that the plantings are established."

TABLE 5
PERFORMANCE TARGETS AND CORRECTIVE ACTIONS FOR THREATENED FAUNA

Performance Indicator	Target – Establishment period[1]	Target – Maintenance period[2]	Corrective Actions
No sightings of threatened fauna species within development footprint	Exclude threatened species from potential impacts by way of exclusion fencing	Exclusion fencing suitably maintained	Review effectiveness of fencing and amend/maintain where necessary. Where mobile species such as the Bush stone-curlew are observed within development footprint, signage and temporary fencing provided where necessary. Review management strategies for these species and amend as required.
No significant decrease in numbers, range or abundance estimates from baseline data resulting from site activities	Ensure buffers to threatened species and/or their habitats are implemented	Buffers to threatened species and/or their habitats are maintained	Habitat enhancement (e.g. nest boxes etc.)
No threatened species decline as a result of feral animal predation	Feral animal control and monitoring and control is completed in accordance with the Kings Forest FAMP (JWA 2020j).	Feral animal control and monitoring is completed in accordance with the Kings Forest FAMP (JWA 2020j).	Review feral animal control in accordance with the Kings Forest FAMP (JWA 2020j)
No threatened species decline as a result of planned or unplanned bushfire.	Bushfire management carried out in accordance with the Kings Forest Koala Fire Management Plan (Wildsite 2020).	Bushfire management carried out in accordance with the Kings Forest Koala Fire Management Plan (Wildsite 2020).	Review approach to fire management.
Threatened fauna habitat values are improved as a result of the rehabilitation of existing habitat	Existing habitat areas are rehabilitated in accordance with the VWMPs (JWA 2020g-i).	Existing habitat areas are maintained in accordance with the VWMPs (JWA 2020g-i).	Habitat enhancement
Notes:			

Performance Indicator	Target – Establishment period[1]	Target – Maintenance period[2]	Corrective Actions
[1] "Establishment period" means the period during which initial environmental repair, restoration and monitoring works required by the relevant approved environmental management plan(s) are undertaken. The establishment period ends when the works meet the establishment period performance criteria, as defined by the relevant approved environmental management plans, to the satisfaction of the Secretary. [2] "Maintenance period" means the period of environmental management and monitoring works commencing immediately after the end of the establishment period. Maintenance period works are to be carried out in accordance with the relevant performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.			

APPENDIX 5 – Koala Monitoring Program

Background

Commonwealth EPBC Act (1999) approval Condition 2a. 2c. and 2f. require that monitoring and reporting be undertaken to assess the effectiveness of the measures referred to in 2a. and 2c., including the parameters to be monitored, methods, timing, frequency and location of monitoring. Conditions 2a. and 2c. relate to measures to protect and conserve the Kings Forest koala population, measures to encourage the building of community awareness and stewardship of koalas.

NSW MP 08_0194 conditions 37, 39, 45A 4.v, 47 3., 50 and 98 relate to monitoring and reporting. These conditions and the relevant section of the KPoM where they are addressed are detailed in **APPENDIX 3**.

Monitoring will be undertaken to determine the effectiveness of management actions implemented. Monitoring will be required during the 'establishment period[3]' and 'maintenance period[4]' of the project as defined within the Project approval (MP08_0194). In order to reflect the requirements of the conditions of approval, monitoring (and reporting on) of the following management strategies will be addressed in the following sections:

- Koala activity;
- Retained koala habitat;
- Compensatory plantings; and
- Koala infrastructure, Construction and Operational management.

Koala Activity

Introduction

This section discusses the proposed monitoring program for koala activity at the Kings Forest site including the key monitoring objectives, methodologies to be implemented for baseline and biennial monitoring, reporting requirements and the specific requirement for koala monitoring to be completed after bushfire events.

[3] means the period commencing with the implementation of the relevant approved environmental management plan(s) and ending when the works specified in that plan meet the establishment period performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary. The establishment period represents the time necessary to carry out initial environmental repair, restoration and monitoring prior to ongoing maintenance.

[4] means the period commencing immediately after the end of the establishment period during which environmental management and monitoring works specified in the relevant approved environmental management plan(s) are to be carried out in accordance with the maintenance period performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.

Monitoring Program

Baseline Koala Activity Monitoring

The aims of the baseline monitoring are to establish survey sites and protocols and to collect data which will allow future monitoring:

1. To determine any changes in the distribution and level of koala activity within the Kings Forest site;
2. To assess any changes in occupancy rates within the Kings Forest site; and
3. To assess any changes in koala population demographics within the Kings Forest site over time.

Baseline koala activity monitoring will be completed across the entire site prior to the commencement of works on the site by suitably qualified and/or accredited persons[5] in accordance with the methodology discussed below**.** Baseline monitoring will include:

- diurnal searches of Kings Forest koala habitat;
- a full measure of koala activity (i.e. application of Spot Assessment Technique (SAT) methodology (Phillips and Callaghan (2011);
- an assessment of the condition of available koala habitat; and
- implementation of permanent photo monitoring points.

The survey data collected will be used to compile a Baseline Monitoring Report.

Biennial Koala Activity Monitoring

Koala activity monitoring shall be completed over the entire Kings Forest site on a biennial basis (i.e. every two years) as a responsibility of the Proponent, from the date of "commencement" of works, and will continue for a period extending to five (5) years after completion of the final precinct or until the all retained habitat is dedicated, whichever is sooner.

Biennial koala activity monitoring will be completed over the Kings Forest site following the methodology described below. Biennial monitoring will include:

- diurnal searches of Kings Forest koala habitat;
- a full measure of koala activity (i.e. application of Spot Assessment Technique (SAT) methodology (Phillips and Callaghan (2011);
- an assessment of the condition of available koala habitat;
- continued monitoring of permanent photo monitoring points; and
- sand tray monitoring will be completed, and/or camera traps installed to assess the usage of underpasses.

[5] Means a qualified ecologist with appropriate training and at least five years of experience in undertaking surveys in relation to the relevant EPBC Act listed threatened species.

In the event that a suspected diseased koala is observed during monitoring, the time, date and location of the sighting must be recorded. These details should be passed on to an appropriate wildlife care organization as soon as practicable. If required, the observer should remain at the location until the wildlife rescuer attends.

Any records of diseased koalas will be included in the results of the Annual KPoM Monitoring Report.

Koala Activity Monitoring After Fire

In the event of an uncontrolled bushfire occurring on the Kings Forest site, an additional koala activity monitoring event will be completed by a suitably qualified ecologist. This will be completed in accordance with the following methodology to monitor the impacts of fire on the local koala population.

Monitoring Methodology

Site Selection

Field site selection has been based on the field sites sampled in 2010 during the Tweed Coast Koala Habitat Study (Phillips *et al*. 2011) positioned using a 600 m x 600 m grid overlay to enable uniform and unbiased coverage of the study area (**FIGURE 1**).

