360 environmental

Black Cockatoo Avoidance and Mitigation Plan- Mitchell Freeway Extension

Prepared for:

Main Roads Western Australia

October 2014

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Abbreviations/Definitions

BCAMP	Black Cockatoo Avoidance and Mitigation Plan
DBH	Diameter at Breast Height
DotE	Department of the Environment
DPaW	Department of Parks and Wildlife
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
Main Roads WA	Main Roads Western Australia
MNES	Matters of National Environmental Significance
MRS	Metropolitan Region Scheme
TPZ	Tree Protection Zone
WC Act	Wildlife Conservation Act 1950

1 Introduction

1.1 Background

Main Roads Western Australia (Main Roads WA) engaged 360 Environmental to prepare this Black Cockatoo Avoidance and Mitigation Plan (BCAMP) for the extension of Mitchell Freeway from Burns Beach Road to Romeo Road (the Project).

The Mitchell Freeway provides the primary road access route from the Perth north-west corridor towards the city of Perth. The freeway currently terminates at Burns Beach Road. An extension to the Mitchell Freeway has been approved by the State Minister for Transport with the proposed works having been divided into three stages (Figure 1). This BCAMP is applicable to Stage 1 and Stage 2 geotechnical works (the Project). Stage 1 includes the following:

- Mitchell Freeway extension from Burns Beach Road to Hester Avenue;
- Grade separated interchanges (including road bridges) at Burns Beach Road, Neerabup Road and Hester Avenue;
- Principal Shared Path (PSP) on western side of the Mitchell Freeway extension from Burns Beach Road to Hester Avenue including a PSP bridge over Burns Beach Road;
- Underpasses at Currambine Station, Neerabup Road and Hester Avenue;
- Hester Avenue duplication from Hidden Valley Retreat to Wanneroo Road;
- Neerabup Road upgrade from Connolly Drive to Wanneroo Road connection to freeway; and
- Wanneroo duplication from just south of relocated Flynn Drive to Hall Road.

Stage 2 geotechnical works will involve temporarily clearing vegetation within a four metre wide track for the purpose of undertaking geotechnical investigations.

Stage 1 of the Mitchell Freeway Extension necessitates the clearing of approximately 86.41 hectares (ha) of Black Cockatoo habitat along with an additional 2.29 ha for geotechnical works to inform future stages. The clearing of Black Cockatoo habitat has direct and potential impacts on all three Black Cockatoo species including:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*);
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*); and
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

1.2 Project Area

The Project Area includes the road reserve between Burns Beach Road and Hester Avenue, located within the City of Wanneroo and City of Joondalup. The proposed works for Stage 1 are confined to the Metropolitan Region Scheme (MRS) amendments 992/33. The MRS boundary (MRS No. 992/33) is land that has been set aside as part of the MRS for future road and transport corridors. The preparatory geotechnical work associated with Stage 2 of the Project is located north of Stage 1 and is located within the proposed future alignment for Mitchell Freeway and Romeo Road. The area of the geotechnical works from Hester Avenue to Romeo Road is included in the MRS boundary 992/33, and the area along Romeo Road is within MRS boundary 1192/57 (Figure 1).

In total the Project Area occupies approximately 137.48 ha comprising of 134.65 ha which is associated with Stage 1 and an additional 2.83 ha which is required for geotechnical work associated with Stage 2.

1.3 Objectives

The objectives of the BCAMP are to:

- Outline avoidance and mitigation measures for impacts to Black Cockatoos prior to, during and post-construction;
- Provide timeframes for the implementation and completion of the above objectives;
- Identify performance indicators for the avoidance and mitigation of impacts to Black Cockatoos;
- Develop a monitoring and reporting programme for Black Cockatoo habitat;
- Identify contingency measures; and
- Establish roles and responsibilities.

The control measures outlined in this document will be to the satisfaction of the Department of the Environment and will not adversely impact other native flora and vegetation.

2 Legislation and Guidance

Black Cockatoos are protected under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the State *Wildlife Conservation Act 1950* (WC Act).

2.1 Commonwealth Legislation

The EPBC Act is the primary Commonwealth environmental legislation applicable to this plan. The EPBC Act facilitates the protection and management of nationally and internationally important fauna, flora, ecological communities and heritage places. It aims to facilitate the protection of the environment, particularly with regard to Matters of National Environmental Significance (MNES). All three Black Cockatoo's from the south west of Western Australia are listed as MNES under the EPBC Act.

The Project was referred to the DotE (EPBC referral number 2013/7091) due to impacts to all three species of Black Cockatoos as MNES under the EBPC Act. These species are:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) - listed as Endangered under the EPBC Act and Endangered under the WC Act;
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) - listed as Vulnerable under the EPBC Act and Endangered under the WC Act; and
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – listed as Vulnerable under the EPBC Act and Vulnerable under the WC Act.

The Project was determined a 'controlled action' which was approved on 2 September 2014 subject to DotE conditions. This plan has been prepared in accordance with Condition 2 as indicated in Table 1.

The BCAMP was submitted to the DotE on the 14 October 2014, as required under Condition 2. The DotE approved the BCAMP on 26 October 2014 (Appendix D).

Table 1. Condition 2 and the Corresponding Section of This Plan Where Condition Has Been Addressed

CONDITION	RELEVANT SECTION
To mitigate impacts to Black Cockatoos, at least three months prior to the commencement of the action, the approval holder must prepare and submit a Black Cockatoo Avoidance and Mitigation Plan (BCAMP) for the Minister's approval. The BCAMP must include, but not be limited to:	The entire plan

CONDITION	RELEVANT SECTION
a) Milestones and objectives of the BCAMP	Section 1.3
b) Avoidance and mitigation measures to reduce impacts to Black Cockatoos and Black Cockatoo habitat prior to, during and post construction, including measures to avoid the spread of dieback	Section 4.1
c) Timeframes for the implementation and completion of the avoidance and mitigation measures	Section 4.1
d) Details of monitoring, reporting and contingency measures if performance indicators are not met	Section 6, Section 7.3 and 7.4
e) Roles and responsibilities of personnel associated with implementing each of the avoidance and mitigation measures.	Section 7.2

2.2 State Legislation

Black Cockatoos are protected under the WC Act. The WC Act was developed for the conservation and protection of wildlife in Western Australia. Under Section 14 of the Act, all native fauna and flora within Western Australia is protected. The Minister may, declare a list of taxa that are in need of special protection. The current listing was gazetted on the 17th September 2013 (Government of Western Australia 2013).

The following other environmental legislation and regulations will apply and will be adhered to for the duration of the Project:

- *Environmental Protection Regulations 1987*;
- *Environmental Protection (Noise) Regulations 1997*;
- *Environmental Protection (Unauthorised Discharges) Regulations 2004*;
- *Environmental Protection Act 1986*;
- *Contaminated Sites Act 2003*;
- *Contaminated Sites Regulations 2006*;
- *Bush Fires Act 1954*;
- *Conservation and Land Management Act 1984*;
- *Local Government Act 1995*;
- *Rights in Water and Irrigation Act 1914*; and
- *Aboriginal Heritage Act 1972*.

Legislation changes will be reviewed regularly with updates regularly received by the Environmental Coordinator through a subscription to Environmental Law.

3 Existing Environment

3.1 Flora and Vegetation

During May–July and September–October, 2013, GHD conducted a Level 2 Flora and Vegetation Survey within the proposed Mitchell Freeway Extension and associated works between Burns Beach Road and Romeo Road (the Study Area) (GHD 2013).

The condition of vegetation across the Study Area was recorded as ranging from 'Excellent' to 'Completely Degraded' (GHD 2013). The survey identified seven vegetation types within the Study Area (Figure 2 and 5). These vegetation types are as follows:

- Mixed low heathland;
- *Banksia* woodland;
- *Eucalyptus gomphocephala* (Tuart) woodland;
- *Banksia sessilis* tall shrubland;
- *Jarrah–Banksia* woodland;
- *Melaleuca huegelii–M. systena* shrubland on limestone; and
- Mosaic of Banksia woodland and low heathland or Banksia woodland and tuart woodland (GHD 2013).

3.2 Black Cockatoo Habitat

Main Roads WA commissioned GHD to conduct a targeted Black Cockatoo Habitat Assessment for the proposed Mitchell Freeway extension and associated works between Burns Beach Road and Romeo Road in 2013 (Appendix A) (GHD 2013a). The assessment was undertaken across the Study Area over a nine day period in May and July 2013. An additional Black Cockatoo Assessment Update was undertaken in September 2013 (GHD 2013b). The Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) was recorded in the Project Area during each site visit (GHD 2013a). Numbers of birds recorded at each sighting ranged from a pair of birds to flocks of over 100 individuals. All three Black Cockatoo species were sighted in the Project Area during the additional Black Cockatoo Assessment Update (GHD 2013b).

3.2.1 Foraging Habitat

The results of the Black Cockatoo Habitat assessments indicate that generally, all the areas containing remnant native vegetation within the Study Area is considered to be suitable Black Cockatoo foraging habitat as they all contain plant species documented as food sources for Black Cockatoos (GHD 2013a) (Figure 3 and 6). Food sources included *Eucalyptus gomphocephala*, *E. marginata*, *E. todtiana*, *Corymbia calophylla*, *Banksia*

grandis, *B. menziesii*, *B. attenuata*, *B. sessilis* and *Allocasuarina fraseriana* (GHD 2013a). The Project will potentially remove up to 86.41 ha (Stage 1) and 2.29 ha (geotechnical work) of suitable foraging habitat.

3.2.2 Breeding Habitat

According to the current modelled distribution of Black Cockatoos (DotE 2014), the Project Area falls within the habitat range of the Carnaby's Black Cockatoo.

The significant tree assessment identified 589 trees (Stage 1 area) and 3 trees (geotechnical work area) with a diameter at breast height (DBH) of >500 mm within the Project Area (GHD 2013a). On average, Carnaby's Black Cockatoos are known to nest in hollows with an entrance diameter greater than 20-30 cm (Johnstone and Storr 1998; Groom 2010). A total of 30 trees (Stage 1 area) contained hollows which were considered to provide suitable breeding habitat (contained a hollow with an entrance diameter greater than 20 cm) (Figure 4). No trees within the geotechnical area contained hollows which were considered to provide suitable breeding habitat (GHD 2013a). None of the trees containing suitable hollows showed evidence of current or past use by Black Cockatoos.

Of the trees with hollows recorded within the Stage 1 Project Area, two were currently occupied by European Honey Bees (*Apis mellifera*). During the early July surveys, a number of Galahs and Australian Ringneck Parrots were observed occupying a number of the hollows in the Project Area (GHD 2013a).

3.2.3 Roosting Habitat

Mapping provided by the Department of Planning Western Australia (2011) identifies two known Carnaby's Black Cockatoo roosting sites east of Wanneroo Road, less than two kilometres (km) from the Project Area. According to mapping undertaken by the Department of Planning report (2011), there are no known roosting sites located within the Project Area, however, during the May–July 2013 survey one potential roosting site was identified within the Project Area. This roosting site was identified near the Clarkson rail line approximately one kilometre south of Neerabup Road. This site showed evidence of roosting by Black Cockatoos, including presence of cut debris (leaves and small branches) on the ground and large amounts of faecal material. However, no individuals were recorded roosting during the survey (GHD 2013a).

3.3 Dieback

Disease in natural ecosystems of Australia, caused by the introduced plant pathogen *Phytophthora cinnamomi* (Dieback), is listed as a key threatening process under the EPBC Act. A Dieback assessment was undertaken by Glevan Consulting (Glevan) in July 2013 along the proposed Mitchell Freeway Extension (the Study Area) to determine any presence of Dieback (Glevan Consulting 2013) (Appendix B).

Glevan determined the Study Area contained a mosaic of infested, uninfested, and unmappable vegetation. Table 2 below demonstrates the areas of occurrence under each category and the associated category definition. Figures 7 and 8 provide Dieback mapping of the Project Area.

Table 2. Occurrence Category Summary (adapted from Glevan Consulting 2013)

CATEGORY	DESCRIPTION	AREA (HA)	% OF TOTAL AREA
Infested (with *P. cinnamomi*)	Areas that a qualified person has determined to have plant disease symptoms consistent with the presence of the pathogen Phytophthora Dieback.	2.6 ha	0.6%
Uninfested	Areas that a qualified person has determined to be free of plant disease symptoms that indicate the presence of the pathogen Phytophthora Dieback.	171.8 ha	39.3%
Unmappable	Those areas where presence or absence of Phytophthora Dieback cannot be determined at the time of the assessment, due to disturbance factors i.e. fire disturbance or forestry activity.	262.9 ha	60.1%
Total		**437.3**	

4 Black Cockatoo Impacts and Mitigation Measures

The Project will potentially remove up to 86.41 ha (Stage 1) and 2.29 ha (geotechnical work) of suitable foraging habitat and 519 (Stage 1) and 1 (geotechnical work) potential breeding trees, including 30 (Stage 1) and 0 (geotechnical work) containing suitable hollows for Black Cockatoo nesting. The Project Area is located within the habitat range of the Carnaby's Black Cockatoo. The ultimate design of the Project will retain some foraging vegetation and potential breeding trees where possible.

The purpose of this plan is to demonstrate how the impact to Black Cockatoo's will be reduced through avoidance and mitigation measures within the Project Area. The following section outlines the avoidance, mitigation and management measures that will be employed prior to, during and post construction of the Project.

4.1 Construction Avoidance and Mitigation Measures

The ultimate design and aim of the Project is to retain Black Cockatoo habitat where possible. Works will be undertaken in previously cleared/disturbed areas and will avoid clearing of native vegetation wherever possible. Any pre-existing access tracks will be utilised where possible to avoid unnecessary clearing of habitat.

Where it is not possible to retain Black Cockatoo habitat (due to construction requirements) avoidance and mitigation measures will be implemented to minimise impacts to Black Cockatoos during clearing. Table 3 outlines the avoidance and mitigation measures to be implemented prior to, during and post construction of the Project.

Table 3. Construction Avoidance and Mitigation Measures

ACTION	TIMING	RESPONSIBILITY
Site Preparation Activities		
Clearly demarcate Black Cockatoo habitat to be retained in the Project Area (as indicated on figure 3 and 6) by start pickets, coloured tape or bunting	Pre construction	Design Manager Environmental Coordinator Construction Manager

ACTION	TIMING	RESPONSIBILITY
Clearly mark Black Cockatoo breeding trees proposed to be retained in the Project Area (as indicated on Figure 4) on design drawings and demarcate by coloured tape or bunting. Any breeding trees identified to be retained will be protected in accordance with *AS 4970 retention of trees on development sites* which involves but is not limited to: • Establishing a Tree Protection Zone (TPZ) and prohibiting threatening activities within the TPZ; • Demarcate and signposting of the TPZ; • Ground Protection within the TPZ where necessary; • Maintaining the TPZ (i.e. mulching, watering, weed control); and • Monitoring of construction activities to ensure compliance with TPZ.	Pre construction	Design Manager Environmental Coordinator Construction Manager
Provide GPS co-ordinates of areas approved to be cleared and those required to be retained to the Main Roads WA to ensure no unapproved clearing is undertaken	Pre construction	Environmental Coordinator
Peg out limits of clearing. Line will be inspected by the Environmental Coordinator and Main Roads WA Environmental Reference Group to determine what trees and vegetation on the limits of clearing can be retained	Pre construction	Environmental Coordinator Main Roads WA Environmental Reference Group
If clearing during Black Cockatoo breeding season (July-November), nesting hollows in potential breeding trees will be checked prior to clearing	Immediately prior to clearing	Environmental Coordinator
If active Black Cockatoo nests are located in the Project Area, the tree and nest will be left undisturbed until fledglings have left the nest	Pre and during construction	Environmental Coordinator Construction Manager Area Manager

ACTION	TIMING	RESPONSIBILITY
Clearing		
Staged clearing will be considered whereby non-active habitat trees are cleared and active habitat trees are left overnight or until vacant before being cleared	During construction	Environmental Coordinator Construction Manager Area Manager
In the event that a Black Cockatoo is identified during clearing, the *Black Cockatoo Handling and Rescue Procedure* should be followed.	During construction	Environmental Coordinator Construction Manager Area Manager
Dieback		
Follow Dieback management measures outlined in the *Construction Environmental Management Plan* and *Dieback Management Plan*	Pre and during construction	All personnel
Clearly demarcate the areas of the site that are infested and uninfested as shown in Figures 7 and 8. The boundaries between the management zones will be clearly marked in the field prior to earthworks commencing	Pre and during construction	Environmental Coordinator Construction Manager Area Manager
All plant, machinery, vehicles and equipment is inspected immediately prior to entering the Project Area to ensure it is free of weeds and soil	Pre and during construction	Civil Contractor/Construction Manager
Strictly avoid the movement of soils and plant material into the uninfected and un-mappable areas within the Project Area	Pre and during construction	Environmental Coordinator Construction Manager Area Manager
Reduce vehicle and plant movement into and within the Project Area as much as possible particularly during wet conditions	Pre and during construction	Environmental Coordinator Construction Manager Area Manager
Restrict access to public into the Project Area	Pre and during construction	Construction Manager Area Manager

ACTION	TIMING	RESPONSIBILITY
Dieback hygiene procedure to be prepared for use by Contractors including the provision of training to all vehicle, plant and machinery operators on site in the effective use of clean down stations and the environmental implications of the spread of the pathogen	Pre and during construction	Environmental Coordinator Construction Manager Area Manager
Ensure the effluent from the clean down stations, leachate from contaminated soil stockpiles and drainage lines from contaminated areas are contained and not able to drain into adjacent Dieback uninfested, unmappable areas or Neerabup National Park.	During construction	Environmental Coordinator Construction Manager Area Manager
As far as practical, time the clearing phase of the operation to occur during the dry months to reduce the risk of spreading the disease	During construction	Environmental Coordinator Construction Manager Area Manager
Revegetation		
Any areas that are cleared during the construction phase of the Project that do not need to remain clear of vegetation will be revegetated. Revegetation will be undertaken in consistency with the *Project Specific Revegetation Plan*	Post construction	Civil contractor

Table 4. Black Cockatoo Handling and Rescue Procedure

STEP 1: STOP WORKS
In the event that a Black Cockatoo is identified during construction all worked should be stopped in the immediate vicinity of the Black Cockatoo and the Construction Manager and Environmental Coordinator should be notified. If the Black Cockatoo does not leave the site voluntarily, the location of the Black Cockatoo should be recorded and provided to a suitable qualified fauna specialist (see Appendix C for list of potential contacts). The suitably qualified fauna specialist should then be engaged to attend the site and remove or relocate the Black Cockatoo. Works must only recommence once the Black Cockatoo has been successfully removed or relocated. The fauna encounter will be reported to the Department of Parks and Wildlife (DPaW).