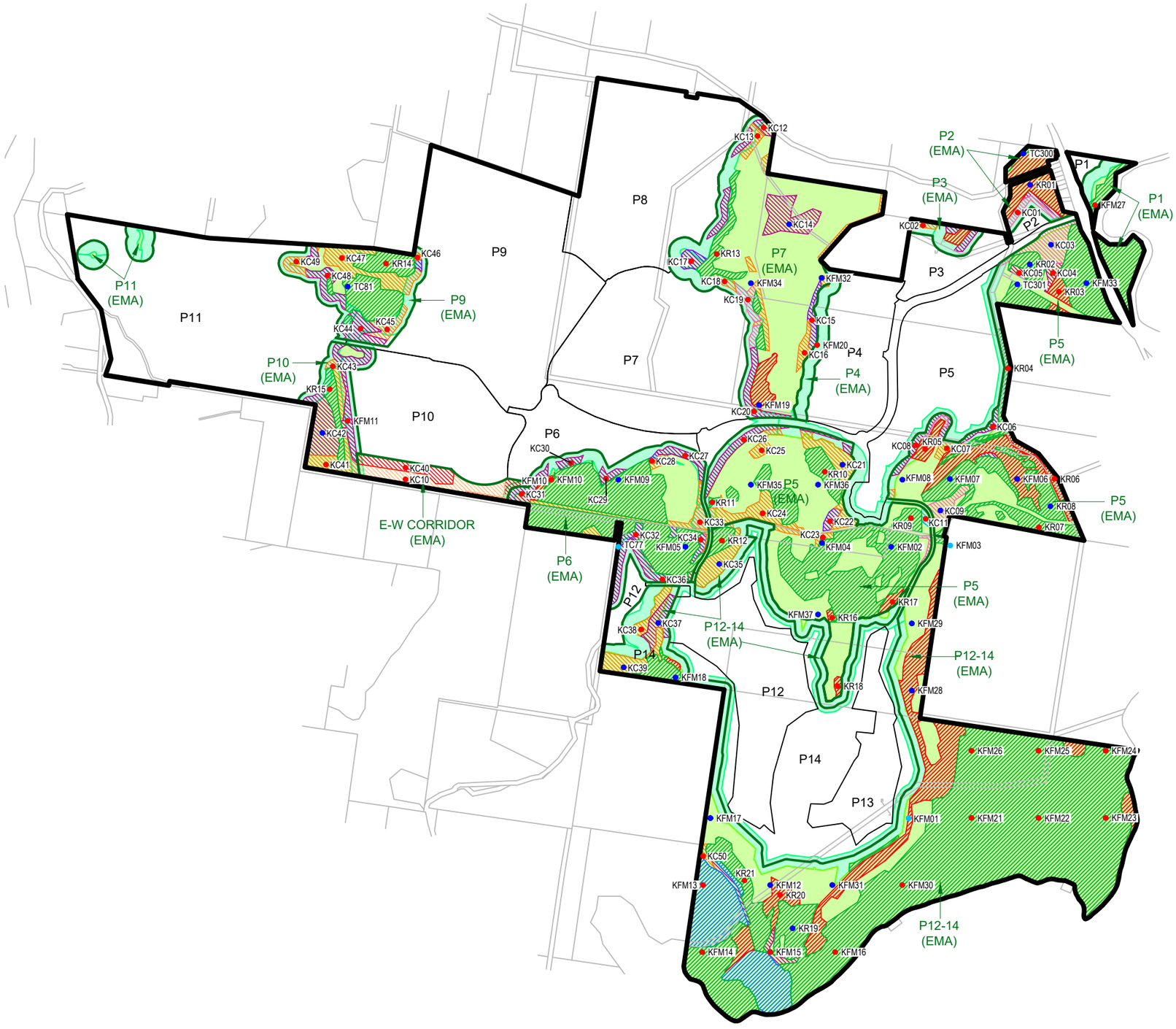
In most cases, the central point of each field site that had been sampled during the Habitat Study (2010) and the Tweed Coast Koala Study (2015) should be readily identifiable (due to the centre of the site being marked with flagging tape in 2010 and 2015). Sites where the previous marked centre tree cannot be found will be located as close as possible to the identified coordinates. The central tree of each field site will be identified with a permanent peg in the ground and marked with the site number to enable future identification.

Sampling

The field surveys will utilise the Spot Assessment Technique (SAT) (Phillips and Callaghan 2011) which involves a radial assessment of koala "activity" within the immediate area surrounding a SAT site. In the field, the technique is applied as follows:

1. Locate the SAT site;
2. Identify and uniquely mark the thirty (30) nearest trees to the SAT site;
3. Undertake a search for koala faecal pellets beneath each of the thirty (30) marked trees based on a cursory inspection of the undisturbed ground surface within a distance of 100 centimetres around the base of each tree, followed (if no faecal pellets are initially detected) by a more thorough inspection involving disturbance of the leaf litter and ground cover within the prescribed search area.

For assessment purposes, a tree is defined as "a live woody stem of any plant species (excepting palms, cycads, tree ferns and grass trees) which has a diameter at breast height (DBH) of 100 mm or greater" (Phillips *et al*. 2000). In the case of multi-stemmed trees, at least one of the live stems must have a DBH of 100 millimetres or greater in order to qualify.



LEGEND

- Koala Activity and Habitat Monitoring - SAT Site and Transect Location
- Koala Habitat Monitoring - Transect Location
- Koala Habitat Monitoring - Photo Point Location
- Environmental Protection Zone (EPZ)
- 50m Buffer to EPZ (only the inner 30 metres to be utilised for offsetting and dedication purposes)
- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary

KOALA HABITAT THAT WILL REMAIN AS HABITAT AFTER DEVELOPMENT (206.49ha)

- Primary Koala habitat to remain after development (31.58ha)
- Secondary (A) Koala habitat to remain after development (162.69ha)
- Secondary (B) Koala habitat to remain after development (12.21ha)

KOALA COMPENSATORY HABITAT (62.51ha)

- Dry primary Koala habitat (25.80ha)
- Dry primary Koala habitat plus dry heath (5.99ha)
- Wet primary Koala habitat (27.15ha)
- Wet primary Koala habitat plus wet heath (0.23ha)
- Wet secondary Koala habitat (3.33ha)

KOALA COMPENSATORY HABITAT WITHIN EAST-WEST CORRIDOR (6.26ha)

- Dry primary Koala habitat (2.90ha)
- Wet primary Koala habitat (3.36ha)

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 500m
1 : 20 000

SOURCE: JWA (2020) KPOM

SCALE: 1 : 20 000 @ A3

JWA PTY LTD
Ecological Consultants

CLIENT
Project 28 Pty Ltd

PROJECT
Flora & Fauna Monitoring Report
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

APPENDIX 4
FIGURE 1

PREPARED: BW
DATE: 22 September 2020
FILE: N97017_FFMR_KPOM.dwg

TITLE
KOALA MONITORING LOCATIONS

Strict adherence to the 100 cm search area is a fundamental component of the SAT methodology. It is this distance that both optimises the probability of success in terms of actually finding faecal pellets, while at the same defining a workable search area (Phillips and Callaghan, 2011). In terms of search effort, an average of approximately two (2) person minutes per tree should be dedicated to the faecal pellet search. For assessment purposes, the search should be concluded once a single faecal pellet has been detected or when the maximum search time has expired, whichever happens first. This process should be repeated until each of the 30 trees in the site has been assessed. Where the location of faecal pellets falls within overlapping search areas due to two (2) or more trees growing in close proximity to each other, both should be scored for pellet(s).

In addition to the SAT analysis demographic attributes of the koala population will be determined via targeted searches of:

a) 25 m fixed radius from the central tree (0.196 ha); and

b) 250 m x 40 m (1 ha) line transect (Dique *et al*. 2003/4) at each field site. The line transects will be permanently erected at each survey site and three (3) ecologists will search along the transect observing koala occurrence.

The following information relating to each koala sighting should be collected:

- Age class: Adult, sub-adult (2-4 kg) or juvenile (less than one (1) year old, less than 2 kg, not yet independent);
- Reproductive status: the presence of a pouch young, back young, or no young associated with an adult female;
- Health status: healthy, or showing signs of Chlamydia such as cystitis (wet, stained bottom) and/or conjunctivitis (red swollen eyes discharging pus), or other indicators of poor health such as discharges from nose or mouth, wasted or emaciated appearance etc.; and
- Koala location: using a map and/or GPS unit, the location of each koala should be plotted on a map to gain an overall distribution of koalas on the site.

Field sampling will be carried out between August to February (i.e. the breeding season) by a three (3) person team of ecologists experienced in koala faecal pellet identification, koala survey and tree species identification.

Data Analysis

Koala Activity

Koala 'activity' at each site will be determined by dividing the number of trees with a koala faecal pellet by the number of trees searched in the site (a minimum of 30). Activity thresholds of Phillip and Callaghan (2011) will be used to describe the results of field sites. This threshold allows interpretation of the activity level at each site in order to determine its relative importance to the koala population. The key measures on the east coast are summarized below in **TABLE 1**.

TABLE 1

SUMMARY OF KOALA ACTIVITY CATEGORIES AND THEIR INTERPRETATION

Activity Category	Activity Level	Interpretation
Significant activity	≥ 22.52%	Site is regularly used by one or more koalas as part of normal ranging behaviour.
Low activity	0% - 22.51%	Occasional or transitory use of the site by (for example) dispersing animals not yet displaying established home ranging movement patterns.

Habitat Utilisation / Occupancy rates

Baseline Habitat Utilisation rate will be estimated on the basis of the numbers of sampled field sites in which koala faecal pellets were recorded, while the Baseline Koala Occupancy rate will be the subset of these sites that had koala activity levels > 22.52%. The first provides a measure of what proportion of available habitat is currently utilised by koalas in any way, the second indicating what proportion of habitat is occupied by resident populations.

A Baseline koala density estimate will be determined by dividing the total number of koalas sighted within the 0.196 ha radial assessments, by the total area covered by this assessment process over the sampling period. A population estimate will then be obtained by extrapolating the density estimate over a total habitat area where each SAT site represents the centre of a habitat grid cell of 6.25 ha or, in the case of the Depot Road sites, 1.56 ha.

A test of significance utilising the Paired Student t-test will be completed after each monitoring event to determine if a statistically significant reduction in koala occupancy rates has occurred (i.e. to test the hypothesis that pre-development koala activity is higher than the post-development koala activity). As sample sizes are relatively small, however, the value of p (typically 0.05 or 0.01 in order for significance to be determined) should be raised to something that better reflects the limitations of the sample size. A p of 0.25 as the statistical benchmark of significant change should be considered, further qualified by a requirement that a major review should be initiated only after consideration of the monitoring data from two (2) successive monitoring events.

Performance Criteria and Corrective Actions

TABLE 2 provides the performance criteria for the koala activity monitoring program. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 2
KOALA ACTIVTY MONITORING PERFORMANCE CRITERIA AND CORRECTIVE ACTIONS

Performance Indicator	Corrective Action	Responsibility
For monitoring purposes, the benchmark habitat occupancy rate to be achieved for koala populations inhabiting the Kings Forest site will be equal to or greater than baseline levels	Investigate habitat usage on the Kings Forest site. Determine which areas of potential habitat are not being utilised by the population. Consult with BCD and koala experts to develop a strategy to improve/facilitate the usage of the potential koala habitat. Implement the strategy.	Ecologist
Notwithstanding the influence of events beyond the control of the Proponent, the KPoM can only be considered successful if the extent of habitat being utilised by koalas across the Kings Forest site increases towards the benchmark (50% occupancy) or does not deviate significantly from the estimate of habitat occupancy rate established by baseline monitoring [#]	Investigate habitat usage on the Kings Forest site. Determine which areas of potential habitat are not being utilised by the population. Consult with BCD and koala experts to develop a strategy to improve/facilitate the usage of the potential koala habitat. Implement the strategy.	Ecologist
Notes: [#] Generally, conclusions relating to changes in the occupancy rate across the Kings Forest site should only be made at every second monitoring event (i.e. every four (4) years) by examining both the occupancy trend over the intervening four (4) year period and by a direct comparison to the occupancy estimate of four (4) years previous.		

Retained Koala Habitat

Condition 45A 3.a) iii. of MP 08_0194 requires that retained koala habitat be managed in accordance with the approved Vegetation Management Plan. The monitoring of retained koala habitat will be completed in accordance with performance criteria contained in the approved Kings Forest Vegetation Management Plans (VMPs). The Annual KPoM Monitoring Reports will also discuss the monitoring results for the retained koala habitat contained within the VMPs.

Compensatory Planting

Introduction

The monitoring of the koala compensatory habitat will be required to comply with Condition 45A.4 – Vegetation Management of MP08_0194. This condition requires that selected performance indicators are monitored during the Establishment period and the Maintenance period. The performance of these indicators will enable verification of revegetation success. The monitoring program will comprise the following components:

- Identification of Performance Indicators;
- Survey site and plot selection;
- Plot based survey;
- Photo-point monitoring;
- Targets for the Performance indicators during the Establishment and Maintenance periods, including Corrective actions if required.

Identification of Performance Indicators

The selection of Performance indicators is an important process as it enables an accurate measurement to be made of the success of the planting program. The success of the planting program is a critical step in the aims and objectives of the KPoM i.e. to ensure the viability of the Kings Forest koala population and ultimately the Tweed Coast koala population.

Condition 45A. 4. lists the following Performance indicators (criteria) to be utilised as targets for the Establishment and Maintenance phase assessment:

- Seedling survival;
- Native canopy cover;
- Weed presence; and
- Shrub and groundcover recruitment.

Survey Site and Plot Selection

Background

To assess if the project completion criteria have been met, vegetation assessments will be completed using transects and quadrats (plots) at the locations shown in **FIGURE 1**. Field site selection has been based on the field sites sampled in 2010 during the Tweed Coast Koala Habitat Study (Phillips *et al*. 2011) positioned using a 600 m x 600 m grid overlay to enable uniform and unbiased coverage of the study area (**FIGURE 1**), with additional monitoring sites added to ensure representative sampling of compensatory habitat areas and types. Where compensatory habitat polygons are small in size or are not covered by transect and plot surveys, photo point monitoring will be completed in accordance with methodology described below**.**

Plot-Based Vegetation Surveys

Plot-based vegetation surveys will be undertaken in appropriate locations within the koala compensatory habitat planting areas (on site and offsite). Vegetation survey sites will be permanently marked (i.e. star pickets or wooden stakes) and the end positions identified on a sitemap using a hand-held Global Positioning System (GPS).

The plot-based vegetation survey will be based on a 20 m × 20 m plot (or 400 m^2 equivalent for linear areas).

The minimum number of plots/transects that must be sampled for each vegetation zone is detailed in **TABLE 3** below.

TABLE 3
MINIMUM NUMBER OF PLOTS AND TRANSECTS REQUIRED IN EACH PLANTING POLYGON

Planting polygon area (ha)	Minimum number of plots/transects
<2	1 plot/transect
>2–5	2 plots/transects
>5–20	3 plots /transects

Survey plots should be established around a central 50 m transect as follows:

a) One 400 m^2 plot (standard 20 m x 20 m) is used to assess all performance indicators as set out in **TABLE 4** below.
b) Five 1 m^2 sub-plots can be added to the program for the first monitoring event to assess groundcover recruitment for the plot. A decision as to the utility of these plots can be made after the first or second monitoring events.

The assessor will assess the plot for the information contained in **TABLE 4**.

TABLE 4
VEGETATION SURVEY DATA TO BE COLLECTED

Attribute	Survey requirement
Seedling survival	The first monitoring event will require a count of the total number of seedlings, individual species counts and a count of the number

Attribute	Survey requirement
	of dead or dying seedlings of each species. Subsequent monitoring events will only require counts of dead or dying seedlings and their species identification.
Native Canopy Cover	Estimate the % foliage cover across the plot. Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1,2,3…), or to the nearest 5% where greater than 5% cover (5,10,15,20,25…)
Weed Presence	Estimate the % cover in the plot of individual weed species. Count the number of each species.
Shrub and Groundcover Recruitment	Identify native shrub and groundcover species, their percentage cover and the numbers recruiting. The identification of individual recruits may not be possible when they first appear. These should be recorded as unidentified until the next or subsequent monitoring events.

The full species name (*Genus species*) must be recorded for all native species, unless insufficient diagnostic plant material is present, in which case the genus name followed by a species number must be used.

Photo Point Monitoring

Photo-monitoring points will be completed as a means of demonstrating compliance or otherwise with performance criteria. Permanent photo stations are to be located in each rehabilitation polygon. Where transects are to be established, photo points are to be located on each transect. Four (4) photos are to be taken from each photo point. Photos are to be taken to the north, south, east and west. Photos should be labelled with the:

- Transect code or photo point code;
- Direction of view; and
- Date & time.

Photos must be supplied in the Annual KPoM Monitoring Reports in a form of prints no smaller than 4" x 6" and must be colour.

Timing of Monitoring Visits

Site visits should occur:

- to set up monitoring transects and quadrats and collect baseline data after 1st event of secondary weeding; and
- six monthly until the establishment period performance criteria are met; and
- then annually during the maintenance period.