STEP 2: INJURIES TO BLACK COCKATOOS	
Uninjured Black Cockatoo	The Black Cockatoo should be removed by a suitably qualified fauna specialist and relocated to a suitable area with a similar habitat as close as possible to where it was found.
Injured Black Cockatoo	The Black Cockatoo should be removed by a suitably qualified fauna specialist and placed in an enclosed box. The injured Black Cockatoo should then be taken to a veterinarian to be treated (see Appendix C for list of potential contacts). If the activities being undertaken are directly injuring Black Cockatoos, all work likely to affect the species will cease. Main Roads WA will be contacted to determine appropriate corrective actions and additional safeguards that need to be implemented.

5 Performance Indicators and Monitoring

5.1 Performance Indicators

Table 5 lists a number of environmental targets and performance indicators that have been developed for the avoidance and mitigation of impacts to Black Cockatoos as per Condition 2 of the approval for EPBC 2013/7091.

Table 5. Performance Indicators

TARGET	KEY PERFORMANCE INDICATOR
100% implementation of Black Cockatoo avoidance and mitigation measures	0 recorded incidents of Black Cockatoo injury or death 0 recorded incidents of demarcated foraging habitat or breeding trees being cleared
No spread of Dieback to uninfested areas of vegetation	0 recorded incidents of Dieback recorded in vegetation monitoring of vegetation in adjacent sensitive bushland 0 recorded incidents of machinery, equipment, vehicles or plant identified in Dieback uninfested and unmappable areas 0 recorded incidents of machinery, equipment, vehicles or plant containing soil or dirt post inspection and wash down 0 recorded incidents of public identified in the Project Area 0 recorded incidents of contaminated drainage entering Dieback unifested areas, unmappable areas or Neerabup National Park.

5.2 Monitoring

Table 6 details the monitoring programme for the BCAMP to achieve the performance targets mentioned above. The monitoring program has been developed to focus on the monitoring and implementation of avoidance and mitigation measures.

Table 6. Monitoring Requirements

PARAMETER	FREQUENCY	LOCATION	RESPONSIBILITY
Site Preparation			
Inspection of demarcated areas	Weekly during construction	Project Area	Environmental Coordinator
Clearing			
Inspection of cleared areas	Daily during clearing	Project Area	Environmental Coordinator
Dieback			
Access to public	Ongoing	Project Area	Construction Manager Area Manager
Inspection of hygiene/wash down standards on vehicles and machinery	Weekly	Wash down areas, laydown areas, site entry points	Environmental Coordinator
Signs of significant erosion and water potentially leaving the site into sensitive bushland areas	After significant rainfall events and as required	Project Area	Environmental Coordinator Construction Manager Area Manager
Photo monitoring	Quarterly	Adjacent sensitive bushland areas	Environmental Coordinator
Revegetation			
Monitoring of revegetation success	Annually for the first three years after completion	Revegetation areas	Main Roads WA

6 Contingency Measures

In the event that the mitigation measures outlined within this plan are unsuccessful, the following contingency measures presented in Table 7 will be employed.

Table 7. Contingency Measures

TRIGGER	ACTION
Non-compliance with management measures detailed in this plan	Identify the cause of non-compliance. Review management measures and amend/ improve where appropriate. Increase training and awareness for all personnel involved in the Project. Monitor the success of corrective actions. Maintain records of non-compliance to inform future improvement.
Unauthorised access/ clearing in demarcated areas	Determine cause and reason for unauthorised access/clearing. Inspect bunting, star pickets, coloured tape and signage. Increase training and awareness for all personnel involved in the Project. Erect adequate bunting and signage if necessary. Monitor success of remedy and take additional measures if required.
Dieback observed within uninfested areas or unmappable areas	Map the new infested area(s). Identify the cause of non-compliance. Review management measures and amend/ improve where appropriate. Increase training and awareness for all personnel involved in the Project. Monitor the success of corrective actions. Maintain records of non-compliance to inform future improvement.
Black Cockatoo nest identified in Project Area	Leave tree and nest undisturbed until fledglings have left nest. If a tree containing a nest and chick must be cleared then the location of the tree should be reported to a suitably qualified fauna specialist and left undisturbed until the fauna specialist arrives. The tree should only be cleared once the chick has been removed by the fauna specialist and taken to an adequate native fauna care facility.
Black Cockatoo identified in Project Area	Stop work, notify Construction Manager and follow *Black Cockatoo Handling and Rescue Procedure.*

7 Plan Implementation

The success of the BCAMP requires leadership to continuously promote best practice environmental management and to ensure the people and resources are available to achieve the plan's objectives. Management will ensure the continuing suitability, adequacy and effectiveness of the plan. The success of the BCAMP also relies heavily on review at regular intervals throughout the Project and making amendments where necessary. Any amendments will be presented to relevant regulatory agencies prior to their implementation.

An important component of the overall site management is the integration and communication of the requirements of this plan to the wider workforce. The following process, tools and management controls outline the means to this communication.

7.1 Training and Inductions

The Civil Contractor commissioned on behalf of Main Roads WA will be responsible for ensuring that environmental training and awareness programs are provided to all staff and Contractors. Awareness training will cover the key components of this plan to ensure all personnel and Contractors are aware of their obligations with respect to environmental responsibilities, any significant environmental risks and of their requirements under relevant legislation and regulations.

A site induction shall be provided by the Civil Contractor to all Contractor personnel and other personnel involved in construction activities prior to commencing work on site. Records of environmental training undertaken for all employees will be kept on site, detailing the type and purpose of the training.

7.2 Roles and Responsibilities

7.2.1 Main Roads WA

The primary responsibilities of Main Roads WA include:

- Ensure legal responsibilities and commitments of this plan are met;
- Act as primary liaison between the Civil Contractor and the DotE;
- Ensure all construction contracts contain relevant environmental management provisions; and
- Report to DotE in accordance with the conditions of approval for EPBC 2013/7091.

7.2.2 Civil Contractor

The primary responsibilities of the Civil Contractor include:

- Overall accountability to ensure construction activities do not adversely impact Black Cockatoo habitat or potential breeding trees being retained;
- Ensure all site personnel are aware of the requirements of the plan and related management plans;
- Provide support to Main Roads WA and other Contractors as required during the construction phase.

7.2.3 Environmental Coordinator

The primary responsibilities of the Environmental Coordinator include:

- Ensure all site personnel are aware of the requirements of the plan and related management plans;
- Regularly review and amend (if required) this plan;
- Regularly review legislation requirements;
- Inspect pegged out clearing line to determine what trees and vegetation can be retained;
- Demarcate Black Cockatoo habitat and record GPS coordinates;
- Check nesting hollows in potential breeding trees;
- Implement Dieback management procedures;
- Demarcate Dieback infested and un-infested areas; and
- Undertake photo monitoring.

7.3 Documentation

Records must be produced and maintained for the availability of regulatory authorities in the event of an audit. These records will presented as part of the compliance and monitoring reporting and will also be utilised to inform continual improvement and development of the BCAMP in the event the scope of the project changes significantly or repeated environmental incidents occur. The following records will be maintained:

- GPS coordinates and mapping of demarcated areas;
- Black Cockatoo encounters in trees to be cleared or injured Black Cockatoos and action(s) taken;
- Records of Dieback mitigation measures such as Dieback hygiene procedures;
- Training and induction records;
- Monitoring reports and daily/weekly checklists; and
- Environmental incident reports and close out reports.

7.4 Reporting

Within three months of every 12 month anniversary of the commencement of the Project, Main Roads WA will publish a report on their website detailing compliance with Condition 2 of the EPBC 2013/7091. Documentary evidence providing proof of the date of publication must be provided to the DotE at the same time as the compliance report is published. This report will remain on the Main Roads WA website for a minimum of 12 months.

Potential or actual contraventions of the Condition 2 of EPBC 2013/7091 must be reported to the DotE in writing within two business days of becoming aware of the actual or potential contravention. All contraventions must also be included in the compliance reports.

8 Summary of Avoidance and Mitigation Measures

A summary of the avoidance and mitigation measures proposed within this plan are provided below. These include:

- Demarcation of Black Cockatoo habitat;
- Demarcation of Dieback infested and un-infested areas;
- Implementation of Dieback management measures;
- Development of key performance indicators;
- Monitoring prior to, during and following construction of the Project;
- Maintaining clear and concise records;
- Implementation of contingency measures; and
- Preparation of annual compliance report.

This plan will be reviewed by the Project Manager and integrate advice of the Environmental Coordinator in the event that the Project scope changes significantly. Upon review, this plan will be revised and reproduced where appropriate. Continued improvement of the plan will occur in response to environmental incident resolutions and any audit findings during the construction of the Project.

9 Limitations

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data and analyses ("client's information") provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

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10 References

Department of Planning Western Australia 2011, *Metropolitan Region Scheme (MRS) - Potential Habitat for the Carnaby's Black Cockatoo Which May Require Further Assessment*, prepared on behalf of Western Australian Planning Commission.

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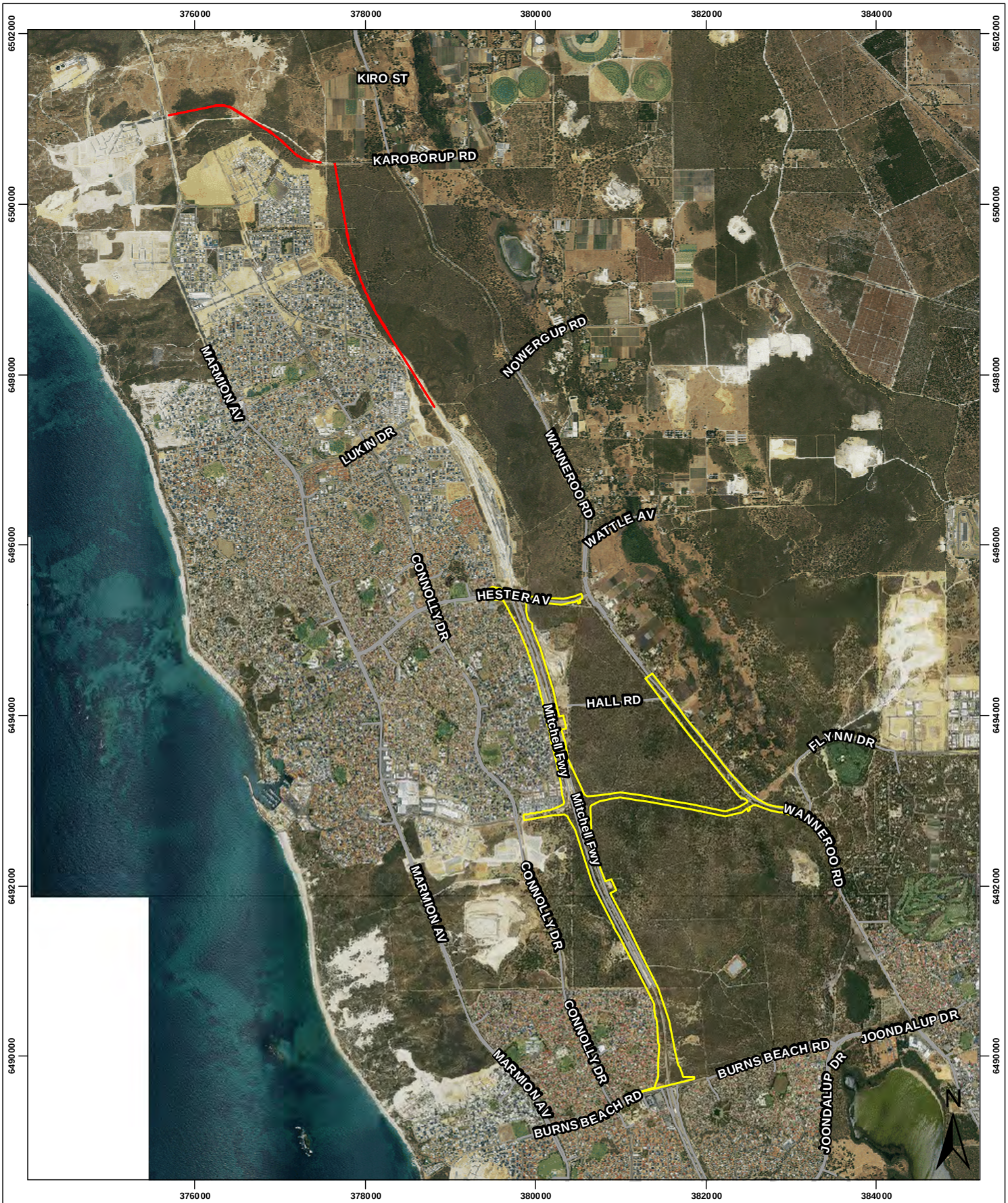
Glevan Consulting 2013, *Phytophthora Dieback Occurrence Assessment and Management Plan,* report prepared by GHD on behalf of Main Roads WA.

FIGURES



Legend

- Major Roads
- Stage 1 Footprint
- Stage 2 Geotechnical Investigation Area

0 250 500 1,000 1,500 2,000

Metres

1:60,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

360 environmental
a 10 Bermondsey St, West Leederville, 6007 WA
t (08) 9388 8360
f (08) 9381 2360
w www.360environmental.com.au

DRAWING ID	DATE
735 F1 Project Area.mxd	30-Sep-2014

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
JJ	CL	MRs	0

Main Roads WA
Mitchell Freeway
Extension Project Stage 1

Black Cockatoo Management Plan

Figure 1 - Project Area

- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STAGE 1 FOOTPRINTS SOURCED FROM MRWA 2014
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE FEB 2014 (© Western Australian Land Information Authority 2014)

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K:\Projects\1.0 ERS\735 Mitchell Fwy Extension Stage 1 Black Cocky\Black Cockatoo Avoidance and Management\Figures

Legend

Stage 1 Footprint

Vegetation Types (GHD 2014)

- 1: Banksia Woodland (35.9ha)
- 2: Jarrah-Banksia Woodland (5.02ha)
- 3: Tuart Woodland (3.47ha)
- 4: Mixed Low Heath on Limestone (0.89ha)
- 6: *Banksia sessilis* Closed Tall Scrub (3.86ha)
- 7: Mosaic of Vegetation Types 1 and 4 (5.42ha)
- 8: Degraded (51.36ha)
- 9: Planted (0.09 ha)
- 10: Rehabilitation (13.01ha)

- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STAGE 1 FOOTPRINTS SOURCED FROM MRWA 2014
- VEGETATION TYPES SOURCED FROM MAIN ROADS (GHD 2014)
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE FEB 2014 (© Western Australian Land Information Authority 2014)

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0 125 250 500 750 1,000
Metres
1:30,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

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DRAWING ID	DATE
735 F2 Vegetation Types.mxd	30-Sep-2014

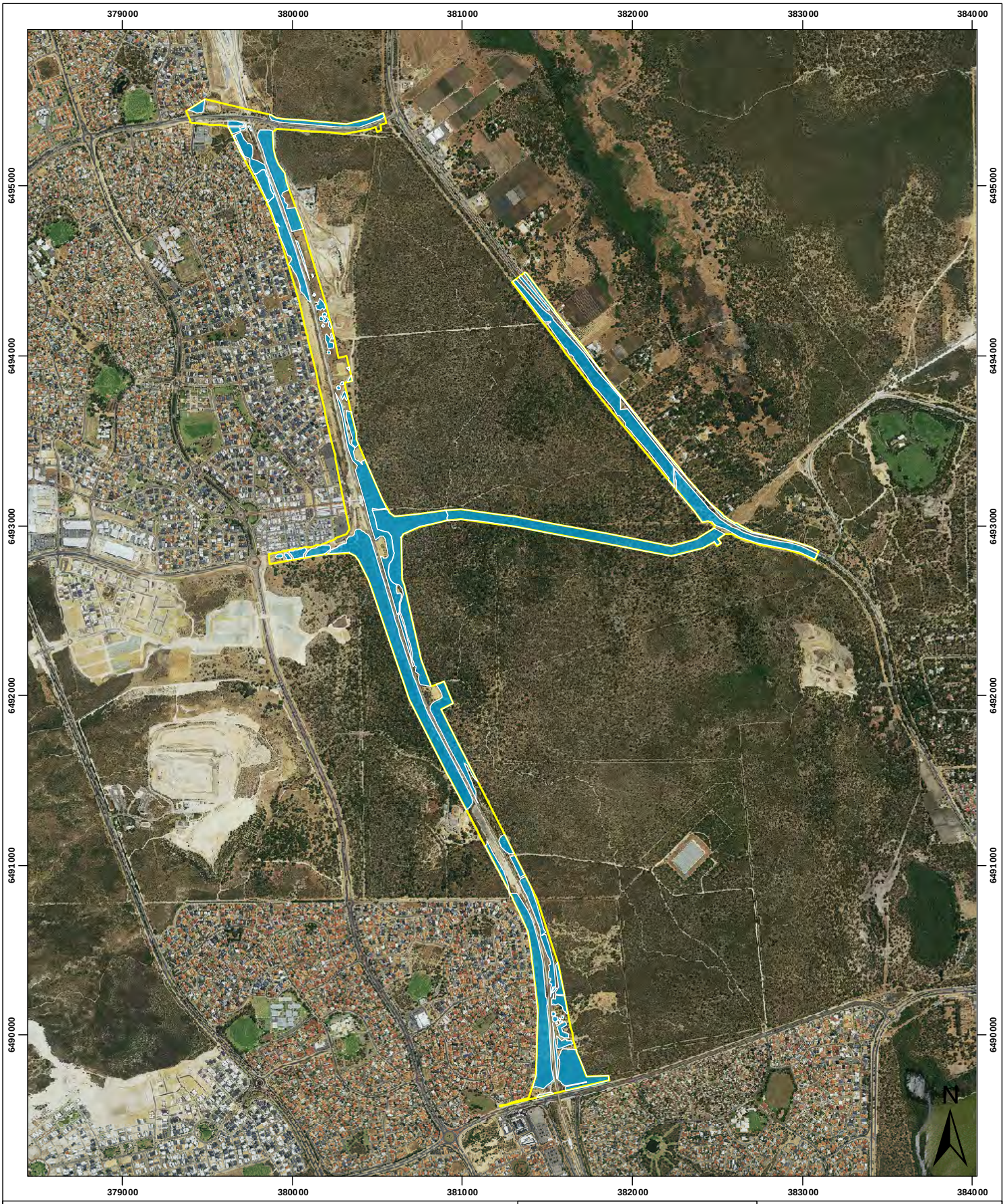
HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
JJ	CL	MRs	0

Main Roads WA
Mitchell Freeway
Extension Project Stage 1

Black Cockatoo Management Plan

Figure 2 - Vegetation Types



Legend

- Stage 1 Footprint
- Stage 1 Black Cockatoo Foraging Habiat (86.41 ha)