Performance Criteria and Corrective Actions

TABLE 5 provides the performance criteria and targets for the proposed rehabilitation strategy. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 5

COMPENSATORY HABITAT PERFORMANCE CRITERIA AND CORRECTIVE ACTIONS

Performance Indicator	Target – Establishment period[1]	Target – Maintenance period[2]	Corrective Actions
Survival and continued growth of seedlings (i.e. planted stock).	>90% survival of koala tree plantings during all monitoring events.	>90% survival of koala tree plantings during all monitoring events.	Irrigation if required. Replacement planting required. Where plantings of particular species or areas fail, discussions with BCD and TSC shall be initiated by the proponent or their consultants to determine an appropriate course of action.
Establishment of native canopy cover within revegetation areas.	Planted trees substantially established[3]	>60% canopy cover of native tree species >1.5 m in height after three years; and >80% canopy cover of native tree species >2.5m in height after five years.	Monitoring and maintenance period must be extended until the targets are met.
All identified weeds controlled to an acceptable level within retained koala habitat and rehabilitation areas in accordance with the approved VWMPs (JWA 2020g-i).	Foliage Projective Cover (FPC) (%) assessed using eye estimates or photo points reduced to <10% within first year.	Foliage Projective Cover (FPC) (%) assessed using eye estimates or photo points: • FPC of weeds reduced to <10% within first year; • <10% in second year; • <5% in the third year and consecutive years.	Weed control as necessary
Shrub and groundcover recruitment.	Evidence of natural recruitment of shrub and ground cover species.	Increasing natural recruitment of shrub and groundcover species.	No planting required. Where natural recruitment fails to meet performance targets discussions with BCD and TSC shall be initiated by the proponent or their

Performance Indicator	Target – Establishment period[1]	Target – Maintenance period[2]	Corrective Actions
			consultants to consider adjustments to the assisted regeneration strategy being used to improve natural recruitment.

Notes:

[1] "Establishment period" means the period during which initial environmental repair, restoration and monitoring works required by the relevant approved environmental management plan(s) are undertaken. The establishment period ends when the works meet the establishment period performance criteria, as defined by the relevant approved environmental management plans, to the satisfaction of the Secretary.

[2] "Maintenance period" means the period of environmental management and monitoring works commencing immediately after the end of the establishment period. Maintenance period works are to be carried out in accordance with the relevant performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.

[3] "Substantial establishment" of the koala habitat plantings means "the plantings have progressed beyond the need for intensive maintenance e.g. weed control, watering etc. and are clearly established by way of persisting through a recognised growth period and an independent restoration ecologist approved by the Secretary has provided a short report confirming that the plantings are established."

Koala Infrastructure, Construction and Operational Management

Introduction

A wide variety of matters not related to matters described above will require monitoring. These are issues that have not necessarily been mandated by consent conditions, but which are necessary for the successful implementation of a KPoM. The Environmental Officer will be responsible for the monitoring of relevant construction activities and koala infrastructure during and after construction.

Monitoring Requirements

Koala infrastructure consists of temporary and permanent fauna exclusion fencing, fauna underpasses (including their furniture), grids and signage. The maintenance of this infrastructure is essential if the aims and objectives of the KPoM are to be achieved i.e. preventing koalas crossing roadways, dogs from entering koala habitat, maintaining connectivity and alerting Kings Forest residents and visitors to the residence of koalas in nearby bushland and their responsibilities in ensuring the safety and persistence of this population.

Monitoring activities during the construction/installation of temporary and/or permanent fences, fauna underpasses, grids and signage should be completed by the Environmental Officer to ensure that:

- there has been no clearing of Wallum sedge frog or heathland regeneration habitat;
- there have been no isolated patches of compensatory koala or Wallum sedge frog habitat or heathland revegetation areas created;
- there have been no barriers to wildlife movement created;
- until permanent fencing and underpass infrastructure is completed, temporary fencing is not to prevent koalas accessing koala habitat on the site;
- fencing occurs on both sides of any road where it traverses an environmental area. Dogs to be prevented from accessing the environmental area and koalas are prevented from crossing the roads;
- there is sufficient functional maintenance zone each side of any fauna exclusion fence;
- Precinct 1 fauna exclusion fence is located along the outer edge of the 50 metre ecological buffer;
- Koala advisory signs are located at 100 metre intervals within Precincts 1, 2, 3, 4 and 5;
- Koala advisory signs are located at every fauna underpass;
- Vandal proof signs are erected at regular intervals advising of the importance of fauna exclusion fences and their maintenance;
- All fence damage is reported promptly and repaired in a timely fashion; and

- all temporary and/or permanent fencing, fauna underpasses and signage is designed and located as shown in the approved KPoM.

Visual inspections of koala infrastructure by the Environmental Officer will be completed on a monthly basis until the land occupied by the infrastructure is dedicated to either TSC or BCD. Where damage or other failures to infrastructure are observed a report, including a photograph, will be prepared within 24 hours in accordance with Condition 76 of MP 08_0194. The damage or failure will be corrected within 48 hours of the reporting of the damage or failure.

In addition, the Environmental Officer will be responsible for monitoring the following matters:

- No dogs to be brought onto the site during construction;
- Implementation of an induction/education program for construction personnel;
- All contractors provided with protocols to be followed if a koala is killed or injured. Provided with Friends of the Koala (FOK) contact details;
- Ensure gates are opened if a bushfire threatens the Kings forest site so as to allow fauna (including koalas) to escape;
- Ensure FOK are informed of any koalas killed on site;
- All koala observations and/or incidents on the site are recorded; and
- Engagement of the community with local koala issues and management.

Reporting on these matters will be included in the Annual KPoM Monitoring Reports to be provided to DPI&E, BCD and TSC.

Performance Criteria and Corrective Actions

TABLE 6 provides the relevant performance criteria for the above additional items requiring monitoring to determine the successful implementation of a KPoM. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 6
PERFORMANCE CRITERIA FOR CONSTRUCTION AND OPERATIONAL ISSUES TO BE MONITORED AND CORRECTIVE ACTIONS

Performance Indicator	Monitoring Frequency	Corrective Action	Responsibility
Koalas are utilising underpasses (as evidenced by sand tray and camera trap monitoring), with utilisation measured by number of through passes, increasing over time	Monthly during construction and then 3 monthly	SKM (2014) have indicated that evidence of usage of designated underpasses by koalas should be based on a frequency which confirms ongoing connectivity is being maintained. The baseline survey will provide underpass usage data upon which all subsequent usage data will be measured. The significance (or otherwise) of deviations from the baseline usage data will be determined by an acknowledged authority in koala biology/ecology when each relevant Annual KPoM Monitoring Report is prepared. Replanting of koala trees in close proximity to underpass openings if required. Assess the adequacy of vegetation surrounding underpass openings, restrictions or disturbances to movement through underpasses etc. Excessive use of underpasses by feral animals (i.e. if only being used by feral animals - identified through sand tray inspections and/or camera traps) will prompt the implementation of appropriate feral animal control programs.	Ecologist
Exclusion fences, fauna underpasses, grids and signage have been correctly installed, remain effective and well maintained	Monthly until the land occupied by the infrastructure is dedicated to either TSC or BCD	Alternative fence design/location may be required, and potentially habitat restoration works where it is determined that there have been barriers created to wildlife movement, there is sufficient functional maintenance zone each side of any fauna exclusion fence, there has been clearing of Wallum sedge frog or heathland regeneration habitat, and/or there have been isolated patches of compensatory koala or Wallum sedge frog habitat or heathland revegetation areas created.	Principal Contractor, ecologist