0 125 250 500 750 1,000

Metres

1:30,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STAGE 1 FOOTPRINTS SOURCED FROM MRWA 2014
- COCKATOO HABITAT SOURCED FROM MAIN ROADS (GHD 2014)
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE FEB 2014 (© Western Australian Land Information Authority 2014)

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DRAWING ID	DATE
735 F3 BC Foraging.mxd	30-Sep-2014

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
JJ	CL	MRs	0

Main Roads WA
Mitchell Freeway
Extension Project Stage 1

Black Cockatoo Management Plan

Figure 3 - Black Cockatoo Foraging Habitat

Legend

Stage 1 Footprint

Black Cockatoo Significant Trees (DBH >500mm)

- Currently Unsuitable for Cockatoos
- Suitable for Cockatoos (30)

NOTE: In this instance, suitable trees are defined as trees with a DBH exceeding 500mm containing one or more hollows of a suitable size for Black Cockatoo habitation (>20cm)

- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STAGE 1 FOOTPRINTS SOURCED FROM MRWA 2014
- COCKATOO HABITAT SOURCED FROM MAIN ROADS (GHD 2014)
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE FEB 2014
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K:\Projects\1.0 ERS\735 Mitchell Fwy Extension Stage 1 Black Cocky\Black Cockatoo Avoidance and Management\Figures

0 125 250 500 750 1,000
Metres
1:30,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

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DRAWING ID	DATE
735 F3 BC Significant Trees.mxd	30-Sep-2014

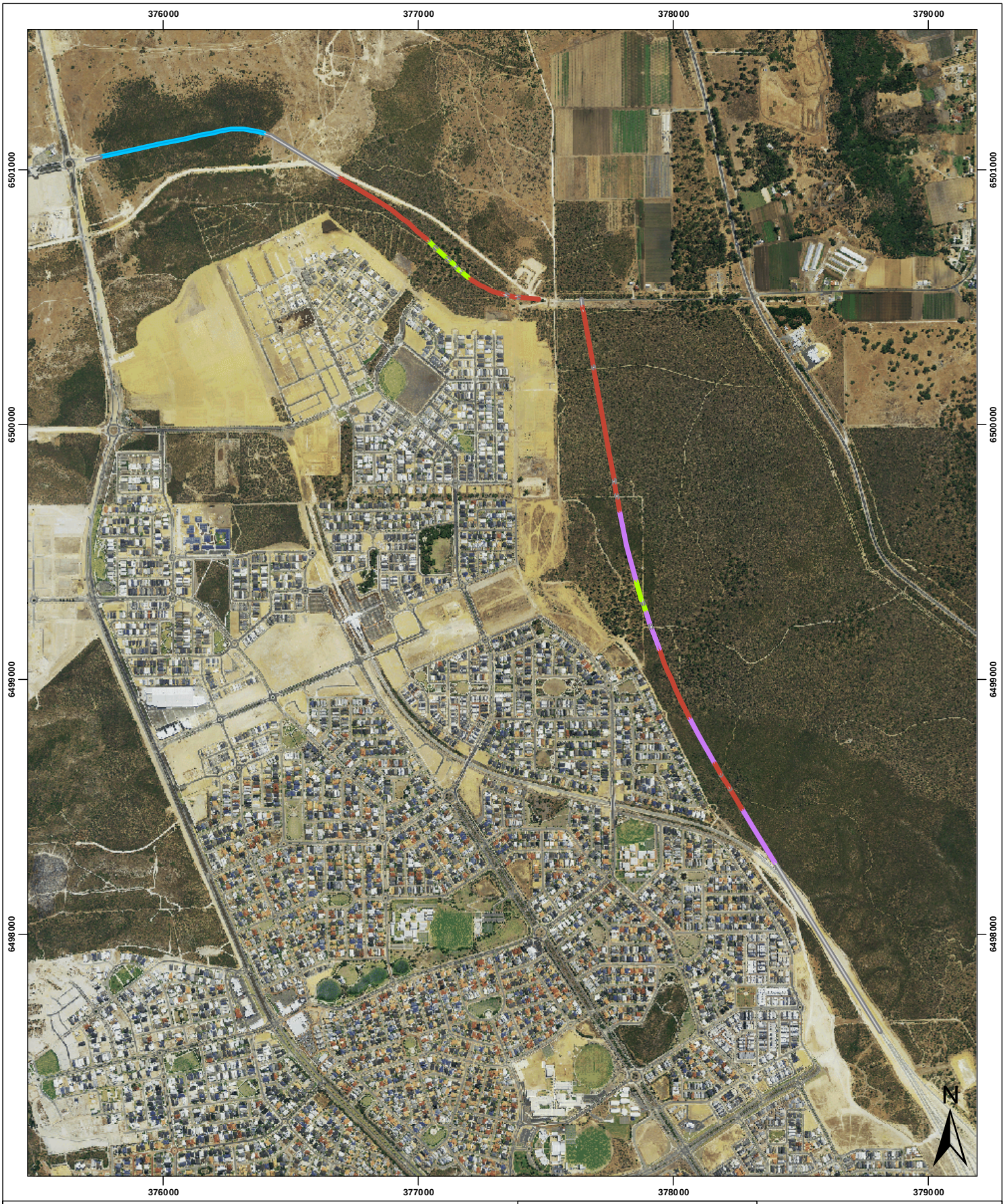
HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
JJ	CL	MRs	0

Main Roads WA
Mitchell Freeway
Extension Project Stage 1

Black Cockatoo Management Plan

Figure 4 - Black Cockatoo Significant Trees



Legend

Vegetation Types (GHD 2014)

- 1: Banksia Woodland (0.79ha)
- 2: Jarrah-Banksia Woodland (0ha)
- 3: Tuart Woodland (0.11ha)
- 4: Mixed Low Heath on Limestone (0.35ha)
- 6: *Banksia sessilis* Closed Tall Scrub (0.26ha)
- 7: Mosaic of Vegetation Types 1 and 4 (0ha)
- 8: Degraded (0.54ha)
- 9: Planted (0ha)
- 10: Rehabilitation (0ha)

- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STAGE 1 FOOTPRINTS SOURCED FROM MRWA 2014
- VEGETATION TYPES SOURCED FROM MAIN ROADS (GHD 2014)
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE FEB 2014 (© Western Australian Land Information Authority 2014)

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K:\Projects\1.0 ERS\735 Mitchell Fwy Extension Stage 1 Black Cocky\Black Cockatoo Avoidance and Management\Figures

0 100 200 400 600 800

Metres

1:20,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

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DRAWING ID	DATE
735 F5 Vegetation Types Geo.mxd	30-Sep-2014

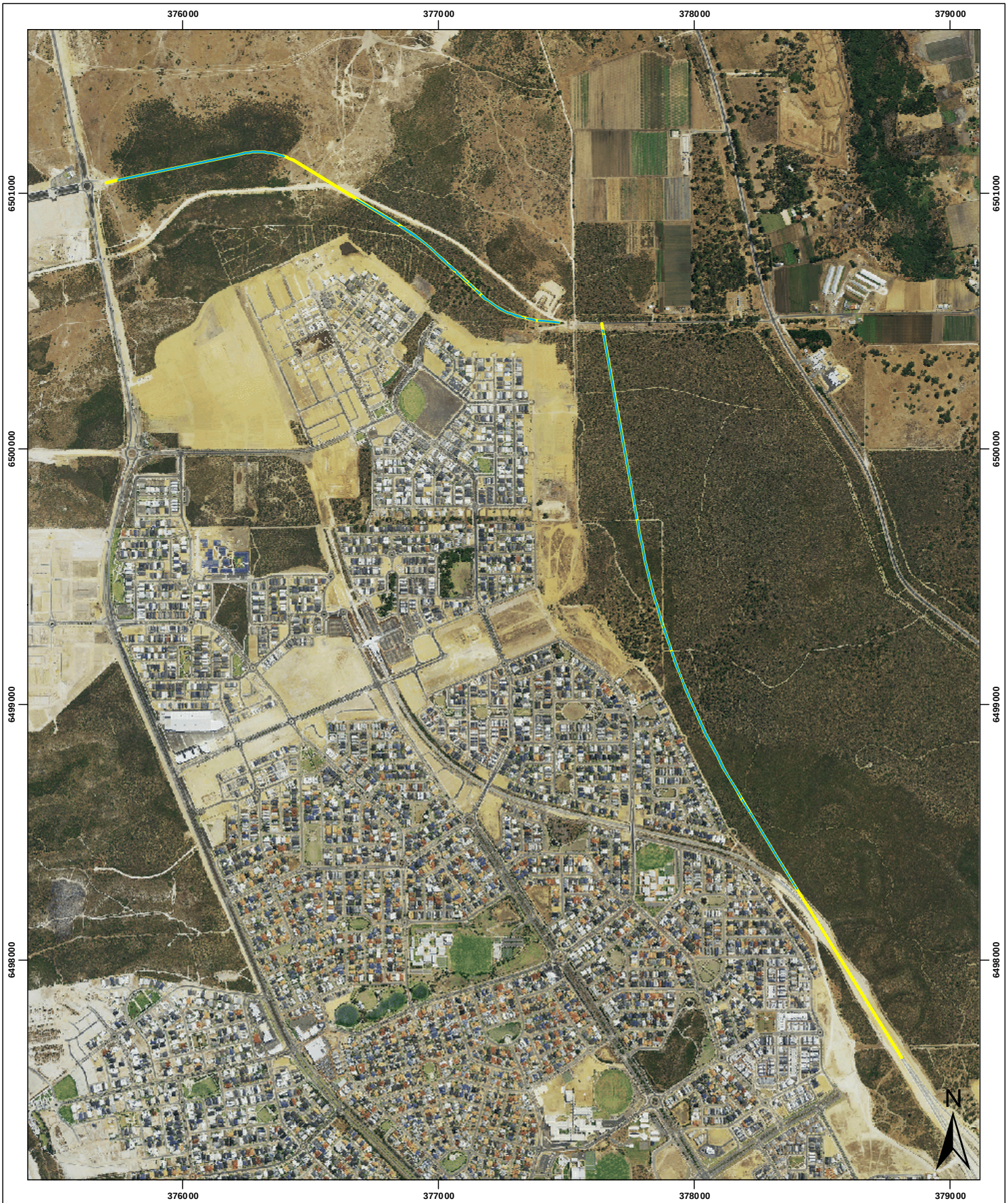
HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
JJ	CL	MRs	0

Main Roads WA
Mitchell Freeway Extension Project Stage 1

Black Cockatoo Avoidance and Mitigation Plan

Figure 5 - Vegetation Types Stage 2 Geotechnical Investigations



Legend

- Stage 2 Geotechnical Investigation Area
- Stage 2 Geotechnical Invest. Area Black Cockatoo Foraging Habitat (2.29 ha)

0 100 200 400 600 800

Metres

1:20,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

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a 10 Bermondsey St, West Leederville, 6007 WA
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f (08) 9381 2360
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DRAWING ID	DATE
735 F6 BC Foraging Geo.mxd	30-Sep-2014

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
JJ	CL	MRs	0

Main Roads WA
Mitchell Freeway
Extension Project Stage 1

Black Cockatoo Management Plan

Figure 6 - Black Cockatoo Foraging Habitat - Geotechnical Inv.

- LOCALITY MAP SOURCED FROM LANDGATE 2006
- STAGE 1 FOOTPRINTS SOURCED FROM MRWA 2014
- COCKATOO HABITAT SOURCED FROM MAIN ROADS (GHD 2014)
- AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE FEB 2014 (© Western Australian Land Information Authority 2014)

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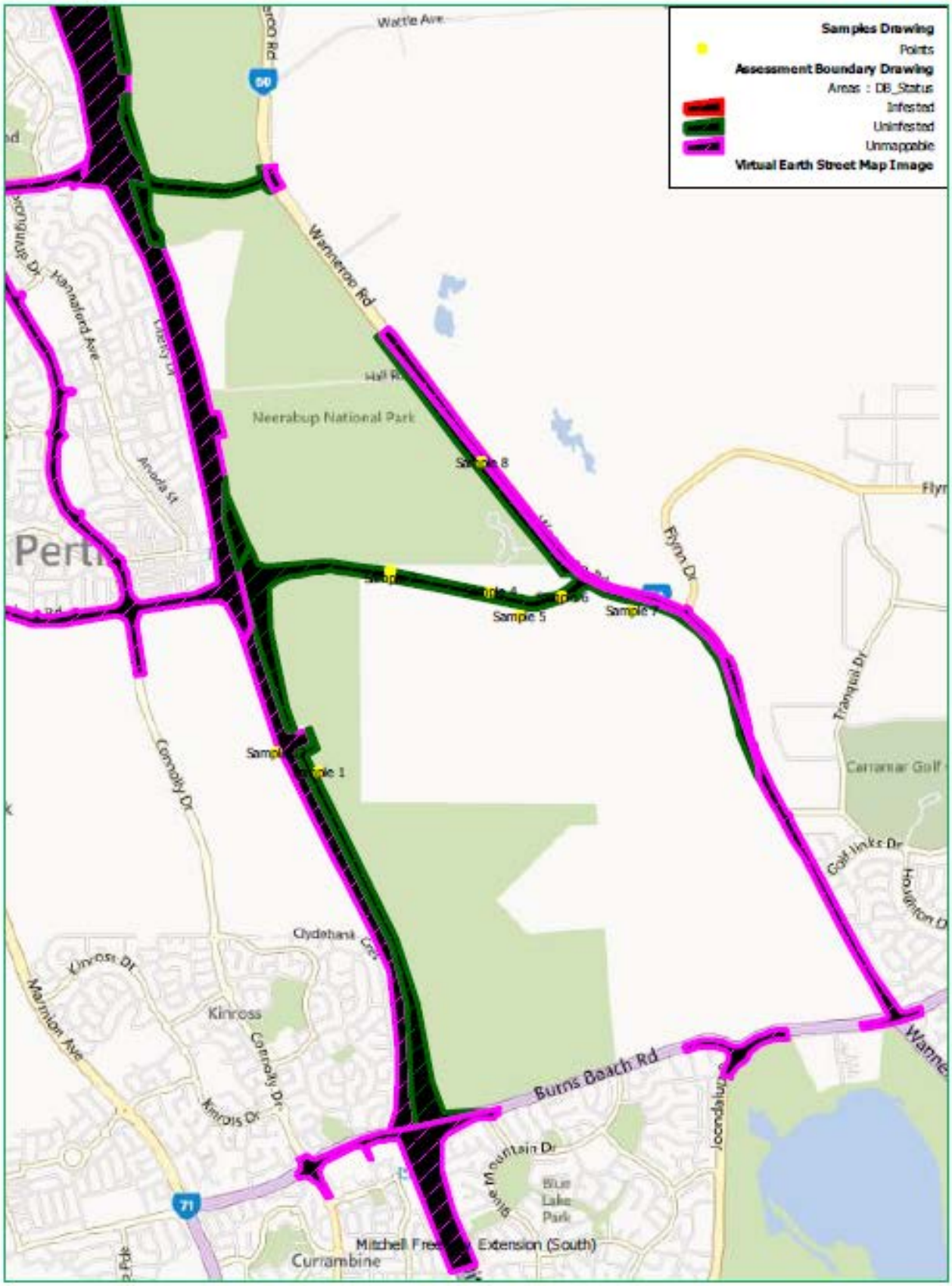

Figure 7. Dieback Mapping Stage 1

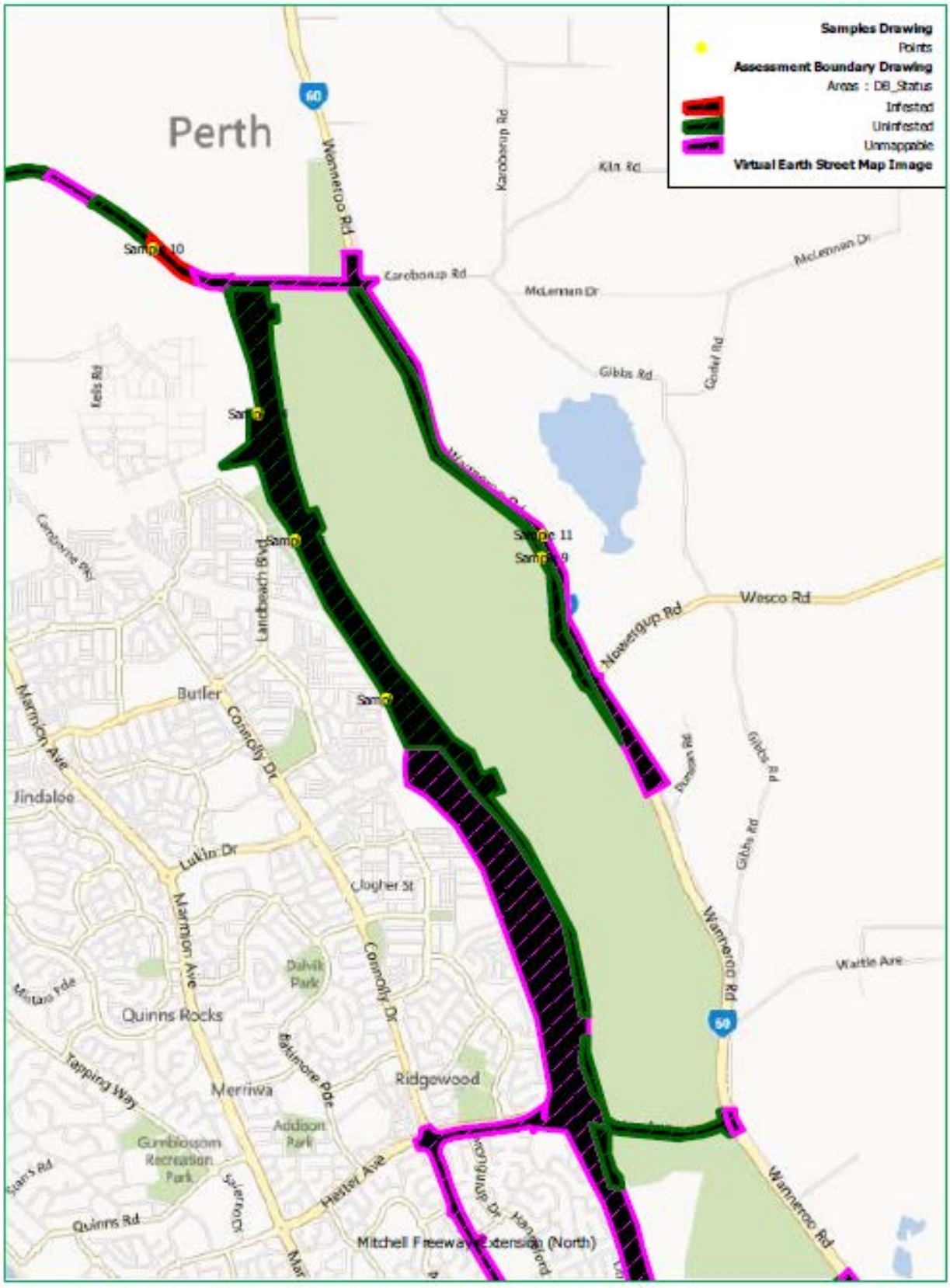

Figure 8. Dieback Mapping Stage 2 Geotechnical Works

APPENDIX A

GHD 2013 Black Cockatoo Assessment

Main Roads Western Australia

Mitchell Freeway Extension

Black Cockatoo Assessment

September 2013

Executive summary

The Mitchell Freeway provides the primary road access route from the Perth north-west corridor towards the City of Perth. The freeway currently terminates at Burns Beach Road. The freeway has been constructed in several stages since the 1960s, with further extensions and widening works planned. The Mitchell Freeway extension has been the subject of a planning process undertaken by Main Roads Western Australia (Main Roads).

Preliminary desktop investigations for the proposed project identified the potential presence of suitable habitat for two threatened Black Cockatoo species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Wildlife Conservation Act 1950* (WC Act) within the Study Area:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*)

Main Roads commissioned GHD Pty Ltd (GHD) to conduct a targeted Black Cockatoo assessment for the proposed Mitchell Freeway extension and associated works between Burns Beach Road and Romeo Road. The Study Area includes the corridor and other associated works required between Burns Beach Road and Romeo Road as part of the Mitchell Freeway Extension Project (proposed Project). The Study Area is approximately 437.3 ha in total.

Desktop Assessment

An EPBC Act Protected Matters Report was generated, for the matters of significance that may occur in, or may relate to, the Study Area. The database search identified the potential presence of two of the threatened Black Cockatoo species occurring within 10 km of the study area:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) – Endangered
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) – Vulnerable

The NatureMap database search also identified the potential presence of the Carnaby's Black Cockatoo and the Baudin's Black Cockatoo, both listed as Threatened (Schedule 1) under the WC Act, within 10 km of the Study Area.

According to the current modelled distribution of the Carnaby's Black Cockatoo (DSEWPaC 2012), the Study Area is located within the non-breeding range and partially within the breeding range of the species. Mapping provided by the Department of Planning Western Australia (2011) identify two known roosting sites east of Wanneroo Road, less than 2 km from the Study Area. There are no known breeding or roosting sites recorded within the Study Area (Department of Planning Western Australia 2011). The Study Area is located outside of the current modelled distribution for the Baudin's Black Cockatoo (DSEWPaC 2012). It is therefore considered highly unlikely that the Baudin's Black Cockatoo will utilise habitat present within the Study Area.

Field Assessment

The Black Cockatoo assessment was undertaken according to the EPBC Act referral guidelines for three threatened Black Cockatoo species: Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii* subsp. *naso*) (DSEWPaC 2012). The field assessment was undertaken by two GHD ecologists over a series of nine days between May and July 2013. The assessment involved visual and aural assessment of the site to identify actual and potential

breeding trees, foraging habitat, roosting areas, current activity and any other signs of use by Black Cockatoos.

The field assessment identified the following:

- Six broad fauna habitat types have been identified in the Study Area based on the predominant landforms, soil and vegetation structure in the area.
- Generally, all the areas containing remnant native vegetation within the Study Area can be considered to represent suitable Black Cockatoo foraging habitat as they all contain plant species documented as foraging habitat. The most dominant/obvious species include *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah), *E. todtiana* (coastal blackbutt), *Corymbia calophylla* (marri), *Banksia grandis*, *B. menziesii*, *B. attenuata*, *B. sessilis* and *Allocasuarina fraseriana* (sheoak). Based on the data collected during the flora and vegetation survey (GHD 2013), the areas of best quality foraging habitat can be regarded as those areas having the highest density and widest range of documented foraging plant species. Areas which had been cleared or contained planted species (both native and introduced) along the road verges generally did not contain suitable foraging species.
- In total, there was 207.01 ha of suitable feeding habitat identified within the Study Area.
- The most commonly observed evidence was that of the Carnaby's Cockatoo in the form of chewed marri nuts and chewed-off branches and nuts from *Banksia* species. The results illustrate that Carnaby's Cockatoos forage extensively across the Study Area.
- The Tuart woodlands, and to a lesser extent, the Jarrah–*Banksia* woodlands mapped within the Study Area are considered to be the most valuable habitat types in terms of providing potential breeding habitat.
- The significant tree assessment identified a total of 836 trees with a diameter at breast height (DBH) of >500 mm within the Study Area. This consisted of 547 *Eucalyptus gomphocephala* (tuart), 197 *E. marginata* (jarrah), 62 *Corymbia calophylla* (marri) and 30 stags (dead trees). The majority (574 – 68%) of the trees were observed to not contain hollows of any size. A total of 65 (8%) of the trees contained one or more "small" hollows (<5 cm entrance size). These hollows are not currently considered to be suitable for Black Cockatoos to use for nesting purposes. A total of 198 (24%) trees contained at least one medium and/or large sized hollow (>5 cm) which may provide suitable breeding habitat now, or in the near future. Of these, 45 trees contained suitable hollows which were considered to provide excellent nesting habitat. None of the trees containing large hollows showed evidence of current or past use by Black Cockatoos. However, of the 45 identified, suitability for breeding is high.
- Of the trees with hollows recorded, 13 were currently occupied by feral bees. During the early July surveys, a number of galahs and Australian ringneck parrots were observed occupying a number of the hollows in the Study Area as their breeding season begins.
- The potential for some trees within the Study Area to be used for overnight roosting exists with one tree identified during the survey as a potential roosting site.
- The Carnaby's Cockatoo was recorded within the Study Area during each site visit. Numbers of birds recorded at each sighting ranged from a pair of birds to flocks of over 100 individuals. Birds were observed either flying over the site, feeding in *Banksia* woodlands and shrublands, resting in trees and tall shrubs or heard calling in the nearby distance.

Significance of potential impacts

Based on the field assessment, the proposed Project has the potential to significantly impact the Carnaby's Black Cockatoo through the clearing of foraging habitat and clearing of potential roosting and breeding habitat. Where possible, measures should be implemented to minimise clearing and mitigate potential impacts.

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Appendix A – Figures

Appendix B – Conservation category codes & definitions

Appendix C – Survey data results

1. Introduction

The Mitchell Freeway provides the primary road access route from the Perth north-west corridor towards the City of Perth. The freeway currently terminates at Burns Beach Road. The freeway has been constructed in several stages since the 1960s, with further extensions and widening works planned. The Mitchell Freeway extension has been the subject of a planning process undertaken by Main Roads Western Australia (Main Roads). The Mitchell Freeway Extension Project (proposed Project) has been divided into three stages, including:

- Freeway extension from Burns Beach Road to Hester Avenue and the connecting roads (Neerabup Road and Hester Avenue): Planned for 2015–2017.
- Freeway extension from Hester Avenue to Romeo Road and connecting road (Romeo Road): Planned for 2017–2021.
- Wanneroo Road duplication from Joondalup Drive to hall Road: Planned for 2027–2029.

Preliminary desktop investigations for the proposed Project identified the potential presence of suitable habitat for two threatened Black Cockatoo species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Wildlife Conservation Act 1950* (WC Act) within the Study Area:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*)

Main Roads commissioned GHD Pty Ltd (GHD) to conduct a targeted Black Cockatoo assessment for the proposed Mitchell Freeway extension and associated works between Burns Beach Road and Romeo Road (proposed Project).

1.1 Purpose & scope

Information from the Black Cockatoo habitat assessment will be used to support an Environmental Impact Assessment (EIA) and subsequent State and Commonwealth approvals documentation, as required. This report provides an assessment of the presence of Black Cockatoos and/or suitable habitat within the Study Area.

The scope of this Black Cockatoo habitat assessment was to:

- Undertake a database and literature review of relevant sources
- Undertake a field assessment to assess and record the extent of suitable Black Cockatoo foraging, breeding and roosting habitat within the Study Area
- Identify the presence or potential presence of Black Cockatoos within the Study Area or immediate surrounds
- Quantify the extent of Black Cockatoo habitat within the Study Area.

1.2 Study Area

The Study Area includes the corridor and other associated works required between Burns Beach Road and Romeo Road as part of the proposed Project. The total Study Area is approximately 437.3 ha.

The Study Area boundary is shown on Figure 1, Appendix A.

1.3 Legislative framework

Flora and fauna within Western Australian are protected under both Federal and State legislation.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. These are defined in the EPBC Act as matters of national environmental significance.

Wildlife Conservation Act 1950 (WC Act)

The WC Act is Western Australia's principle biodiversity conservation legislation. Under the Act, individual species of plants and animals are protected, with the level of protection depending on whether or not the species is recognised as Threatened.

Department of Parks and Wildlife Priority Species Lists

In Western Australia, the Department of Parks and Wildlife (DPaW) (formerly the Department of Environment and Conservation – DEC) produces a supplementary list of Priority Flora and Priority Fauna; these being species which are considered to be poorly known, uncommon, or under threat, but for which there is insufficient justification on the basis of known distribution and population sizes for listing under the WC Act. These species have no special legislative protection, but their presence would normally be considered relevant to an assessment of the conservation status of an area. Such taxa may need further survey and evaluation of conservation status, before consideration can be given to declaration as Threatened flora.

A description of the conservation codes under the EPBC Act, WC Act and DPaW Priority listings are provided in Appendix B.

1.4 Report limitations & assumptions

This report has been prepared by GHD for Main Roads and may only be used and relied on by Main Roads for the purpose agreed between GHD and Main Roads as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Main Roads arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Main Roads and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Methodology

2.1 Desktop assessment

Prior to the field assessment a review of publically available databases was conducted, this desktop assessment included:

- A review of the DPaW and Western Australian Museum (WAM) NatureMap database
- A review of the Department of the Environment (DotE) (formerly the Department of Sustainability Environment Water Population and Communities – DSEWPaC) EPBC Act Protected Matters database
- Literature review of reports and available documents regarding the target species in the area
- Collation of existing data on known locations of breeding and feeding birds and night roost locations.

2.2 Field assessment

The Black Cockatoo assessment was undertaken according to the EPBC Act referral guidelines for three threatened Black Cockatoo species: Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii* subsp. *naso*) (DSEWPaC 2012).

The Black Cockatoo habitat assessment was undertaken by two GHD ecologists over a series of nine days between May and July 2013. The assessment involved visual and aural assessment of the site to identify potential breeding trees, foraging habitat, roosting areas, current activity and any other signs of use by Black Cockatoos.

Information collected during the field survey included:

1. Identification of foraging habitat.

   The location and extent of suitable Black Cockatoo foraging habitat was identified and mapped for the Study Area, based on the vegetation associations and presence/absence of known foraging species. During the field surveys any direct or indirect evidence of foraging by cockatoos was recorded.

2. Identification of potential breeding and roosting habitat.

   All trees within the Study Area were assessed for the potential to contain or develop suitable nesting hollows for Black Cockatoos. Suitable breeding habitat for Black Cockatoos is defined by DSEWPaC (2012) as trees of species known to support breeding within the range of the species which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm (DSEWPaC 2013). The location of suitable breeding trees with a DBH >500 mm was recorded in the Study Area and are referred to as 'Significant Trees'. Additionally details of tree species, size and number of hollows observed, evidence of use and any other significant observations were recorded for each tree.

3. Observations

   Opportunistic observations (both visual and aural) for the presence of Black Cockatoos within the Study Area and surrounding region were also noted during the survey.

The above information was used to map and calculate the amount of feeding habitat, potential breeding habitat and roost sites within the Study Area.

2.3 Survey limitations

The DSEWPaC Protected Matters Search Tool (PMST) database is used to identify species listed under the EPBC Act and draws on various sources to report on the potential of the species occurrence within an area. The DSEWPaC PMST is broad-scale in its reporting and often the specific habitat requirements of the species do not occur, or are unlikely to occur, within a Study Area. For this reason not all species reported by the search tool need to be considered in management decisions. The DEC NatureMap database reports on actual records of the species within the designated area and can provide more accurate information of the likelihood of species presence. Neither data base can be considered exhaustive.

The majority of the Study Area was accessible; however, there were two small fenced areas adjacent to the railway that could not be accessed during this survey. Trees within these areas could not be assessed for suitability as roosting or breeding habitat. It is recommended that these areas are accessed during the spring flora survey.

The assessment of tree hollows from ground level can result in an over estimation of hollow numbers as the full characteristics of each hollow cannot be clearly identified (i.e. size and depth of hollow).

This assessment was undertaken outside of the known breeding season for Black Cockatoos therefore actual breeding events could not be recorded. All breeding trees (i.e. those with existing hollows and >500 mm DBH) were recorded and considered as potential breeding opportunities.

3. Desktop assessment

3.1 Database review

An EPBC Act Protected Matters Report was generated for the matters of significance that may occur in, or may relate to, the Study Area. The database search identified the potential presence of two of the threatened Black Cockatoo species occurring within 10 km of the study area:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) – Endangered
- Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) – Vulnerable

The NatureMap database search also identified the potential presence of the Carnaby's Black Cockatoo and the Baudin's Black Cockatoo, both listed as Threatened (Schedule 1) under the WC Act, within 10 km of the Study Area.

According to NatureMap, there are numerous records of Carnaby's Black Cockatoo within and surrounding the Study Area. There are only three records of Baudin's Black Cockatoo occurring within 10 km of the Study Area, two at Lake Joondalup and another approximately 6 km south-east of the Study Area.

3.2 Literature review

3.2.1 Carnaby's Black Cockatoo

Description

Carnaby's Black Cockatoo is a large cockatoo that in adult form measures 53 to 58 cm in length, with a wingspan of approximately 110 cm, and a mass of 520 to 790 g. It is mostly brownish-black or greyish-black in colour but has narrow off-white margins on the feather; a large patch over the ear coverts that is off-white or cream to brownish-white in males and yellowish-white (and slightly larger) in females; and broad white panels in the tail. It has a large bill that is black or greyish-black in males and off-white to greyish white with a black tip in females. In both sexes the iris is dark brown or reddish-brown but the ring of skin that surrounds the eye is bright pink in males and grey or dark grey in females (DSEWPaC 2013).

Distribution

Carnaby's Black Cockatoo inhabits a large area of south-west Western Australia, extending from Kalbarri south-east to Cape Arid. It occurs mostly in the Wheatbelt, in areas that receive between 300 and 750 mm of rainfall annually, but is also found in wetter regions in the extreme south-west (including the Swan Coastal Plain and the southern coast) (DSEWPaC 2013).

Breeding mainly occurs in the Wheatbelt, from the Stirling Ranges north-west to near Three Springs, but has also been recorded on the coastal plain to the south-west, around Bunbury (Higgins 1999; Saunders 1974b cited in DSEWPaC 2013). There are several small resident populations on the northern Swan Coastal Plain at Boonanarring, Mooliabeenee and Yanchep National Park and on the southern Swan Coastal Plain at Lake Clifton, near Bunbury and potentially Baldivis. At each of these sites the birds forage in remnant bushland and in adjacent pine plantations (Johnstone et al. 2008 cited in DSEWPaC 2013).

Habitat

Foraging

The Carnaby's Black Cockatoo forages in native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as *Banksia* spp. (including formerly *Dryandra*

spp.), *Hakea* spp. and *Grevillea* spp. They also forage in pine plantations (*Pinus* pp.), eucalypt woodland and forest that contain foraging species, individual trees and small stands of these species. Common food items include seeds, flowers and nectar of native proteaceous species, eucalypts and Callistemon. Also seeds of introduced species including *Pinus* spp., *Erodium* spp., wild radish, canola, almonds and pecan nuts; insects and insect larvae and occasionally flesh and juice of apples and persimmons (DSEWPaC 2012).

Breeding

The Carnaby's Black Cockatoo generally breeds in woodland or forest, but also breeds in former woodland or forest now present as isolated trees. Nesting mainly occurs in hollows in smooth-barked eucalypts (salmon gum – *Eucalyptus salmonophloia* – and wandoo – *E. wandoo*) but also in tuart (*E. gomphocephala*), jarrah (*E. marginata*), flooded gum (*E. rudis*), York gum (*E. loxophleba* subsp. *loxophleba*), powderbark (*E. accedens*), karri (*E. diversicolor*) and marri (*C. calophylla*) (DSEWPaC 2012). Nest hollows range from 2.5-12 m above ground and the size of the entrance from 23-30 cm and depth of hollows from 1-2.5 m (Johnstone and Storr 1998).

Roosting

During the non-breeding season, when most of the cockatoos are on the Swan Coastal Plain, they roost in tall native or introduced eucalypts and occasionally pines (DSEWPaC 2013). They generally roost in or near riparian environments or natural and artificial permanent water sources. Species utilised for roosting include flat-topped yate *E. occidentalis*, salmon gum, wandoo, marri, blackbutt (*E. patens*), tuart, introduced eucalypts (e.g. blue gum) and introduced pines. Flocks may use several different night roosts across the year, with major night roosts typically used for a period of weeks or until the local foraging resources are exhausted (DSEWPaC 2012). Roost sites may be repeatedly used over multiple years (DSEWPaC 2013). Night roosts are generally located in the tallest trees in an area (DSEWPaC 2012).

Conservation status

The Carnaby's Black Cockatoo is listed as Endangered under the EPBC Act and Threatened (Schedule 1) under the WC Act.

Over the last 50 years most of the feeding habitat of Carnaby's Black Cockatoo has been destroyed by agricultural clearing. Any suitable habitat that remains is fragmented, and often degraded by soil salinity and weed invasion. Feeding habitat is often so far away from nests that the growth rate and survival of nestlings is significantly reduced. The original food sources for Carnaby's Black Cockatoo on the Swan Coastal Plain have been largely replaced by urban development and introduced pine plantations that are to be reduced significantly in the future. Additionally, as they require old trees with large hollows for nesting, it would take many decades for trees planted now to become suitable (Burbidge 2004).

Occurrence in the Study Area & surrounding region

According to the current modelled distribution of the Carnaby's Black Cockatoo (DSEWPaC 2012), the Study Area is located within the non-breeding range and partially within the breeding range of the species.

Mapping provided by the Department of Planning Western Australia (2011) identify two known roosting sites east of Wanneroo Road, less than 2 km from the Study Area.

There are no known breeding or roosting sites recorded within the Study Area (Department of Planning Western Australia 2011).