Performance Indicator	Monitoring Frequency	Corrective Action	Responsibility
		Any damage to fences, fauna underpasses, grids and signage will be reported to the Site Manager and prompt immediate repair, within two (2) working days of the discovery of the damage, will be completed by site personnel or independent contractors as determined by the Site Manager. If dogs are shown to have breached the intact fences and entered the Environmental Protection Zones a review of the fence design will occur within 1 month of the breach being detected. Evidence may include: reported sightings by the public, Project 28 staff or contractor personnel; dog tracks found during koala underpass sand tray monitoring events; photographs of dogs taken by camera traps; dead or injured koalas. The review will be completed by an acknowledged authority in koala biology/ecology. All recommendations from the review will be implemented. Repeated instances of vandalism to koala mitigation infrastructure will prompt the implementation of mobile security patrols by a commercial security specialist.	
No evidence or reports of dog attacks on a koala	As required	If there is an instance of one (1) attack by a dog on a koala then an investigation of causes will be triggered. Exclusion fencing will be assessed as described above. Dog management within the Kings Forest estate will be investigated. If dog management strategies are considered to be ineffective or dog owners do not have sufficient awareness of their responsibilities, then TSC, BCD and relevant specialists will be consulted and a more prescriptive dog ownership/management/education strategy will be prepared and implemented, including the installation of additional educational signage if necessary.	Contractor, ecologist, Project 28
No reported vehicle strike	As required	If there is an instance of one (1) koala killed or injured on Kings Forest	Contractor,

Performance Indicator	Monitoring Frequency	Corrective Action	Responsibility
mortalities		internal roads then an investigation of causes will be triggered. All koala exclusion fences will be inspected and re-instated or mended as appropriate. All vegetation adjacent to or covering fences will be lopped or treated as appropriate so as to ensure koalas cannot use vegetation to travel over the fences. Inspection protocols will be amended where appropriate to ensure that fence damage and/or vegetation growth does not provide escape opportunities for koalas in the future.	ecologist, Project 28
High rates of diseased koalas are not detected	As required	Disease condition assessments will be carried out during the baseline monitoring assessment and in every biennial assessment thereafter. Five (5) years after commencement of construction consultation will occur with relevant BCD scientists and other koala experts as necessary or convenient. A report will be completed. If expert opinion considers that disease occurrence is over and above that which would be expected in a wild population of koalas or they consider that there has been a significant increase in diseased animals since the Baseline assessment, then advice will obtained from appropriate BCD scientists and/or other koala experts as considered necessary or appropriate. The advice will be implemented.	Ecologist
Swimming pool drownings	As required	If there is an instance of a koala drowning in a residential pool then an investigation will be triggered. Koala exclusion fences will be assessed and strategies provided as discussed above. Pool ownership strategies e.g. checking to ensure all pool owners have pool fences which are koala-proof. Other strategies could include the provision of ropes in pools. A report will be prepared in consultation with BCD, TSC and/or koala experts as necessary or appropriate. The recommendations contained in the report will be implemented.	Ecologist
Bushfire related deaths or damage to habitat are	As required	If a bushfire occurs within land owned by Project 28 an investigation will be triggered to assess damage to koalas and their habitat on the Kings	Project 28, Ecologist

Performance Indicator	Monitoring Frequency	Corrective Action	Responsibility
minimised		Forest lands. The investigation will include a survey of the koala population occurring on the Kings forest site. Consultation will occur with RFS, TSC and BCD to determine the cause of the fire. A report will be prepared after the consultation. The report will address, causes, impacts and proposed changes, if considered necessary, to Bushfire management plans.	
No dogs to be brought onto the site during construction.	As required	Dog removed from site and owner re-educated.	Environmental Officer
Implementation of an induction/education program for construction personnel.	Monthly	Any construction personnel that has not completed the induction/education program are to cease work until completed.	Environmental Officer
All contractors provided with protocols to be followed if a koala is killed or injured. Provided with Friends of the Koala (FOK) contact details.	Monthly	To be provided as part of the induction/education program (see above).	Environmental Officer
Ensure gates are opened if a bushfire threatens the Kings forest site so as to allow fauna (including koalas) to escape.	As required	Gates to be opened accordingly. Re-education of appropriate site personnel as necessary.	Environmental Officer
Ensure FOK are informed of any koalas killed on site.	As required	FOK to be informed accordingly. Re-education of appropriate site personnel as necessary.	Environmental Officer
All koala observations and/or incidents on the site are recorded.	Monthly	Any outstanding observation/incident reports to be included in monthly reporting.	Environmental Officer
Engagement of the community with local koala issues and management.	As required	Appropriate community liaison/consultation completed as necessary.	Proponent/ Environmental Officer

APPENDIX 6 – WSF Monitoring Program

Introduction

Monitoring will be undertaken to determine the effectiveness of mitigation measures implemented. Monitoring will be required during the 'establishment period[6]' and 'maintenance period[7]' of the project as defined within the Project approval (MP08_0194).

Monitoring (and reporting on) of the following management strategies will be addressed in the following sections:

- Water quality;
- WSF occupancy rates;
- Retained WSF habitat;
- Compensatory plantings; and
- Infrastructure, Construction and Operational management.

All survey data collected for the project must be collected and recorded so as to conform to draft or approved EPBC Act survey guidelines and/or policy statements relevant to WSF as made available on the Department's website. When requested by the Department, the approval holder must provide to the Department all species and ecological survey data and related survey information from ecological surveys undertaken for the WSF. This survey data must be provided within thirty (30) business days of request, or in a timeframe agreed to by the Department in writing. The Department may use the survey data for other purposes.

Water Quality Monitoring

Baseline monitoring

The OWMP (G&S 2020b) prepared for the site contains details of the water quality monitoring program that will be implemented within the construction site and should be read in conjunction with this WSFMP.

Baseline water quality monitoring will be completed prior to construction to establish appropriate discharge criteria for the construction phase. Performance criteria will be set by monitoring the following parameters for a minimum of eight (8) monitoring rounds prior to commencement of construction works:

- pH;
- Electrical conductivity;
- Turbidity;

[6] means the period commencing with the implementation of the relevant approved environmental management plan(s) and ending when the works specified in that plan meet the establishment period performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary. The establishment period represents the time necessary to carry out initial environmental repair, restoration and monitoring prior to ongoing maintenance.

[7] means the period commencing immediately after the end of the establishment period during which environmental management and monitoring works specified in the relevant approved environmental management plan(s) are to be carried out in accordance with the maintenance period performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.

- Dissolved oxygen;
- Temperature;
- Suspended solids;
- Total nitrogen and nitrate, nitrite and ammonium;
- Total and soluble phosphorus;
- Oil and grease;
- Calcium;
- Magnesium;
- Total and dissolved iron;
- Dissolved manganese;
- Filtered aluminium;
- Bicarbonate;
- Carbonate;
- Chloride;
- Sulfate; and
- Colour