3.2.2 Baudin's Black Cockatoo

Description

Baudin's Black-Cockatoo is a large cockatoo that measures 50 to 57 cm in length, with a wingspan of approximately 110 cm, and a mass of 560 to 770 g. It is mostly dull black in colour, with pale whitish margins on the feathers, large, rounded patches (white to yellowish-white in the female and dusky-white to brownish-white in the male) on the ear coverts, and rectangular white panels in the tail. It has a large bill (with a very elongated upper mandible) that is coloured black in the male and whitish-grey with a black tip in the female; a dark brown iris that is surrounded by a reddish-pink eye-ring in the male and a grey eye-ring in the female; a short, rounded, erectile crest; and grey feet (Higgins 1999; Johnstone & Storr 1998 cited in DSEWPaC 2013)

Distribution

The Baudin's Black Cockatoo is found only in the extreme south-west of Western Australia. The range of the species, which is generally bounded by the 750 mm isohyet, extends from Albany northwards to Gidgegannup and Mundaring and inland to the Stirling Ranges and near Boyup Brook (Davies 1966; Saunders 1974, 1979; Saunders et al. 1985; Storr 1991 cited in DSEWPaC 2013). Breeding has been recorded in the far south of the range, in an area extending from Nornalup northward to near Bridgetown, or sometimes further north to Lowden and Harvey (Higgins 1999; Saunders 1979; Storr 1991 cited in DSEWPaC 2013). The occurrence of the species varies throughout its range, from scarce to moderately common.

The southern and northern limits of the species, from Albany to Mundaring, are for the most part connected by extensive tracts of forest (Saunders 1979 cited in DSEWPaC 2013). This, together with the dispersion of recent records, suggests that overall, the distribution of Baudin's Black-Cockatoo is not particularly fragmented. However, there is said to be considerable fragmentation of the habitat at the southern limits of the distribution, where the continuity of the population is probably dependent upon a relatively narrow strip of coastal forest (Blyth 2005, pers. comm. cited in DSWEPaC 2013).

Habitat

Foraging

The Baudin's Black Cockatoo forages on eucalypt woodlands and forest, and proteaceous woodland and heath. During the breeding season they feed primarily on native vegetation, particularly marri. Outside the breeding season, they may feed in fruit orchards (mostly apple and pear, but also persimmon) and tips of *Pinus* spp. (DSEWPaC 2013).

Common food items include mostly marri (seeds, flowers, nectar and grubs) and proteaceous trees and shrubs. Also other native sees and introduced frits; insects and insect larvae; pith of kangaroo paw Anigozanthos flavidus; juice of ripe persimmons; tips of *Pinus* spp. and seeds of apples and pears (DSEWPaC 2012).

Breeding

The Baudin's Black Cockatoo generally breeds in woodland or forest, but may also breed in former woodland or forest now present as isolated trees. They nest in hollows in live or dead trees of karri, marri, wandoo and tuart (DSEWPaC 2012).

Roosting

The Baudin's Black Cockatoo generally roosts in or near riparian environments or other permanent water sources. Suitable roosting trees species include jarrah, marri, flooded gum,

blackbutt, tuart, and introduced eucalypts including blue gum and lemon scented gum (*Corymbia citriodora*).

Conservation status

The Baudin's Black Cockatoo is listed as Vulnerable under the EPBC Act and Threatened (Schedule 1) under the WC Act.

Loss of habitat was formerly the major threat to Baudin's Black Cockatoo. Up to a quarter of the original habitat for this species has been cleared for agriculture (Burbidge 2004). The major threats to the species at present appear to be illegal shooting and competition with introduced bees for nest hollows (J. Blyth 2005, pers. comm. cited in DSEWPaC 2013).

Occurrence in the Study Area & surrounding region

The Study Area is located outside of the current modelled distribution for the Baudin's Black Cockatoo (DSEWPaC 2012). It is therefore considered highly unlikely that the Baudin's Black Cockatoo will utilise habitat present within the Study Area.

4. Field assessment

4.1 Habitat types

Six broad fauna habitat types were identified in the Study Area based on the predominant landforms, soil and vegetation structure in the area. These habitat types are as follows:

- Low heathland
- *Banksia* woodland
- Tuart woodland
- *Banksia sessilis* tall shrubland
- Jarrah–*Banksia* woodland
- Planted roadside vegetation/highly disturbed/cleared.

In addition to the habitat types above, approximately 27 ha was identified as a mosaic of Banksia woodland and low heathland or Banksia woodland and tuart woodland. The amount of each habitat type present within the Study Area and its suitability as Black Cockatoo habitat is provided in Table 1. Habitat mapping of the Study Area is provided in Figure 1, Appendix A.

Table 1 Summary of habitat types within the Study Area

Habitat type	Potential food species	Density of food species	Potential breeding habitat	Potential roosting habitat	Total area (ha)
Low heathland	*Banksia sessilis*, *B. attenuata*, *Grevillea* spp. and *Hakea* spp.	Scattered/ patchy	None	None	21.31
Banksia woodland	*B. menziesii*, *B. attenuata*, *B. grandis*, *B. sessilis*, *Eucalyptus todtiana*, *Allocasuarina fraseriana*, *Eucalyptus* spp., and *Grevillea* spp.	Dominant species	None	None	90.56
Tuart woodland	*E. gomphocephala*, *Banksia* spp., *Allocasuarina fraseriana*, *Hakea lissocarpha*, *Grevillea* spp. and occasional *E. marginata* and *C. calophylla*.	Dominant species	Suitable	Potential	55.61
Banksia sessilis tall shrubland	*B. sessilis* and *Hakea trifurcata.*	Dominant species	None	None	5.96
Jarrah–*Banksia* woodland	*E. marginata*, *B. attenuata*, *B. menziesii* and *Allocasuarina fraseriana.*	Dominant species	Limited	Potential	12.74
Planted roadside vegetation/highly disturbed/cleared	Planted eucalypts.	None to very scattered	None	None	223.87

Habitat type	Potential food species	Density of food species	Potential breeding habitat	Potential roosting habitat	Total area (ha)
Mosaic[i] of *Banksia* woodland and low heathland					23.69
Mosaic[i] of *Banksia* woodland and tuart woodland					3.63
Total					**437.3**

[i] Mosaics are vegetation/habitat units with more than one vegetation/habitat type within them. These mosaics are examples of "structurally and floristically different vegetation[/habitat] types within one map unit that are not uniquely tied together ecologically (e.g. are part of the patterning of the landscape)" (ESCAVI 2003). These mosaics occur because occurrences of each vegetation/habitat type are smaller than the scale of the minimum mapping unit (i.e. 1:10,000).

4.2 Black Cockatoo foraging habitat

The broad habitat types (based on vegetation structure/composition) are shown in Figure 1, Appendix A. Generally, all the areas containing remnant native vegetation within the Study Area can be considered to represent suitable Black Cockatoo foraging habitat as they all contain plant species documented as foraging habitat. The most dominant/obvious species include *Eucalyptus gomphocephala*, *E. marginata*, *E. todtiana*, *Corymbia calophylla*, *Banksia grandis*, *Banksia menziesii*, *Banksia attenuata*, *Banksia sessilis* and *Allocasuarina fraseriana*. Based on the data collected during the flora and vegetation survey (GHD 2013), the areas of best-quality foraging habitat can be regarded as those areas having the highest density and widest range of documented foraging plant species (see Table 1). Areas which had been cleared or contained planted species (both native and introduced) along the road verges generally did not contain suitable foraging species.

In total, there was 207.01 ha of suitable foraging habitat identified within the Study Area. Suitable foraging habitat is mapped in Figure 2, Appendix A.

The location and nature of Black Cockatoo foraging evidence observed during the survey is provided in Appendix C. The observations were only made opportunistically and do not represent all the evidence present at the time of the survey. The most commonly observed evidence was that of the Carnaby's Black Cockatoo in the form of chewed marri nuts and chewed off branches and nuts from *Banksia* species. The results illustrate that Carnaby's Black Cockatoos forage across the Study Area extensively.

4.3 Black Cockatoo breeding habitat

According to mapping provided by DSEWPaC (2012) the Study Area is located within the known breeding range for the Carnaby's Black Cockatoo. During the field survey, suitable breeding habitat for the Carnaby's Black Cockatoo was identified within the Study Area. The Tuart woodlands and, to a lesser extent, the Jarrah–*Banksia* woodlands mapped within the Study Area are considered to be the most valuable habitat types in terms of providing potential breeding habitat.

The significant tree assessment identified a total of 833 trees with a diameter at breast height (DBH) of >500 mm within or immediately adjacent to the Study Area. This consisted of 546 *Eucalyptus gomphocephala* (tuart), 196 *E. marginata* (jarrah), 61 *Corymbia calophylla* (marri) and 30 stags (dead trees). The majority (570, 68%) of the trees were observed to not contain hollows of any size. A total of 60 (7%) of the trees contained one or more "small" hollows (<5 cm entrance size), these hollows are not currently considered to be suitable for Black Cockatoos to use for nesting purposes but maybe in the future. A total of 198 (24%) trees contained at least one medium and/or large sized hollow (>5 cm) which may provide suitable breeding habitat now, or in the near future. Of these, 45 trees contained suitable hollows which were considered to provide excellent nesting habitat. None of the trees containing large hollows showed evidence of current or past use by Black Cockatoos. However, of the 45 identified, suitability for breeding is high.

Of the trees with hollows recorded, 13 were currently occupied by feral bees. During the early July surveys, a number of galahs and Australian ringneck parrots were observed occupying a number of the hollows in the Study Area as their breeding season begins. Additionally one hollow was observed being prepared by western long-billed corella. Feral bees, galahs, corella and parrots are known threats to Black Cockatoos as they face competition for hollows to nest in.

Details of the trees with a DBH of >500 mm identified during the survey are provided in Appendix C. The location of these trees is mapped on Figure 3, Appendix A.

4.4 Black Cockatoo roosting habitat

A roost is an area or site with a roost tree or a number of roost trees where Black Cockatoos congregate at dusk to rest overnight. A night roost can include tall trees (>8 m height) within 1 km of the central roosting area of larger roost sites (>150 cockatoos) and within 500 m for smaller roost sites (<150 cockatoos) (Glossop et al. 2011). Typically, night roost sites have a standing water source nearby for drinking which may be a natural waterway or lake but constructed lakes, farm dams and stock water troughs are also used (Glossop et al. 2011).

One tree recorded during the survey was identified as a potential roosting site. The Study Area provides suitable roosting habitat based on the presence of suitable roosting trees, close proximity of known roosting sites (Department of Planning 2011) and presence of suitable foraging habitat. Although there is no standing water within the Study Area, there are a number of lake systems in the nearby area, including Lake Joondalup to the south and Neerabup and Nowergup lakes to the east.

4.5 Cockatoo sightings

The Carnaby's Black Cockatoo was recorded within the Study Area during each site visit. Numbers of birds recorded at each sighting ranged from a pair of birds to flocks of over 100 individuals. Birds were observed either flying over the site, feeding in *Banksia* woodlands and shrublands, resting in trees and tall shrubs or heard calling in the nearby distance.

The location of each cockatoo sighting is provided in Appendix C.

4.6 Habitat on a regional scale

The south-west region is now a severely fragmented landscape and the further loss of foraging habitat, the lack of suitable breeding sites, climate change, alterations in the landscape, changing forest structure with almost every part of the Jarrah-Marri forest logged in the past and with most trees too young to form hollows, and competition with exotic species all exacerbate the future conservation of Black Cockatoos (Johnstone and Kirkby 2010).

Much of the remaining bushland on the Swan Coastal Plain portion of the Perth metropolitan region is in the north-west corridor, around Tamala Park/Burns Beach, Neerabup and north of Alkimos. However most of this land is zoned for urban development and is being planned, subdivided and gradually cleared. This includes *Banksia* shrublands and woodlands that are seasonal foraging resources for the Carnaby's Black Cockatoo. Pine plantations have also provided an important food source for Carnaby's Black Cockatoos since the 1940s. The nearby Gnangara, Pinjar and Yanchep pine plantations have provided a source of stability in an otherwise disappearing and fragmenting landscape. The area between Gnangara and Yanchep is primarily rural with pockets of native bushland.

Although large areas of foraging habitat is present in the surrounding region, this includes pine plantations that are gradually being removed and other areas where habitat is threatened by land use change. Bushland on the northern Swan Coastal Plain would be considered to be increasingly important to the future of the Carnaby's Black Cockatoo given:

- The species is reported as breeding in or near Yanchep National Park, and, therefore, retaining food resources nearby is additionally significant
- The current and future loss of the pine plantations that have acted as a key food source and roosting habitat for the species, so retaining other foraging grounds is additionally important.

5. Discussion

The Study Area was identified as containing suitable foraging habitat and potential breeding and roosting habitat for the Endangered Carnaby's Black Cockatoo. This species was observed multiple times within the Study Area during the field surveys.

A total of 207.01 ha of foraging habitat was identified within the Study Area. Generally, all the areas containing remnant native vegetation can be considered to represent suitable Black Cockatoo foraging habitat as they all contain plant species documented as foraging habitat. The areas of best quality foraging habitat can be regarded as those areas having the highest density and widest range of documented foraging plant species (see Table 1). Areas which had been cleared or contained planted species (both native and introduced) along the road verges generally did not contain suitable foraging species. The remnant native vegetation remaining within the Study Area and surrounding region is considered to provide significant foraging habitat for this species in an area that is currently under threat from accelerated clearing for urban development.

Black Cockatoo species breed in hollows in very long-lived trees. Hollows large enough for nesting Black Cockatoos are usually only found in trees that are more than 200 years old (DSEWPaC 2012). The size of the tree (measured as DBH) can be a useful indication of the hollow-bearing potential of the tree. In a woodland stand of trees of suitable diameter at breast height, all trees of all ages and size are potentially important for maintaining breeding in the long term through maintaining the integrity of the habitat and allowing for recruitment of trees to provide future nest hollows. Maintaining the long-term supply of trees of a size to provide suitable nest hollows is particularly important in woodland stands that are known to support cockatoo breeding (DSEWPaC 2012). The significant tree assessment identified a total of 833 trees within the Study Area with a DBH of >500 mm, of which 198 (24%) contained at least one medium or large sized hollow. A total of 45 of the hollow-bearing trees recorded during the survey was considered to be currently suitable for Black Cockatoo nesting.

The majority of significant trees were identified within the Tuart and Jarrah–*Banksia* woodlands mapped within the Study Area. The Tuart woodlands and to a lesser extent, the Jarrah–*Banksia* woodlands mapped within the Study Area are considered to be the most valuable habitat types in terms of providing potential breeding habitat for Black Cockatoos. Although it is unclear whether Black Cockatoos currently breed within the Study Area, a number of the hollow-bearing trees do provide suitable nesting habitat. There are natural water sources in the nearby region, including Lake Joondalup, Neerabup Lake and Nowergup Lake and birds can access suitable foraging habitat in the surrounding nature reserves and National Parks. The potential for some trees within the Study Area to be used for overnight roosting exists with one tree identified during the survey as a potential roosting site.

The Carnaby's Black Cockatoo usually breeds in the northern Wheatbelt areas and then moves west to forage in at major food sources on the northern Swan Coastal Plain during the non-breeding season (Johnstone and Kirkby 2010). However, the habitat used for breeding by Carnaby's Black Cockatoo has shifted considerably southwards and westwards in recent times. Tuart forests of the Swan Coastal Plain appear now to form part of its breeding habitat and this species has been recorded breeding at the nearby Yanchep National Park (Johnstone et al. 2003, Johnstone and Kirkby 2010). On the Swan Coastal Plain, most nests are in Tuart (Johnstone and Kirkby 2010). It has been noted that a number of nest trees used by Carnaby's Black Cockatoos are estimated to be between 300 and 500 years old (Western Australian Museum 2012). This highlights the importance of retaining existing trees with hollows or hollow-forming potential. Large trees are not only important for breeding, but also for roosting by Carnaby's Black Cockatoos.

5.1 Significance of potential impacts

5.1.1 Risk referral table

Referral to DSEWPaC under the EPBC Act is triggered if a proposed action has, or potentially has, a significant impact on any Matter of National Environmental Significance (MNES), including National Heritage values. The presence of the Carnaby's Black Cockatoo which is listed as Endangered under the EPBC Act is considered a MNES.

In October 2012, DSEWPaC released the referral guidelines for the assessment of projects for potential impacts on Black Cockatoos (DSEWPaC 2012). These guidelines are for all three threatened Black Cockatoo species and, while they do not provide information relative to particular areas of the State, they provide information to decide whether a project may trigger referral.

Within these guidelines, DSEWPaC provides a risk table that gives guidance on what it views as risks/impacts to Black Cockatoos that will trigger referral. Risk is broken into three categories (high, uncertain and low) and primarily focuses on direct impacts (i.e. to breeding, feeding and roosting areas) as well as indirect impacts. If there is uncertainty in regards to risks on Black Cockatoos then DSEWPaC recommends referring the project or contacting the DSEWPaC to ensure legal certainty.

The risk referral table is shown in Table 2 with an assessment of the Project against each of the potential risks. This assessment identified the Project is at risk of causing significant impacts on the Carnaby's Black Cockatoo due to the presence of foraging habitat and presence of potential roosting and breeding habitat.

Table 2 Department of Sustainability, Environment, Water, Population and Communities risk referral table for Black Cockatoos

Risk type	Referral trigger
High risk of significant impacts: referral to DSEWPaC recommended	
Clearing of any known nesting tree.	No currently known nesting trees. A targeted cockatoo assessment undertaken during the breeding season (Sept/Oct) would identify current use of the Study Area for breeding.
Clearing of any part or degradation of breeding habitat in a woodland or forest within a species' known breeding range.	Yes, referral will be triggered as potential breeding habitat was identified within the Study Area which is within the known breeding range of the Carnaby's Black Cockatoo.
Clearing of more than 1 ha of quality foraging habitat.	Yes referral will be triggered. 207.01 ha of foraging habitat was identified within the Study Area.
Creating a gap or greater than 4 km between patches of Black Cockatoo habitat (breeding, foraging or roosting).	No, referral is not triggered.
Clearing or degradation (including pruning of top canopy) of a known roosting site.	Referral may be triggered. One potential roosting site was identified in the Study Area.
Uncertainty: referral recommended or contact the DSEWPaC	
Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat.	Yes referral will be triggered. The project will impact on more than 1 ha of good quality foraging habitat.
Clearing or disturbance in areas surrounding Black Cockatoo habitat that has the potential to degrade habitat through introduction of invasive species, edge effect, hydrological	Referral is likely to be triggered.

Risk type	Referral trigger
changes, increase human visitation or fire.	
Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows.	Yes referral will be triggered. The clearing of suitable nesting hollows would reduce the amount of available nesting habitat, increasing competition for remaining hollows in the area.
Actions with the potential to introduce known plant diseases such as Phytophthora spp.	Referral is unlikely to be triggered; *Phytophthora* is known to occur widely in the region and may already be present at the site. Management measures should be implemented to reduce the risk of introduction and spread of Phytophthora.
Low risk of significant impacts: referral may not be required but may refer to DSEWPaC for legal certainty	
Actions that do not affect Black Cockatoo habitat or individuals.	Not applicable
Actions whose impacts occur outside the modelled distribution of the three Black Cockatoos.	Not applicable

6. Conclusion & recommendations

The desktop assessment identified the potential presence of two threatened Black Cockatoo species within the Study Area, the Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) listed as Endangered under the EPBC Act and Threatened under the WC Act and the Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) which is listed as Vulnerable under the EPBC Act and Threatened under the WC Act. According the modelled distribution of these species (DSEWPaC 2012), the Study Area is located within the non-breeding range and partially within the breeding range of the Carnaby's Black Cockatoo and is outside of the currently modelled distribution for the Baudin's Black Cockatoo. Therefore, it is considered highly unlikely that the Baudin's Black Cockatoo will utilise habitat present within the Study Area.

The Carnaby's Black Cockatoo was recorded multiple times in the Study Area during the field surveys. Numbers of birds recorded at each sighting ranged from a pair of birds to flocks of over 100 individuals.

Based on the habitat definitions provided in the referral guidelines (DSEWPaC 2012), the majority of remnant native vegetation within the Study Area represents suitable foraging habitat for Black Cockatoos. A total of 207.01 ha of suitable foraging habitat was identified in the Study Area. Feeding activity by Carnaby's Black Cockatoos was observed throughout the Study Area, predominantly on marri nuts and *Banksia* species. The Study Area ranged in quality from poor to excellent in terms of their value as feeding habitats depending on the presence and density of suitable foraging species.

During the field survey, suitable breeding habitat for the Carnaby's Cockatoo was identified within the Study Area. The Tuart woodlands and to a lesser extent, the Jarrah–*Banksia* woodlands mapped within the Study Area are considered to be the most valuable habitat types in terms of providing potential breeding habitat. The significant tree assessment identified a total of 833 trees within the Study Area with a diameter at breast height (DBH) of >500 mm. This consisted of 546 *Eucalyptus gomphocephala* (tuart), 196 *E. marginata* (jarrah), 61 *Corymbia calophylla* (marri) and 30 stags (dead trees). None of the trees containing large hollows showed evidence of current or past use by Black Cockatoos. However, all are highly suitable as breeding trees.

Within the Study Area, one tree was identified as a potential roosting site. Suitable roosting habitat was identified in the Study Area based on the presence of suitable tall trees, close proximity of known roosting sites and presence of suitable foraging habitat (Department of Planning 2011). Although there is no standing water within the Study Area, there are a number of lake systems in the nearby area, including Lake Joondalup to the south and Neerabup and Nowergup lakes to the east.

An assessment of the Project against the risk referral triggers outlined in the risk referral table provided by DSEWPaC (2012) identified that the Project is at risk of causing a significant impact to Black Cockatoo habitat.

6.1 Recommendations

Based on the results of this Black Cockatoo assessment, it is recommended:

1. The final road design:
   - Avoids clearing of native vegetation wherever possible
   - Maximise the potential for the Study Area to continue to be utilised by Black Cockatoos during and following the Project

- Avoids locations of significant Black Cockatoo habitat trees and core foraging areas wherever possible
- Is selected to favour aligning within previously disturbed areas.

2. Rehabilitated areas maximise the ability to provide future foraging and nesting habitat.
3. No clearing should be undertaken during the Carnaby's Black Cockatoo breeding season (late July to late October) where possible. When clearing during the breeding season cannot be avoided, a pre-clearance survey should be undertaken to inspect hollows for nesting Black Cockatoos.
4. Undertake a breeding season (September/October) assessment of the 198 trees identified to have hollows greater than 5 cm. This data will assist in determining if Carnaby's Black Cockatoos are utilising the area for breeding.

7. References

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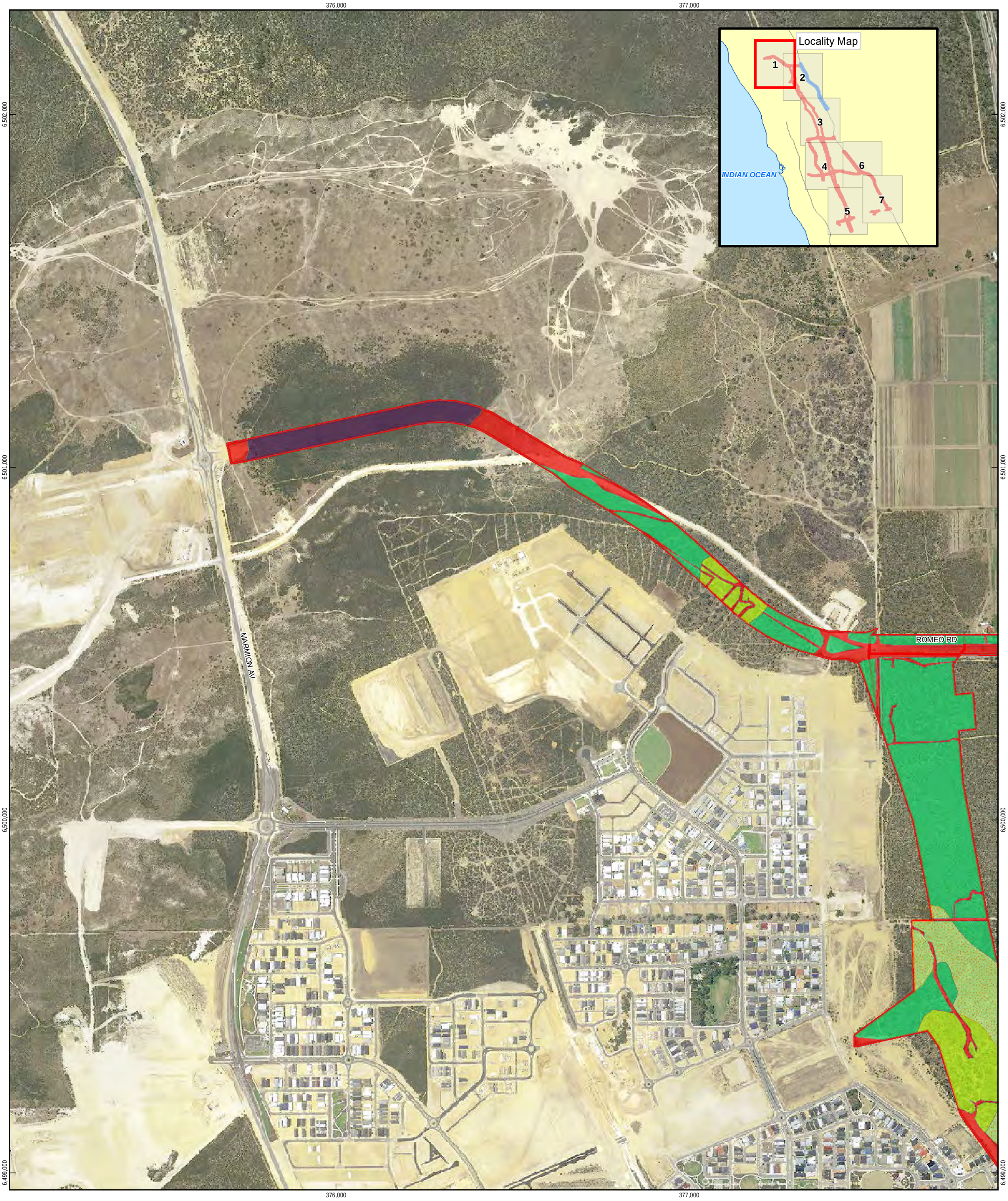
Appendices

Appendix A – Figures



LEGEND

Road

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

Habitat type

Banksia sessilis tall schrubland

Banksia woodland

Jarrah–*Banksia* woodland

Low heatland

Mosaic *Banksia* woodland and low heathland

Mosaic *Banksia* woodland and tuart woodland

Tuart woodland

Planted roadside vegetation / highly disturbed / cleared

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number 61-2943502
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Map Sheet 1 of 7

Fauna Habitat Types

Figure 1

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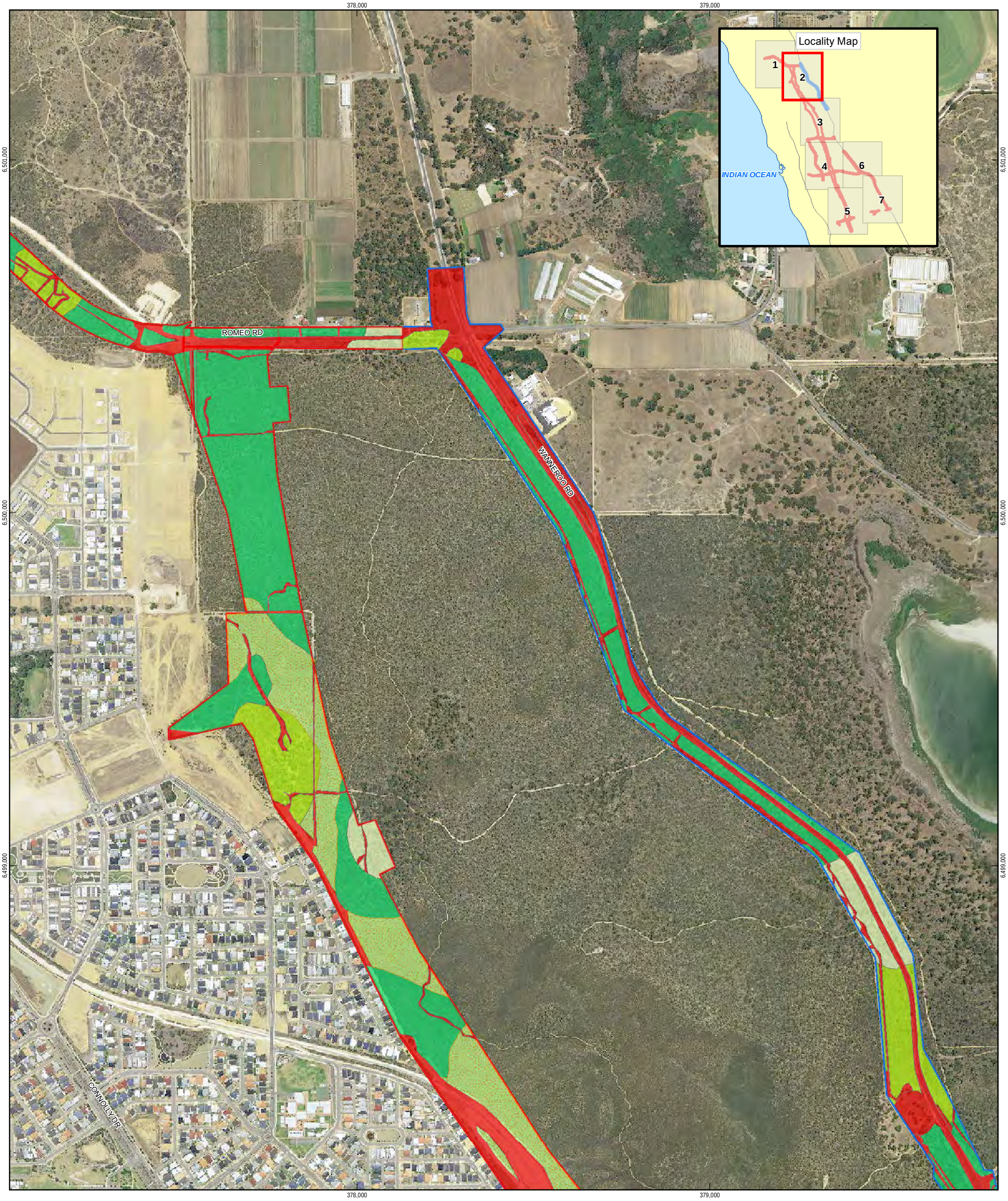
239 Adelaide Terrace Perth WA 6004 Australia **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: MRWA: Road - 20130530; GA: Topo 250k Series 3 - 2006; GHD: Study Area - 20130527, Habitat type - 20130730; Landgate: Metro Central Mosaic - 2013. Created by: slee2, vdinh



LEGEND

Road

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

Habitat type

Banksia sessilis tall schrubland

Banksia woodland

Jarrah–*Banksia* woodland

Low heatland

Mosaic *Banksia* woodland and low heathland

Mosaic *Banksia* woodland and tuart woodland

Tuart woodland

Planted roadside vegetation / highly disturbed / cleared

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

SLIP ENABLER

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Fauna Habitat Types

Job Number	61-2943502
Revision	0
Date	25 Sep 2013

Map Sheet 2 of 7

Figure 1

G:\61\29435\GIS\Maps\MXD\612943502_G001_Fig01_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

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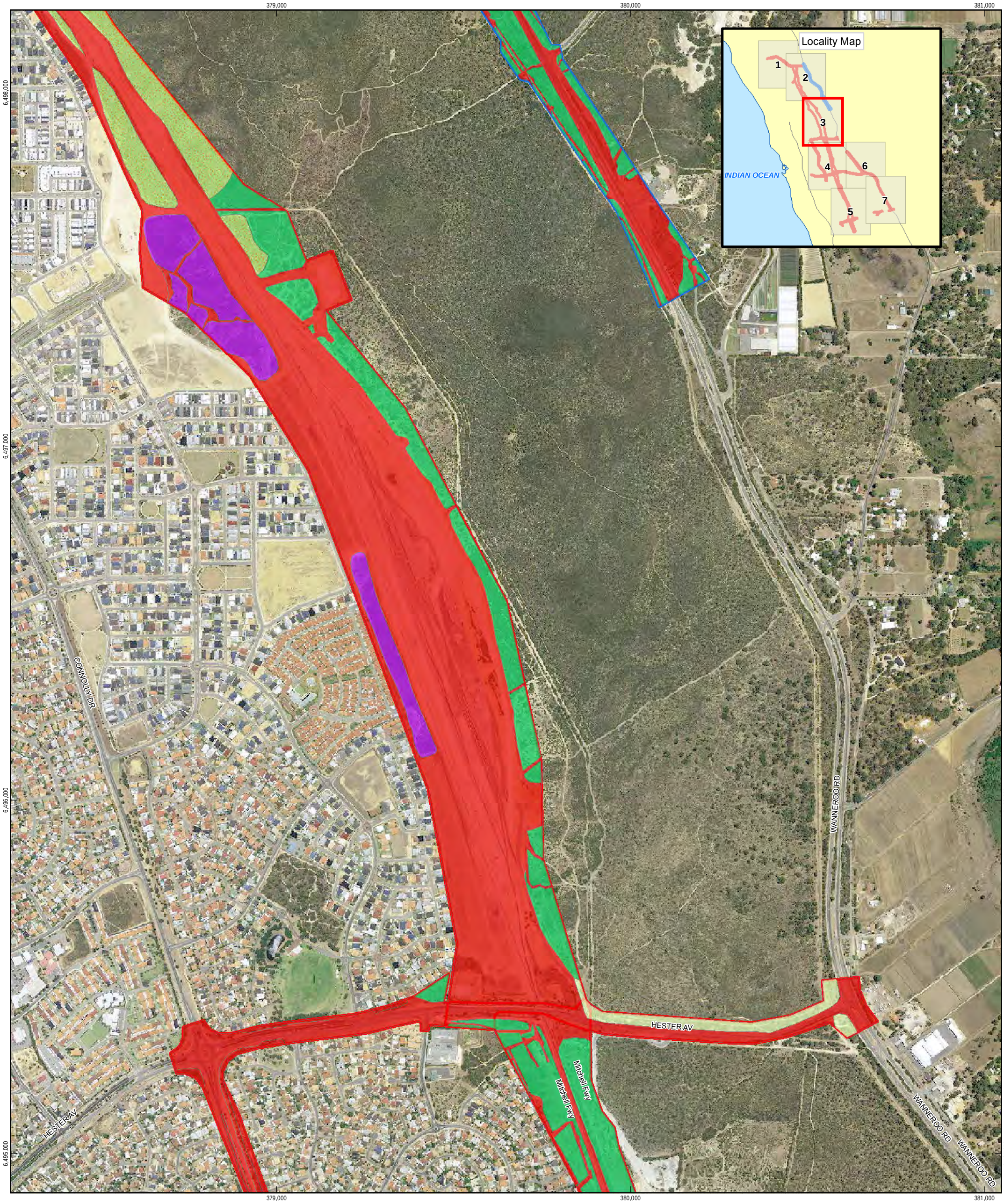

LEGEND

- Road
- **Study Area**
  - Proposed Dual Carriage Way
  - Proposed Extension and Upgrade Areas
- **Habitat type**
  - *Banksia sessilis* tall schrubland
  - *Banksia* woodland
  - Jarrah–*Banksia* woodland
  - Low heatland
  - Mosaic *Banksia* woodland and low heathland
  - Mosaic *Banksia* woodland and tuart woodland
  - Tuart woodland
  - Planted roadside vegetation / highly disturbed / cleared

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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GHD

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SLIP ENABLER

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

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Map Sheet 3 of 7

Fauna Habitat Types

Figure 1

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379,000 380,000 381,000

6,495,000 6,494,000 6,493,000 6,492,000

Locality Map

1 2 3 4 5 6 7

INDIAN OCEAN

WANNEROO RD

Mitchell Fwy

MARMION AV

CONNOLLY DR

LEGEND

Road

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

Habitat type

Banksia sessilis tall schrubland

Banksia woodland

Jarrah–*Banksia* woodland

Low heatland

Mosaic *Banksia* woodland and low heathland

Mosaic *Banksia* woodland and tuart woodland

Tuart woodland

Planted roadside vegetation / highly disturbed / cleared

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number 61-2943502
Revision 0
Date 25 Sep 2013

Map Sheet 4 of 7

Fauna Habitat Types

Figure 1

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Data source: MRWA: Road - 20130530; GA: Topo 250k Series 3 - 2006; GHD: Study Area - 20130527, Habitat type - 20130730; Landgate: Metro Central Mosaic - 2013. Created by: slee2, vdinh

381,000 382,000

6,491,000

6,490,000

6,489,000

CONNOLLY DR

Mitchell Fwy

BURNS BEACH RD

SUNLANDER DR

MARMION AV

Locality Map

1 2 3 4 5 6 7

INDIAN OCEAN

LEGEND

Road

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

Habitat type

Banksia sessilis tall schrubland

Banksia woodland

Jarrah–*Banksia* woodland

Low heatland

Mosaic *Banksia* woodland and low heathland

Mosaic *Banksia* woodland and tuart woodland

Tuart woodland

Planted roadside vegetation / highly disturbed / cleared

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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GHD

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Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number 61-2943502
Revision 0
Date 25 Sep 2013