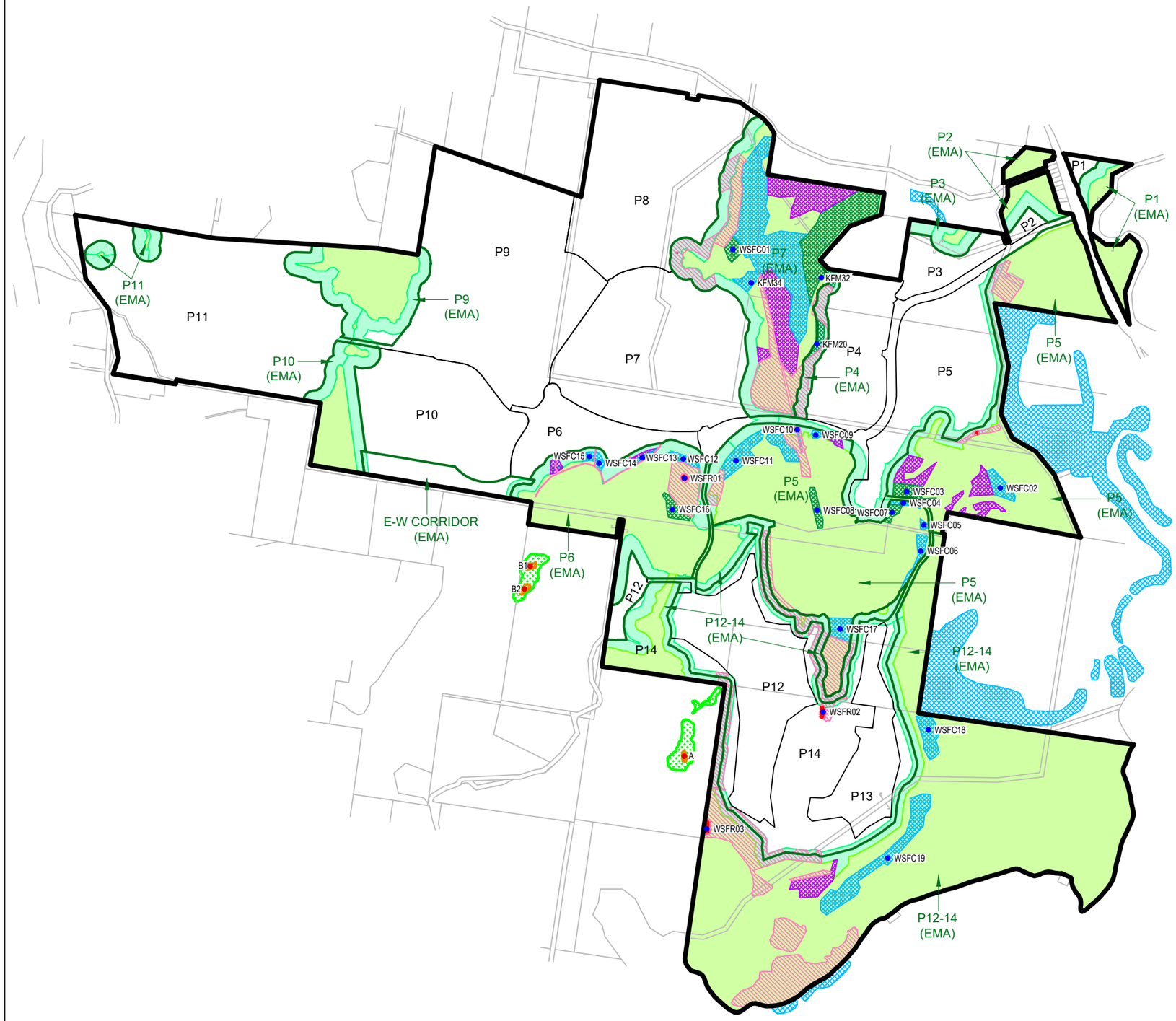
Ongoing monitoring

Surface water monitoring will be completed within the construction site monthly during the construction phase and following the first monthly rainfall event (defined as >25mm in 24 hours) for the following parameters:

- pH;
- Electrical conductivity;
- Turbidity;
- Total and soluble nitrogen and phosphorus;
- Suspended solids;
- Dissolved oxygen; and
- Oil and grease.

If the parameters of the surface water within the construction site do not comply with the release criteria range, then such waters will be contained within detention basins and adjusted to within the range prior to release.

Surface water monitoring will also be completed within adjacent WSF breeding habitat (**FIGURE 1**). The monitoring will be completed at the same period and frequency as the annual WSF monitoring (3 sampling events during September - March), and on an episodic basis i.e. during a very wet period and also during a very dry period.



LEGEND

- Annual WSF Monitoring Location - Onsite (WSFR#, WSFC#, KFM#)
- Annual WSF Monitoring Location - Offsite (A, B1, B2)
- Environmental Protection Zone (EPZ)
- 50m Buffer to EPZ (only the inner 30 metres to be utilised for offsetting and dedication purposes)
- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary

EXISTING WSF HABITAT THAT WILL REMAIN AS HABITAT AFTER DEVELOPMENT (45.29ha)

- WSF breeding habitat with suitable groundwater conditions to remain as breeding habitat after development (0.41ha)
- WSF forage habitat with suitable groundwater conditions to remain as forage habitat after development (44.88ha)

WSF COMPENSATORY HABITAT (47.36ha)

- Compensatory WSF breeding habitat (9.76ha)
  - depth to groundwater = 0m to -0.2m
  - sedgeland plantings (PCT 1290 - Soft Twig-rush Sedgeland of North Coast Wallum Swamps)
- Compensatory WSF breeding habitat (24.26ha)
  - depth to groundwater = -0.2m to -1m
  - wet heath plantings (PCT 1297 - Wet heathland and shrubland of coastal lowlands of the NSW North Coast Bioregion)
- Compensatory WSF forage habitat (13.34ha)
  - depth to groundwater = -1m to >-2m
  - dry heath plantings (PCT 663 - Banksia dry shrubland on coastal sands of the NSW North Coast Bioregion)

WSF HABITAT OFFSITE (47.98ha)

- WSF breeding habitat (0.28ha)
- WSF forage habitat (3.25ha)
- WSF potential habitat (44.45ha)

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 500m
1 : 20 000

SOURCE: JWA (2020) WSFMP

SCALE: 1 : 20 000 @ A3

JWA PTY LTD
Ecological Consultants

CLIENT
Project 28 Pty Ltd

PROJECT
Flora & Fauna Monitoring Report
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

APPENDIX 5
FIGURE 1

PREPARED: BW
DATE: 22 September 2020
FILE: N97017_FFMR_WSFMP.dwg

TITLE
WALLUM SEDGE FROG MONITORING LOCATIONS

Water quality on the construction site will continue to be maintained during the maintenance period of the operational phase through utilisation of appropriate water sensitive urban design measures. Stormwater traversing the site in each catchment will be directed through a series of stormwater treatment devices in order to minimise flow velocities and allow the settling of entrained sediment/uptake of nutrients prior to discharge. The above measures will ensure that retained areas of WSF habitat are not degraded due to potential decline in water quality.

Performance Criteria and Corrective Actions

TABLE 1 provides the performance criteria and targets for the water quality monitoring programs. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 1
WATER QIUALITY MONITORING PERFORMANCE CRITERIA AND CORRECTIVE ACTIONS

Performance Indicator	Target	Corrective Actions
pH	Stable pH between 4.0 and 5.5	• Investigate reason for relevant parameter/s outside of baseline levels/range and take immediate action to stop the cause of the problem and prevent the problem from occurring again. • Return the relevant parameter/s to performance target levels prior to subsequent monitoring event.
Conductivity	Conductivity of <350uS.cm-1	
Turbidity	Below baseline levels	
Suspended solids	Below baseline levels	
Nutrient levels	Below baseline levels	
Temperature	Within baseline range	
Dissolved oxygen	Within baseline range	
Pollutants	No evidence of pollutants	

WSF Occupancy Rates

Introduction

This section discusses the proposed monitoring program for WSF occupancy rates at the Kings Forest site including the key monitoring objectives, methodologies to be implemented for baseline and annual monitoring, and the specific requirement for WSF monitoring to be completed after bushfire events.

Monitoring Program

Baseline WSF Monitoring

The aims of the baseline monitoring are to establish survey sites and protocols and to collect data which will allow future monitoring:

1. To determine any changes in the distribution and level of WSF activity within the Kings Forest site; and

2. To assess any changes in WSF occupancy rates within the Kings Forest site.

Data gathered during the eight (8) week WSF habitat survey, detailed in JWA (2013), surface/ground water characteristics to be monitored in accordance with the Overall Water Management Plan (G&S 2020b), surveys completed by Dr Arthur White in August and December 2014, and surveys to be completed immediately prior to the commencement of construction for each Precinct will form the baseline data against which data collected during subsequent monitoring events will be compared.

Baseline WSF monitoring will be completed prior to the commencement of works within each relevant stage of the development by suitably qualified and/or accredited persons in accordance with the following methodology.

All surveys will be completed in accordance with the Commonwealth Department of the Environment, Water, Heritage and the Arts "Survey guidelines for Australia's threatened frogs" (DEWHA 2010) and the New South Wales Department of Environment and Climate Change "Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians" (NSW DECC 2009). In particular, the following methods are considered essential for the Kings Forest site:

- Baseline monitoring will be undertaken during the WSF breeding season (i.e. between late September and early March) during appropriate weather conditions.
- Monitoring surveys will be completed following rainfall events greater than 25 mm in 24 hours. The nearest Bureau of Meteorology rainfall recording station to the site is Kingscliff (Woram Place) weather station (#058137), which is located approximately 5 km to the north of the site. The nearest Bureau of Meteorology temperature recording station to the site is Murwillumbah (Bray Park) weather station (#058158) approximately 15 km from south-west of the site. To assist in interpretation of survey results, details of the weather conditions experienced during the surveys and rainfall readings for the five (5) days up to and including the survey events, taken at the Kingscliff and Murwillumbah weather stations, are to be included.
- At a minimum, the methodology will include the installation of a permanent 50 m transect in each area of suitable habitat onsite relevant to the development stage. **FIGURE 1** shows the locations of monitoring sites. Each transect is to cross retained or created breeding habitat.
- Permanent 50 m transects will also be installed and surveys completed in two (2) high quality off-site WSF habitats. These two (2) areas have each been identified in BEC (2014) as Areas A and B (**FIGURE 1**). The data from the surveys in Areas A and B will provide benchmarks for site data.
- The observer/s will walk transect whilst listening for calling frogs or observing non-calling individuals. All species of frog calling of observed (including pest species) will be recorded. A count will be completed of all WSF recorded within 1 m of each survey transect.
- All transect count surveys will commence at least 30 minutes after dark when wallum sedge frogs have had an adequate amount of time to emerge from their diurnal retreat sites (Lewis & Goldingay 2005). Performing surveys in this way allows for some direct

comparison with long term monitoring of this species performed by Lewis and Goldingay (2005) across the broader region.