Map Sheet 5 of 7

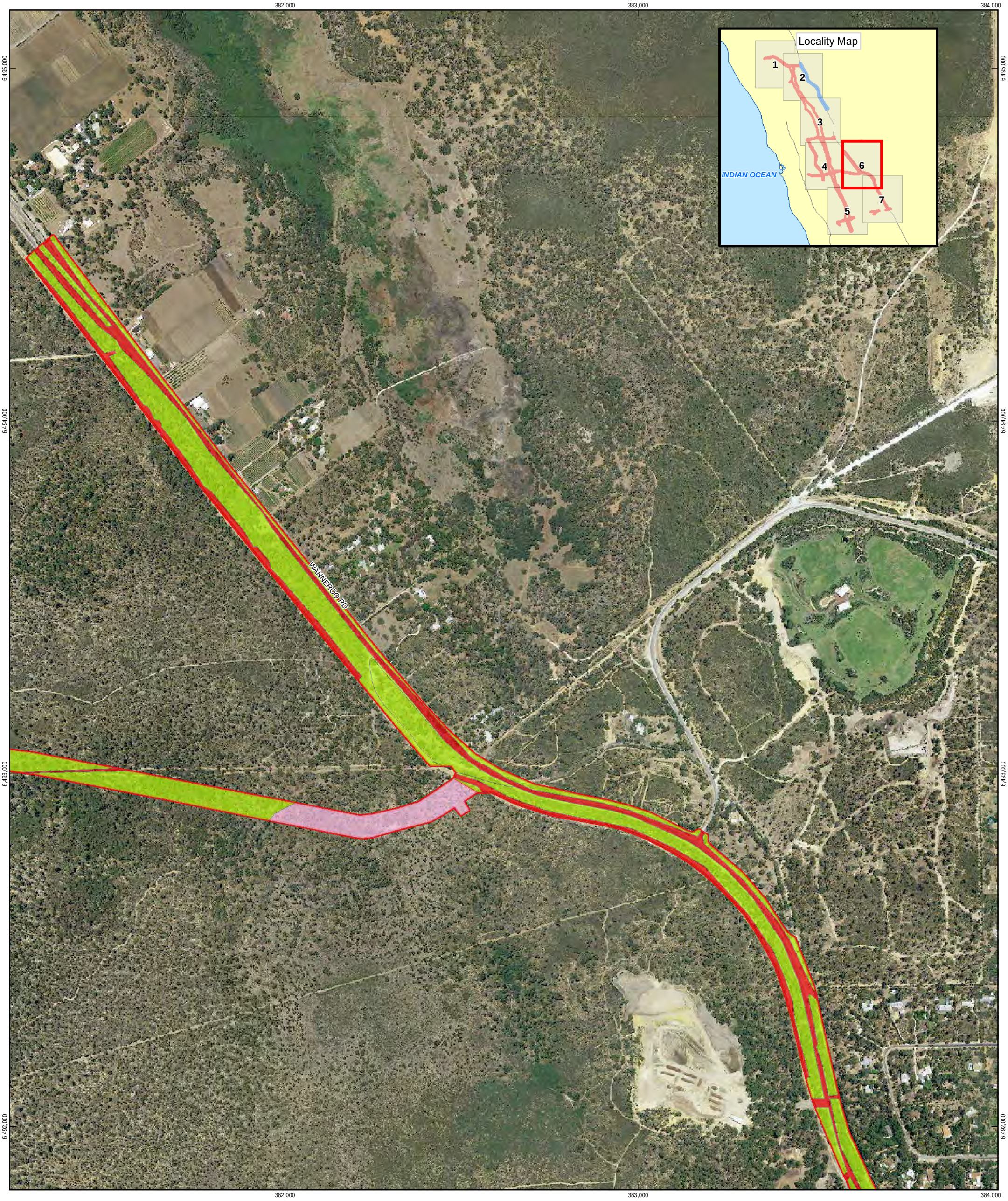
Fauna Habitat Types

Figure 1

G:\61\29435\GIS\Maps\MXD\612943502_G001_Fig01_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: MRWA: Road - 20130530; GA: Topo 250k Series 3 - 2006; GHD: Study Area - 20130527, Habitat type - 20130730; Landgate: Metro Central Mosaic - 2013. Created by: slee2, vdinh



LEGEND

Road

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

Habitat type

Banksia sessilis tall schrubland

Banksia woodland

Jarrah–*Banksia* woodland

Low heatland

Mosaic *Banksia* woodland and low heathland

Mosaic *Banksia* woodland and tuart woodland

Tuart woodland

Planted roadside vegetation / highly disturbed / cleared

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number 61-2943502
Revision 0
Date 25 Sep 2013

Map Sheet 6 of 7

Fauna Habitat Types

Figure 1

G:\61\29435\GIS\Maps\MXD\612943502_G001_Fig01_Rev0.mxd

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383,000 384,000 385,000

6,492,000 6,491,000 6,490,000

LEGEND

Road

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

Habitat type

Banksia sessilis tall schrubland

Banksia woodland

Jarrah–*Banksia* woodland

Low heatland

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Mosaic *Banksia* woodland and tuart woodland

Tuart woodland

Planted roadside vegetation / highly disturbed / cleared

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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Date	25 Sep 2013

Map Sheet 7 of 7

Fauna Habitat Types

Figure 1

G:\61\29435\GIS\Maps\MXD\612943502_G001_Fig01_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

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376,000

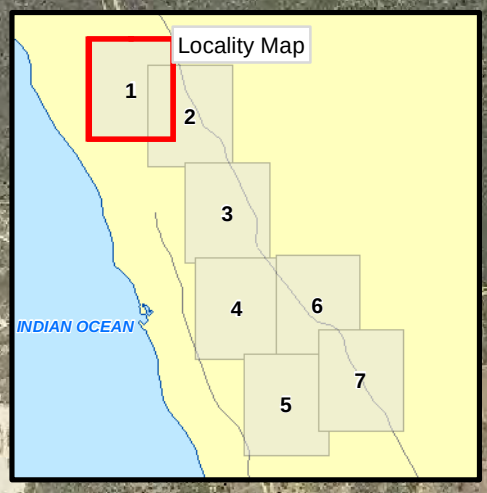
377,000

6,502,000

6,501,000

6,500,000

6,499,000



LEGEND

Cockatoo Foraging Habitat

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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GHD

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Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

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Revision	0
Date	25 Sep 2013

Map Sheet 1 of 7

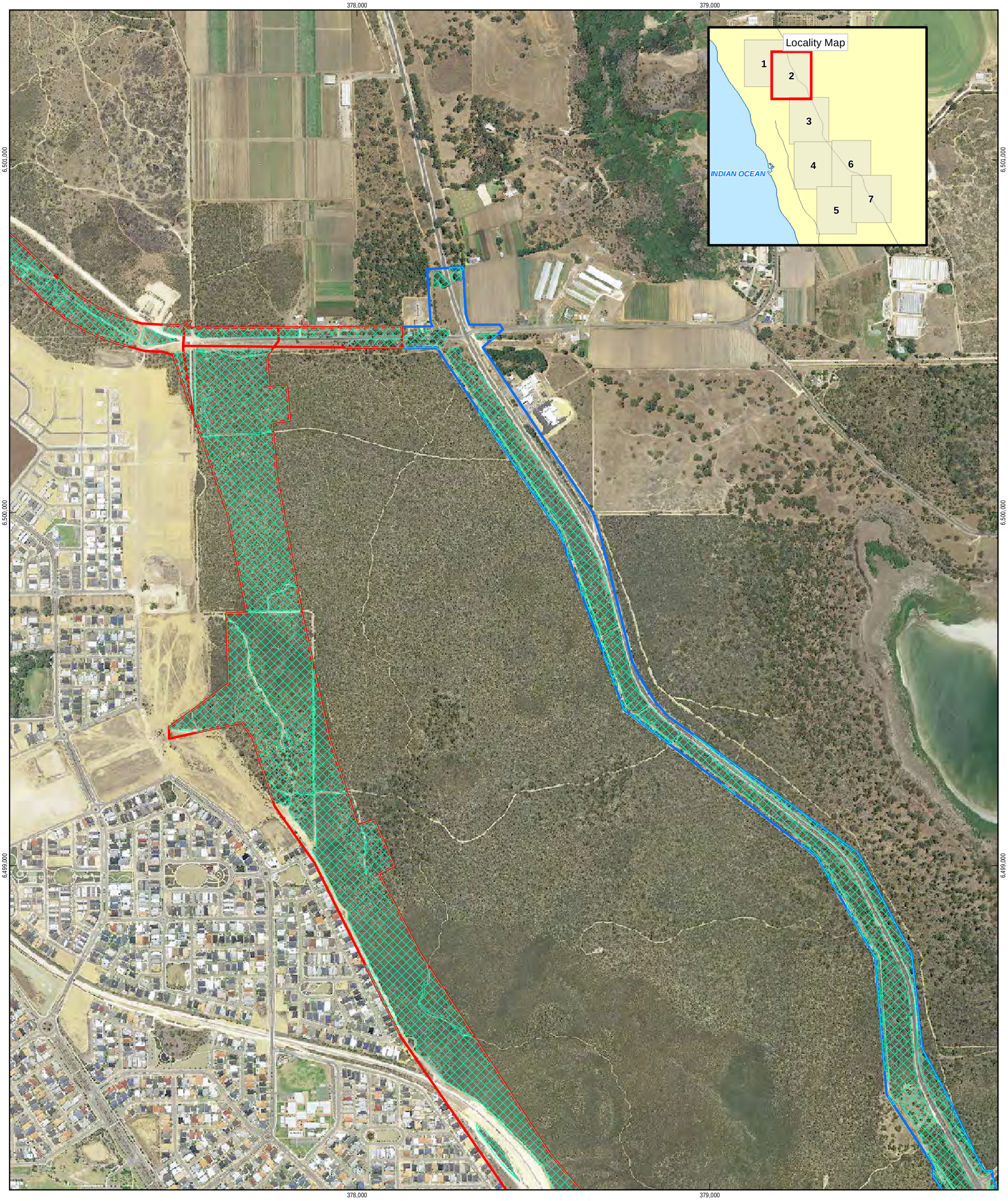
Cockatoo foraging habitat

Figure 2

G:\61\29435\GIS\Maps\MXD\612943502_G002_Fig02_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: GA: Topo 250k Series 3 - 2006; GHD:Study Area - 20130527, Cocckatoo Foraging Habitat - 20130801; Landgate: Metro Central Mosaic - 2013. Created by: slee2



LEGEND

Cockatoo Foraging Habitat

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number 61-2943502
Revision 0
Date 25 Sep 2013

Map Sheet 2 of 7

Cockatoo foraging habitat

Figure 2

G:\61\29435\GIS\Maps\MXD\612943502_G002_Fig02_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

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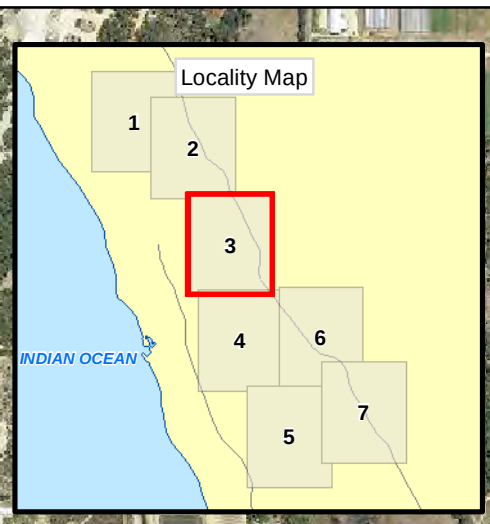
379,000 380,000 381,000

6,498,000 6,497,000 6,496,000 6,495,000



LEGEND

Cockatoo Foraging Habitat

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number 61-2943502
Revision 0
Date 25 Sep 2013

Map Sheet 3 of 7

Cockatoo foraging habitat

Figure 2

G:\61\29435\GIS\Maps\MXD\612943502_G002_Fig02_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

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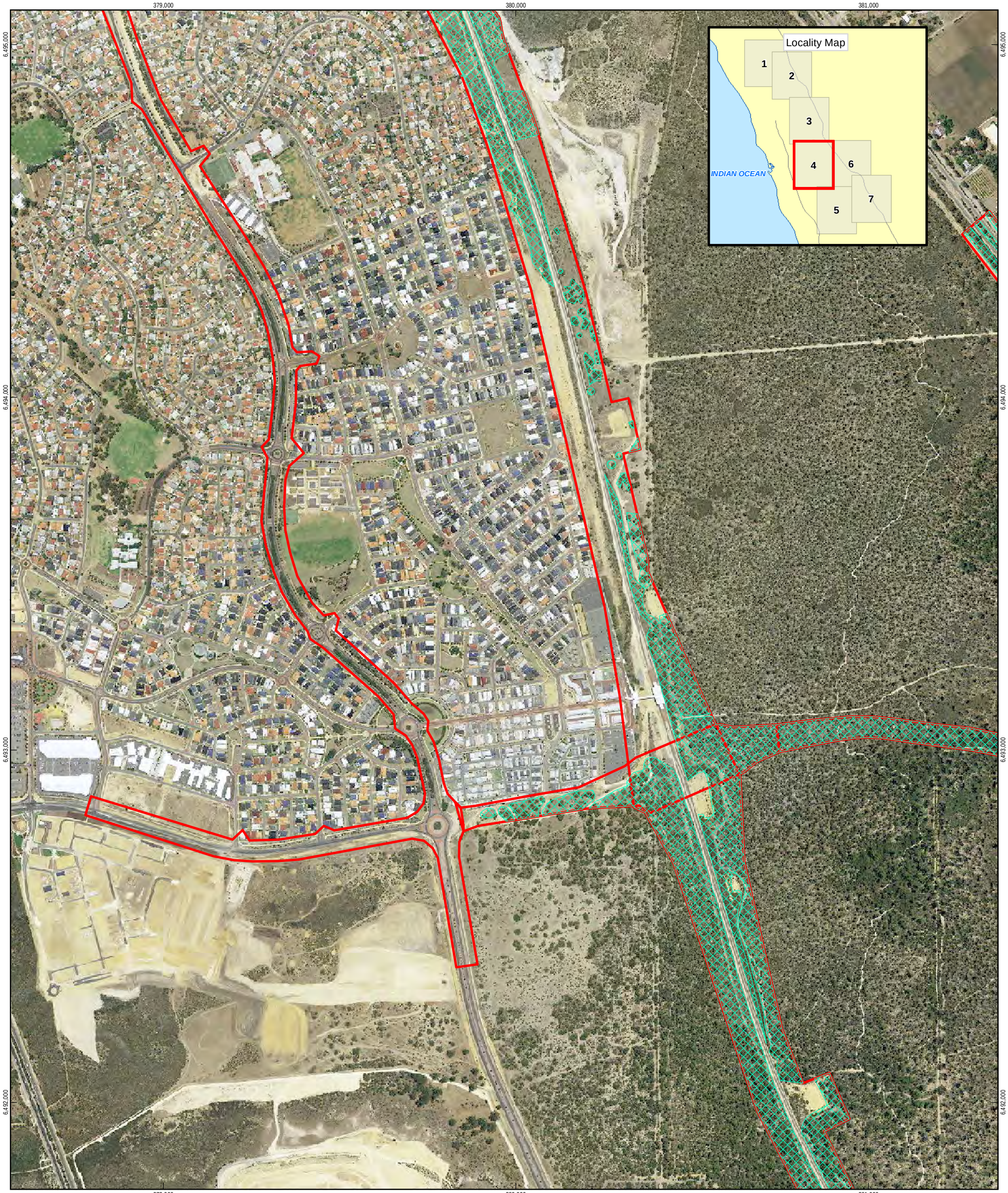

LEGEND

Cockatoo Foraging Habitat

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number	61-2943502
Revision	0
Date	25 Sep 2013

Map Sheet 4 of 7

Cockatoo foraging habitat

Figure 2

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239 Adelaide Terrace Perth WA 6004 Australia **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

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381,000 382,000

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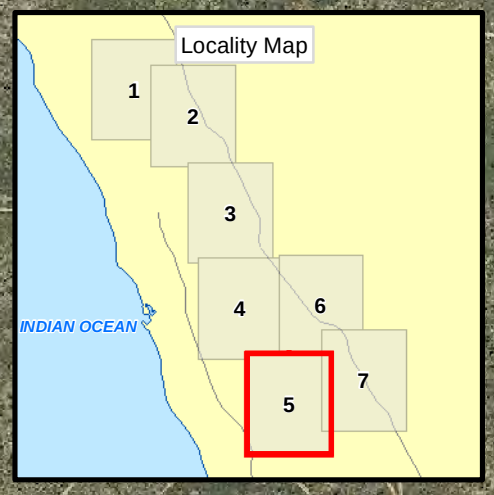

LEGEND

Cockatoo Foraging Habitat

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number	61-2943502
Revision	0
Date	25 Sep 2013

Map Sheet 5 of 7

Cockatoo foraging habitat

Figure 2

G:\61\29435\GIS\Maps\MXD\612943502_G002_Fig02_Rev0.mxd

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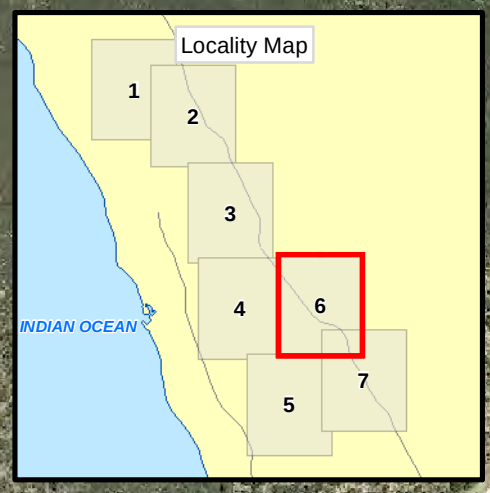
Data source: GA: Topo 250k Series 3 - 2006; GHD:Study Area - 20130527, Cocckatoo Foraging Habitat - 20130801; Landgate: Metro Central Mosaic - 2013. Created by: slee2

382,000 383,000 384,000

6,495,000 6,494,000 6,493,000 6,492,000



LEGEND

Cockatoo Foraging Habitat

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number 61-2943502
Revision 0
Date 25 Sep 2013

Map Sheet 6 of 7

Cockatoo foraging habitat

Figure 2

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239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: GA: Topo 250k Series 3 - 2006; GHD:Study Area - 20130527, Cocckatoo Foraging Habitat - 20130801; Landgate: Metro Central Mosaic - 2013. Created by: slee2

LEGEND

Cockatoo Foraging Habitat

Study Area

Proposed Dual Carriage Way

Proposed Extension and Upgrade Areas

1: 10,000 (at A3)

0 0.05 0.1 0.2 0.3 0.4 0.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number 61-2943502
Revision 0
Date 25 Sep 2013

Map Sheet 7 of 7

Cockatoo foraging habitat

Figure 2

G:\61\29435\GIS\Maps\MXD\612943502_G002_Fig02_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: GA: Topo 250k Series 3 - 2006; GHD:Study Area - 20130527, Cocckatoo Foraging Habitat - 20130801; Landgate: Metro Central Mosaic - 2013. Created by: slee2