- Dip netting/tadpole searches and egg clutch surveys will be completed within any suitable areas (i.e. standing water) along the transects.
- If individual frogs are observed then their age class will be classified as adults >16 mm, sub adults <16 mm and juveniles as showing some evidence of a tail stub.
- In areas where a 50 m transect can't be established a timed 30 min search including an inspection of emergent macrophyte cover, dip netting/tadpole searches and egg clutch surveys within potential breeding habitat will be used as a substitute.
- If WSF are not heard calling and no non-calling individuals are observed at a survey site call playback will be implemented in an attempt to elicit a response.

Annual WSF Monitoring

WSF monitoring shall be completed in association with each relevant stage of the Kings Forest development on an annual basis as a responsibility of the Proponent, from the date of "commencement" of works in each relevant development stage, and will continue for a period extending to five (5) years after completion of the relevant development stage or until the retained habitat associated with the relevant development stage is dedicated, whichever is sooner.

Annual WSF monitoring will comprise three (3) sampling events undertaken per WSF breeding season (i.e. between late September and early March) during appropriate weather conditions and will be completed following the methodology described above.

In the event that a suspected diseased WSF is observed during monitoring, appropriate disease management protocols must be implemented. Any records of diseased WSF will be included in the results of the Annual WSF Monitoring Report.

WSF Monitoring After Fire

In the event of an uncontrolled bushfire occurring on the Kings Forest site, an additional WSF monitoring event will be completed by a suitably qualified ecologist. This will be completed in accordance with the methodology described above to monitor the impacts of fire on the local WSF population.

Data Analysis

An abundance measure of WSF will be obtained by counting all WSF within 1 m of each survey transect to derive a standard unit of measure expressed as the number of frogs per 100 m^2 of habitat.

A test of significance utilising the Paired Student t-test will be completed after each monitoring event to determine if a statistically significant reduction in WSF occupancy rates has occurred (i.e. to test the hypothesis that pre-development WSF occupancy rates are higher than the post-development WSF occupancy rates). As sample sizes are relatively small,

however, the value of p (typically 0.05 or 0.01 in order for significance to be determined) should be raised to something that better reflects the limitations of the sample size. A p of 0.25 as the statistical benchmark of significant change should be considered, further qualified by a requirement that a major review should be initiated only after consideration of the monitoring data from two (2) successive monitoring events.

Performance Criteria and Corrective Actions

TABLE 2 provides the performance criteria and targets for the WSF monitoring program. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 2
WSF MONITORING PERFORMANCE CRITERIA AND CORRECTIVE ACTIONS

<table>
<tr><th>Performance Indicator</th><th>Corrective Action</th><th>Responsibility</th></tr>
<tr><td>For monitoring purposes, the benchmark habitat occupancy rate to be achieved for WSF populations inhabiting the Kings Forest site will be equal to or greater than baseline levels</td><td rowspan="2">Investigate habitat usage on the Kings Forest site. Determine which areas of potential habitat are not being utilised by the population. Consult with BCD and WSF experts to develop a strategy to improve/ facilitate the usage of the potential WSF habitat. Implement the strategy.</td><td rowspan="2">Ecologist</td></tr>
<tr><td>Notwithstanding the influence of events beyond the control of the Proponent, the WSFMP can only be considered successful if the extent of habitat being utilised by WSF across the Kings Forest site does not deviate significantly from the estimate of habitat occupancy rate established by baseline monitoring [#]</td></tr>
<tr><td colspan="3">Notes:
[#] Generally, conclusions relating to changes in the occupancy rate across the Kings Forest site should only be made at every second monitoring event (i.e. every 2 years) by examining both the occupancy trend over the intervening two (2) year period and by a direct comparison to the occupancy estimate of two (2) years previous.</td></tr>
</table>

Retained WSF Habitat

The monitoring of retained WSF habitat will be completed in accordance with performance criteria contained in the approved Kings Forest VWMPs (JWA 2020g-i). The Annual WSF Monitoring Reports will also discuss the monitoring results for the retained WSF habitat contained within the VWMPs (JWA 2020g-i).

Compensatory Planting

Introduction

The monitoring of the WSF compensatory habitat will be completed during the Establishment period to enable verification of revegetation success. The monitoring program comprises the following components:

- Identification of Performance Indicators;
- Survey site and plot selection;
- Plot based surveys;
- Photo-point monitoring; and
- Targets for the performance indicators during the Establishment and Maintenance periods, including corrective actions if required.

Identification of Performance Indicators

The selection of Performance indicators is an important process as it enables an accurate measurement to be made of the success of the planting program. The success of the planting program is a critical step in the aims and objectives of the WSFMP i.e. to ensure the viability of the Kings Forest WSF population.

The following performance indicators (criteria) will be utilised as targets for the Establishment and Maintenance phase assessment:

- Seedling survival;
- Native canopy cover;
- Weed presence; and
- Shrub and groundcover recruitment.

Survey Site and Plot Selection

Background

To assess if the project completion criteria have been met, vegetation assessments will be completed using transects and quadrats (plots) at the locations shown in **FIGURE 1**. Field site selection has been based on the need to ensure representative sampling of compensatory habitat areas and types. Where compensatory habitat polygons are small in size or are not covered by transect and plot surveys, photo point monitoring will be completed in accordance with below sections.

Plot-Based Vegetation Surveys

Plot-based vegetation surveys will be undertaken in appropriate locations within the WSF compensatory habitat planting areas. Vegetation survey sites will be permanently marked (i.e. star pickets or wooden stakes) and the end positions identified on a sitemap using a hand-held Global Positioning System (GPS).

The plot-based vegetation survey will be based on a 20 m × 20 m plot (or 400 m^2 equivalent for linear areas).

The minimum number of plots/transects that must be sampled for each vegetation zone is detailed in **TABLE 3** below.

TABLE 3
MINIMUM NUMBER OF PLOTS AND TRANSECTS REQUIRED IN EACH PLANTING POLYGON

Planting Polygon Area (ha)	Minimum Number of Plots/Transects
<2	1 plot/transect
>2–5	2 plots/transects
>5–20	3 plots /transects

Survey plots should be established around a central 50 m transect as follows:

c) One 400 m^2 plot (standard 20 m x 20 m) is used to assess all performance indicators as set out in **TABLE 4** below.

d) Five 1 m^2 sub-plots can be added to the program for the first monitoring event to assess groundcover recruitment for the plot. A decision as to the utility of these plots can be made after the first or second monitoring events.

The assessor will assess the plot for the information contained in **TABLE 4**.

TABLE 4
VEGETATION SURVEY DATA TO BE COLLECTED

Attribute	Survey requirement
Seedling survival	The first monitoring event will require a count of the total number of seedlings, individual species counts and a count of the number of dead or dying seedlings of each species. Subsequent monitoring events will only require counts of dead or dying seedlings and their species identification.
Native Canopy Cover	Estimate the % foliage cover across the plot. Cover should be recorded in decimals if <1% (0.1, 0.2…), or whole numbers up to 5% (1, 2, 3), or to the nearest 5% where >5% cover (5, 10, 15, 20, 25…)
Weed Presence	Estimate the % cover in the plot of individual weed species. Count the number of each species.
Shrub and Groundcover Recruitment	Identify native shrub and groundcover species, their percentage cover and the numbers recruiting. The identification of individual recruits may not be possible when they first appear. These should be recorded as unidentified until the next or subsequent monitoring events.

The full species name (*Genus species*) must be recorded for all native species, unless insufficient diagnostic plant material is present, in which case the genus name followed by a species number must be used.

Photo Point Monitoring

Photo-monitoring points will be completed as a means of demonstrating compliance or otherwise with performance criteria. Permanent photo stations are to be located in each rehabilitation polygon. Where transects are to be established, photo points are to be located on each transect. Four (4) photos are to be taken from each photo point. Photos are to be taken to the north, south, east and west. Photos should be labelled with the:

- Transect code or photo point code;
- Direction of view; and
- Date and time.

Photos must be supplied in the Annual WSF Monitoring Reports in a form of prints no smaller than 4" x 6" and must be colour.

Timing of Monitoring Visits

Site visits should occur:

- To set up monitoring transects and quadrats and collect baseline data after 1st event of secondary weeding; and
- Six-monthly until the establishment period performance criteria are met; and
- Then annually during the maintenance period.

Performance Criteria and Corrective Actions

TABLE 5 provides the performance criteria and targets for the proposed rehabilitation strategy. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 5
COMPENSATORY HABITAT PERFORMANCE CRITERIA AND CORRECTIVE ACTIONS

Performance Indicator	Target – Establishment Period[1]	Target – Maintenance Period[2]	Corrective Actions
Survival and continued growth of seedlings (i.e. planted stock).	>90% survival of plantings during all monitoring events.	>90% survival of plantings during all monitoring events.	Irrigation if required. Replacement if planting required.
Establishment of native ground cover within revegetation areas (including at the entrances to underpasses where appropriate).	Plantings substantially established.[3]	Foliage Projective Cover (FPC) (%) of native groundcovers assessed using eye estimates or photo points: • >60% after 3 years; and • <80% after 5 years	Monitoring and maintenance period must be extended until the targets are met.
All identified weeds controlled to an acceptable level in accordance with the approved Kings Forest Weed Management Plans.	Foliage Projective Cover (FPC) (%) of weeds assessed using eye estimates or photo points reduced to <10% within first year.	Foliage Projective Cover (FPC) (%) of weeds assessed using eye estimates or photo points: • FPC of weeds reduced to <10% within first year; • <10% in second year; • <5% in the third year and consecutive years.	Weed control as necessary.
Natural recruitment of native species within rehabilitation areas (including at the entrances to underpasses).	Evidence of natural recruitment.	Increasing natural recruitment.	Additional/supplementary planting if required.

Notes:
[1] "Establishment period" means the period during which initial environmental repair, restoration and monitoring works required by the relevant approved environmental management plan(s) are undertaken. The establishment period ends when the works meet the establishment period performance criteria, as defined by the relevant approved environmental management plans, to the satisfaction of the Secretary.
[2] "Maintenance period" means the period of environmental management and monitoring works commencing immediately after the end of the establishment period. Maintenance period works are to be carried out in accordance with the relevant performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.
[3] "Substantial establishment" of the WSF habitat plantings means "the plantings have progressed beyond the need for intensive maintenance e.g. weed control, watering etc. and are clearly established by way of persisting through a recognised growth period and an independent restoration ecologist approved by the Secretary has provided a short report confirming that the plantings are established."

Infrastructure, Construction and Operational Management

Introduction

A wide variety of matters not related to matters in above will require monitoring. These are issues that have not necessarily been mandated by consent conditions, but which are necessary for the successful implementation of the WSFMP. The Environmental Officer will be responsible for the monitoring of relevant construction activities and infrastructure during and after construction.

Monitoring Requirements

Relevant infrastructure consists of temporary and permanent fauna exclusion fencing and signage. The maintenance of this infrastructure is essential if the aims and objectives of the WSFMP are to be achieved i.e. preventing access by WSF to the development footprint and alerting Kings Forest residents and visitors to the residence of WSF in nearby bushland and their responsibilities in ensuring the safety and persistence of this population.

Monitoring activities during the construction/installation of temporary and/or permanent fences and signage should be completed by the Environmental Officer to ensure that:

- There has been no clearing of WSF habitat;
- There have been no isolated patches of compensatory WSF created;
- There have been no barriers to wildlife movement created;
- Until permanent fencing and underpass infrastructure is completed, temporary fencing is not to prevent WSF accessing habitat on the site;
- Fencing occurs on both sides of any road where it traverses an environmental area;
- There is sufficient functional maintenance zone each side of any fauna exclusion fence;
- Vandal proof signs are erected at regular intervals advising of the importance of fauna exclusion fences and their maintenance; and
- All fence damage is reported promptly and repaired in a timely fashion.

Visual inspections of relevant infrastructure by the Environmental Officer will be completed on a monthly basis until the land occupied by the infrastructure is dedicated to either TSC or BCD. Where damage or other failures to infrastructure are observed a report, including a photograph, will be prepared within 24 hours in accordance with Condition 76 of MP 08_0194. The damage or failure will be corrected within 48 hours of the reporting of the damage or failure.

In addition, the Environmental Officer will be responsible for monitoring the following relevant matters:

- Implementation of an induction/education program for construction personnel;
- All contractors provided with protocols to be followed if an animal is killed or injured; and

- Engagement of the community with local WSF issues and management.

Reporting on these matters will be included in the Annual WSF Monitoring Reports to be provided to DPI&E, BCD and TSC.

Performance Criteria and Corrective Actions

TABLE 6 provides the relevant performance criteria for the above additional items requiring monitoring to determine the successful implementation of the WSFMP. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 6
PERFORMANCE CRITERIA FOR CONSTRUCTION AND OPERATIONAL ISSUES TO BE MONITORED AND CORRECTIVE ACTIONS

Performance Indicator	Monitoring Frequency	Corrective Action	Responsibility
Exclusion fences and signage have been correctly installed, remain effective and well maintained	Monthly until the land occupied by the infrastructure is dedicated to either TSC or BCD	Alternative fence design/location may be required, and potentially habitat restoration works where it is determined that there have been barriers created to wildlife movement, there is insufficient functional maintenance zone each side of any fauna exclusion fence, there has been clearing of WSF habitat, and/or there have been isolated patches of compensatory WSF habitat areas created. Any damage to fences or signage will be reported to the Site Manager and prompt immediate repair, within two (2) working days of the discovery of the damage, will be completed by site personnel or independent contractors as determined by the Site Manager. Repeated instances of vandalism to infrastructure will prompt the implementation of mobile security patrols by a commercial security specialist.	Principal Contractor/ Ecologist
High rates of diseased WSF are not detected	As required	Disease condition assessments will be carried out during the baseline monitoring assessment and in every annual assessment thereafter. Five (5) years after commencement of construction consultation will occur with relevant BCD scientists and other WSF experts as necessary or convenient. A report will be completed. If expert opinion considers that disease occurrence is over and above that which would be expected in a wild population of WSF or they consider that there has been a significant increase in diseased animals since the baseline assessment, then advice will be obtained from appropriate BCD scientists and/or other WSF experts as considered necessary or appropriate. The advice will be implemented.	Ecologist
Bushfire related deaths or damage to habitat are minimised	As required	If a bushfire occurs within land owned by Project 28 an investigation will be triggered to assess damage to WSF and their habitat on the Kings Forest lands. The investigation will include a survey of the WSF population occurring on the Kings forest site. Consultation will occur with RFS, TSC and BCD to determine the cause of the fire. A report will be prepared after the consultation. The report will address causes, impacts and proposed changes, if considered necessary, to Bushfire management plans.	Project 28/ Ecologist
Implementation of an induction/education program for construction personnel.	Monthly	Any construction personnel that has not completed the induction/education program are to cease work until completed.	Environmental Officer
All contractors provided with protocols to be followed if a native animal is killed or injured.	Monthly	To be provided as part of the induction/education program (see above).	Environmental Officer
Engagement of the community with local WSF issues and management.	As required	Appropriate community liaison/consultation completed as necessary.	Proponent/ Environmental Officer