377,000

6,501,000

349
348
347
346
345
342
343
344
341
340
338
339
337

ROMEO RD

481
482

SANTORINI PROM
BENENDEN AV
BENDEN AV
KELLS RD
BELLINI GDNS
MUSEO L
NEWBURY WY
ARTAL

6,500,000

Locality Map
INDIAN OCEAN
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

377,000

LEGEND

Tree Species
- Jarrah
- Marri
- Tuart
- Stag

Tree Caracteristics
- No hollows
- At least one medium or large sized hollow
- Provides suitable cockatoo hollows
- Potential roost site

Observations
- Carnaby's Black Cockatoo
- Evidence of foraging

Study Area
- Proposed Dual Carriage Way
- Proposed Extension and Upgrade Areas

1: 5,000 (at A3)

0 30 60 120 180 240

Meters

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

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Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

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Map Sheet 1 of 21

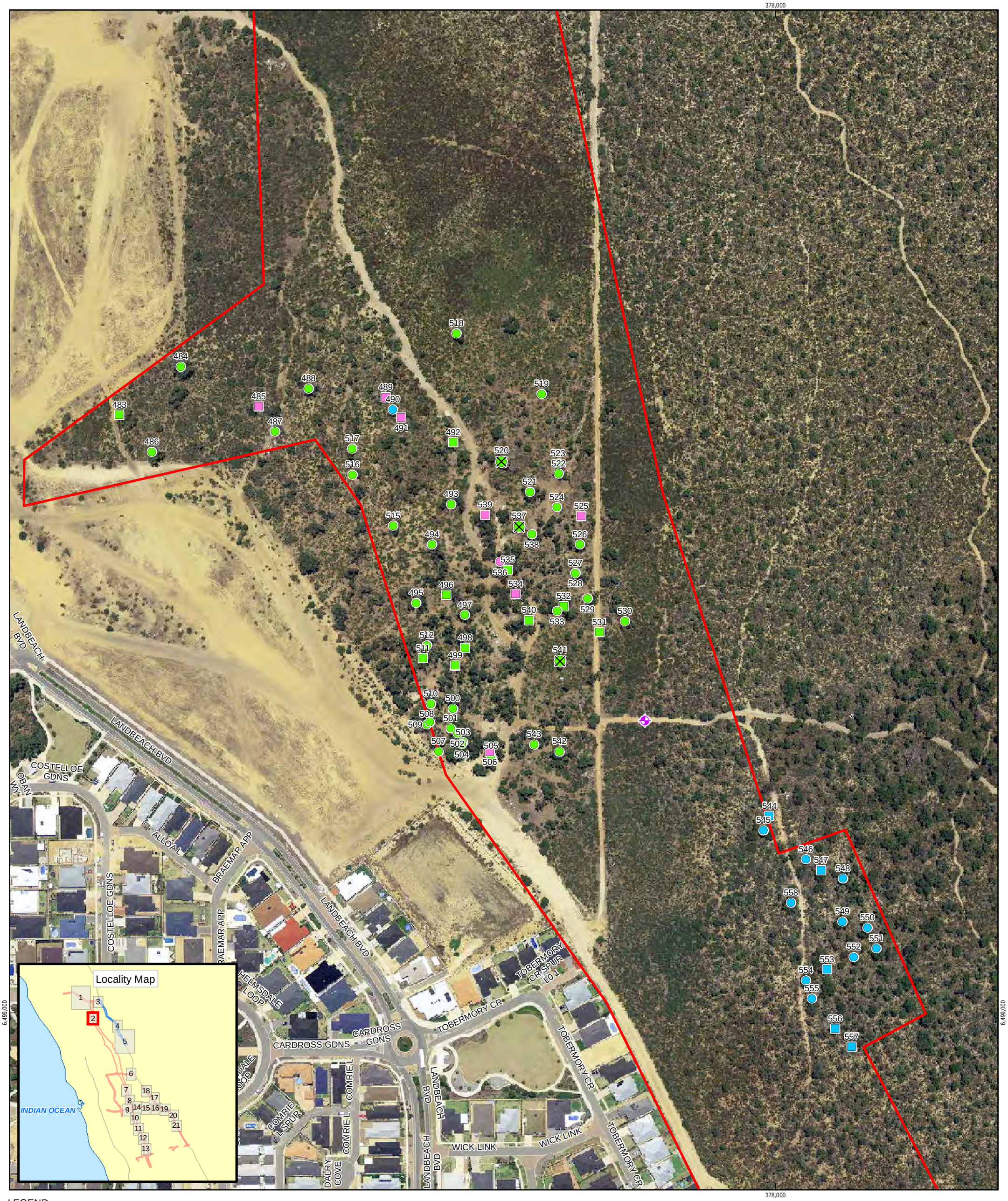
Significant Trees & Cockatoo Sightings

Figure 3

G:\61\29435\GIS\Maps\MXD\612943502_G003_Fig03_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: GA: Topo 250k Series 3 - 2006; GHD: Proposed Extention and Upgrade Areas - 20130527; Landgate: Metro Central Mosaic - 2013, Tree Caracteristics and Species - 20130730, Carnaby's Black Cockatoo - 20130730. Created by: vdinh



LEGEND

Tree Species

- Jarrah
- Marri
- Tuart
- Stag

Tree Caracteristics

- No hollows
- At least one medium or large sized hollow
- Provides suitable cockatoo hollows
- Potential roost site

Observations

- Carnaby's Black Cockatoo
- Evidence of foraging

Study Area

- Proposed Dual Carriage Way
- Proposed Extension and Upgrade Areas

1: 2,500 (at A3)

0 15 30 60 90 120

Meters

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number	61-2943502
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Date	25 Sep 2013

Map Sheet 2 of 21

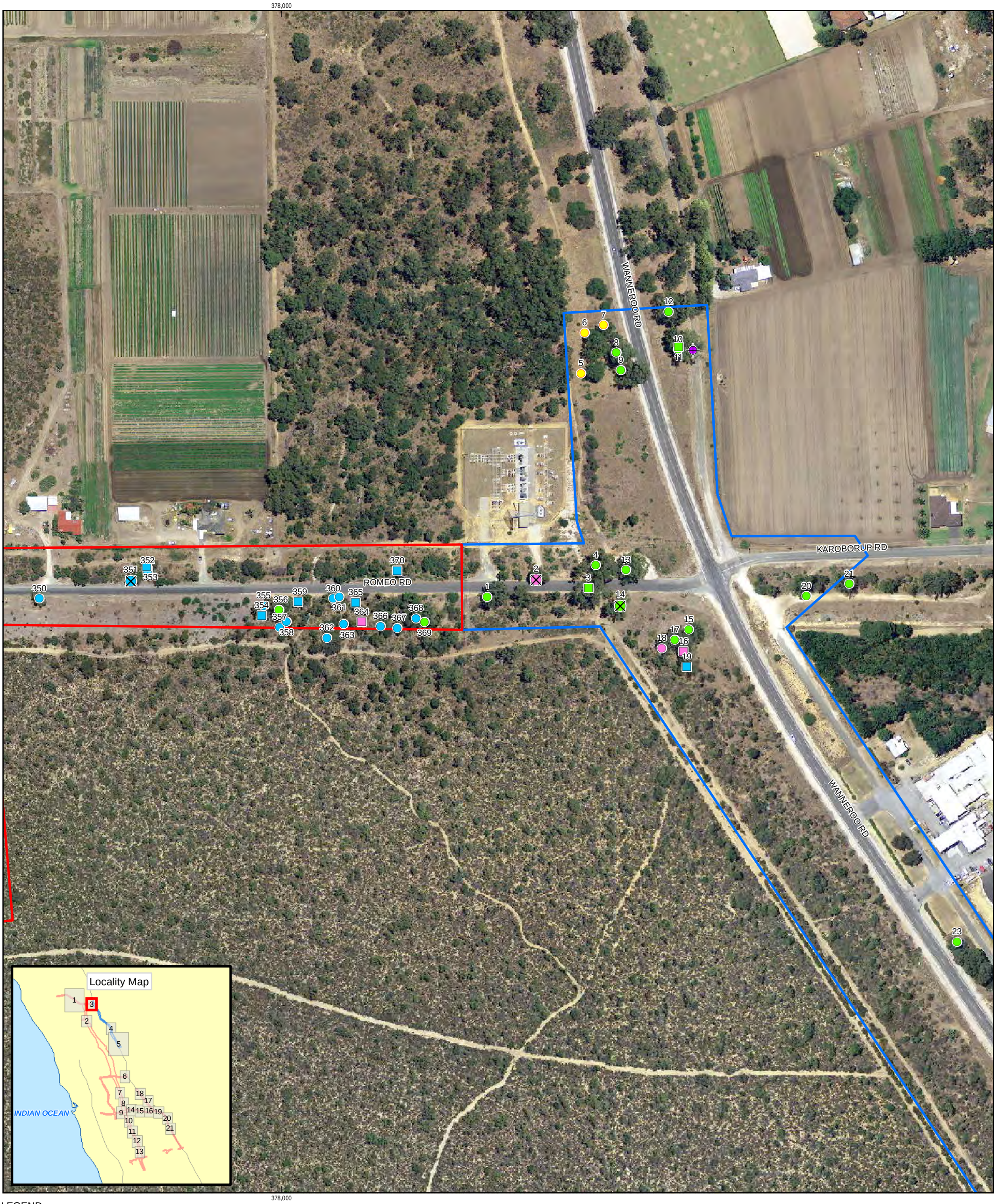
Significant Trees & Cockatoo Sightings

Figure 3

G:\61\29435\GIS\Maps\MXD\612943502_G003_Fig03_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: GA: Topo 250k Series 3 - 2006; GHD: Proposed Extention and Upgrade Areas - 20130527; Landgate: Metro Central Mosaic - 2013, Tree Caracteristics and Species - 20130730, Carnaby's Black Cockatoo - 20130730. Created by: vdinh



LEGEND

Tree Species

- Jarrah
- Marri
- Tuart
- Stag

Tree Caracteristics

- No hollows
- At least one medium or large sized hollow
- Provides suitable cockatoo hollows
- Potential roost site

Observations

- Carnaby's Black Cockatoo
- Evidence of foraging

Study Area

- Proposed Dual Carriage Way
- Proposed Extension and Upgrade Areas

1: 2,500 (at A3)

0 15 30 60 90 120

Meters

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number	61-2943502
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Map Sheet 3 of 21

Significant Trees & Cockatoo Sightings

Figure 3

G:\61\29435\GIS\Maps\MXD\612943502_G003_Fig03_Rev0.mxd

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6,499,000

6,499,000

WANNEROO RD

Locality Map

INDIAN OCEAN

LEGEND

Tree Species

- Jarrah
- Marri
- Tuart
- Stag

Tree Caracteristics

- No hollows
- At least one medium or large sized hollow
- Provides suitable cockatoo hollows
- Potential roost site

Observations

- Carnaby's Black Cockatoo
- Evidence of foraging

Study Area

- Proposed Dual Carriage Way
- Proposed Extension and Upgrade Areas

1: 2,500 (at A3)

0 15 30 60 90 120

Meters

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
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Revision 0
Date 25 Sep 2013

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Significant Trees & Cockatoo Sightings

Figure 3

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239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: GA: Topo 250k Series 3 - 2006; GHD: Proposed Extention and Upgrade Areas - 20130527; Landgate: Metro Central Mosaic - 2013, Tree Caracteristics and Species - 20130730, Carnaby's Black Cockatoo - 20130730. Created by: vdinh

380,000

6,498,000

6,497,000

NOWERGUP RD

WANNEROO RD

GIBBS RD

OCEAN TAVERN ACC

60

DUNSTAN RD

MANZAS PL

Locality Map

INDIAN OCEAN

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

LEGEND

Tree Species

- Jarrah
- Marri
- Tuart
- Stag

Tree Caracteristics

- No hollows
- At least one medium or large sized hollow
- Provides suitable cockatoo hollows
- Potential roost site

Observations

- Carnaby's Black Cockatoo
- Evidence of foraging

Study Area

- Proposed Dual Carriage Way
- Proposed Extension and Upgrade Areas

1: 5,000 (at A3)

0 30 60 120 180 240

Meters

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

SLIP ENABLER

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

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Revision	0
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Significant Trees & Cockatoo Sightings

Figure 3

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LEGEND

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- Proposed Extension and Upgrade Areas

1: 2,500 (at A3)

0 15 30 60 90 120

Meters

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

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GHD

mainroads WESTERN AUSTRALIA

SLIP ENABLER

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

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Significant Trees & Cockatoo Sightings

Figure 3

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380,000

6,494,000

LIBERTY DR SPUR
LIBERTY DR
LIBERTY DR
CHATTANOOGA VSTA
LIBERTY DR
ELMHURST DR
WINMORE WY
CHATTANOOGA VSTA
ASTOR LINK
ELMHURST DR
ELMHURST DR
POMONA WY
CHATTANOOGA VSTA
LIBERTY DR
ELMHURST DR
DEKLAB LINK
ELMHURST DR
CHATTANOOGA VSTA
ELY PL
ELMHURST DR
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CHATTANOOGA VSTA
CHATTANOOGA VSTA
HOYT L
SALISHAN ST
WHEELER LINK
SALISHAN ST
LIBERTY DR
CHATTANOOGA VSTA
HACIENDA DR
HACIENDA DR
GRANDOAK DR
LANTERN WY
HALL RD

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Locality Map
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
INDIAN OCEAN

380,000

6,494,000

LEGEND

Tree Species
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- Stag

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Meters
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Significant Trees & Cockatoo Sightings

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Horizontal Datum: Geocentric Datum of Australia
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GHD

mainroads WESTERN AUSTRALIA

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Significant Trees & Cockatoo Sightings

Figure 3

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380,000

6,493,000

ISLINGTON L SPUR
CHEROKEE GRN
CHEROKEE GRN SPUR
VERRADO WY
STANMORE PL
HATTON L SPUR
HATTON L
SIDCUP L SPUR
OCEAN KEYS BVD
PAVONIA LINK
LADERA DR
CELEBRATION BVD
HIGHBURY L
HIGHBURY L SPUR
PORTSLADE L
GAUDI WY
ORENCO BEND

559
371

683 685 681 684 682 686 680 679 678 687 688 689 673 672a 676 677 672b 668 671 693 674 692 690 691 675 670 664 665 666 667 669 694 695 696 697 699 698 700 701 702 703 704

Locality Map

INDIAN OCEAN

380,000

LEGEND

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Meters

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Significant Trees & Cockatoo Sightings

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381,000

6,492,000

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Meters

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Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

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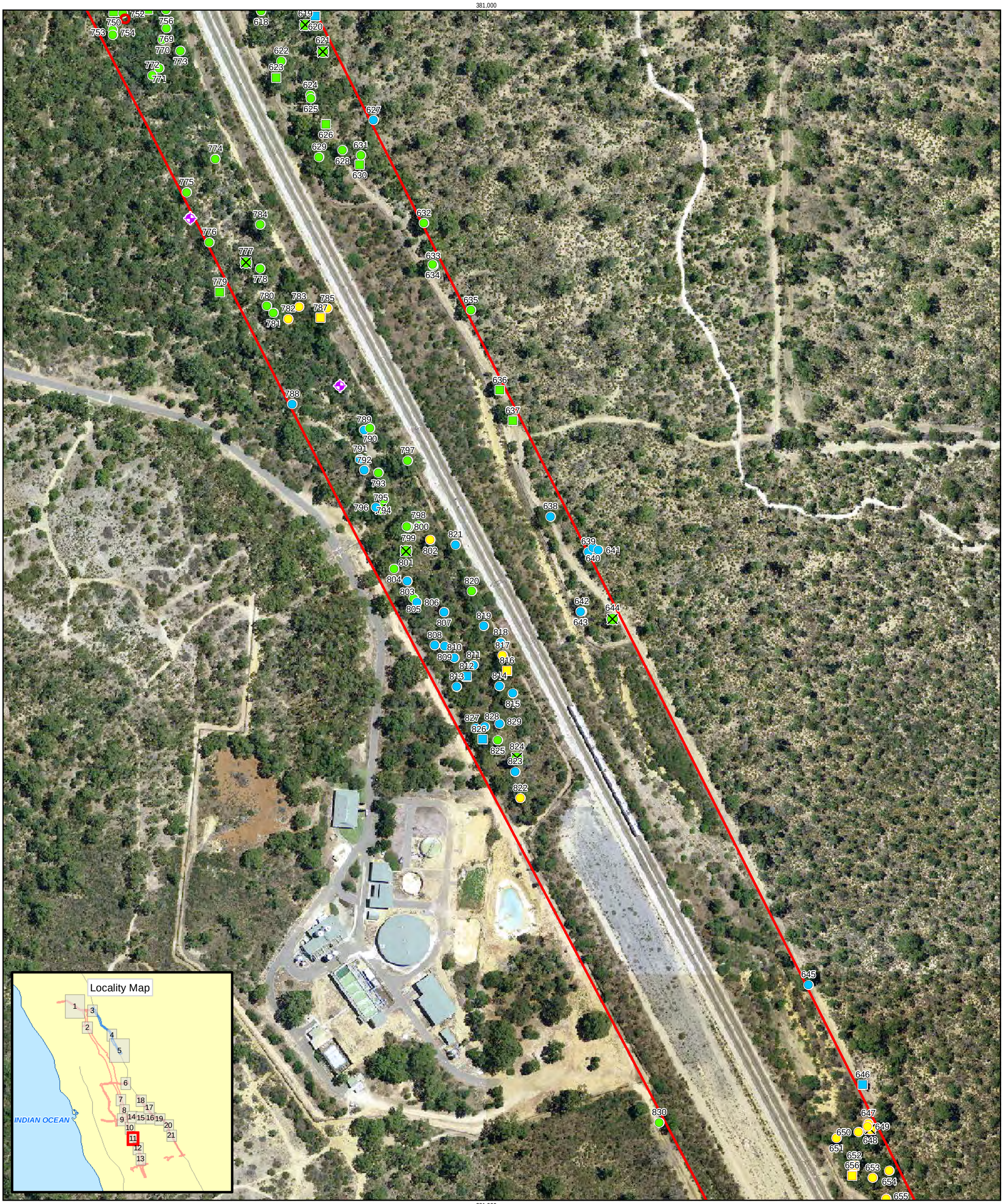
381,000



381,000

LEGEND

Tree Species

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- Stag

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Meters

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Horizontal Datum: Geocentric Datum of Australia
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Significant Trees & Cockatoo Sightings

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381,000

6,491,000

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831
832
833
476
477
657

CLYDEBANK PL
ERIGHT PASS
SELKIRK DR
AWE PASS
MENTEITH PL
ROLO CT
GLOMACH CCT
CLYDEBANK PL

Locality Map
INDIAN OCEAN

381,000

LEGEND

Tree Species
- Jarrah
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Main Roads Western Australia
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Significant Trees & Cockatoo Sightings

Figure 3

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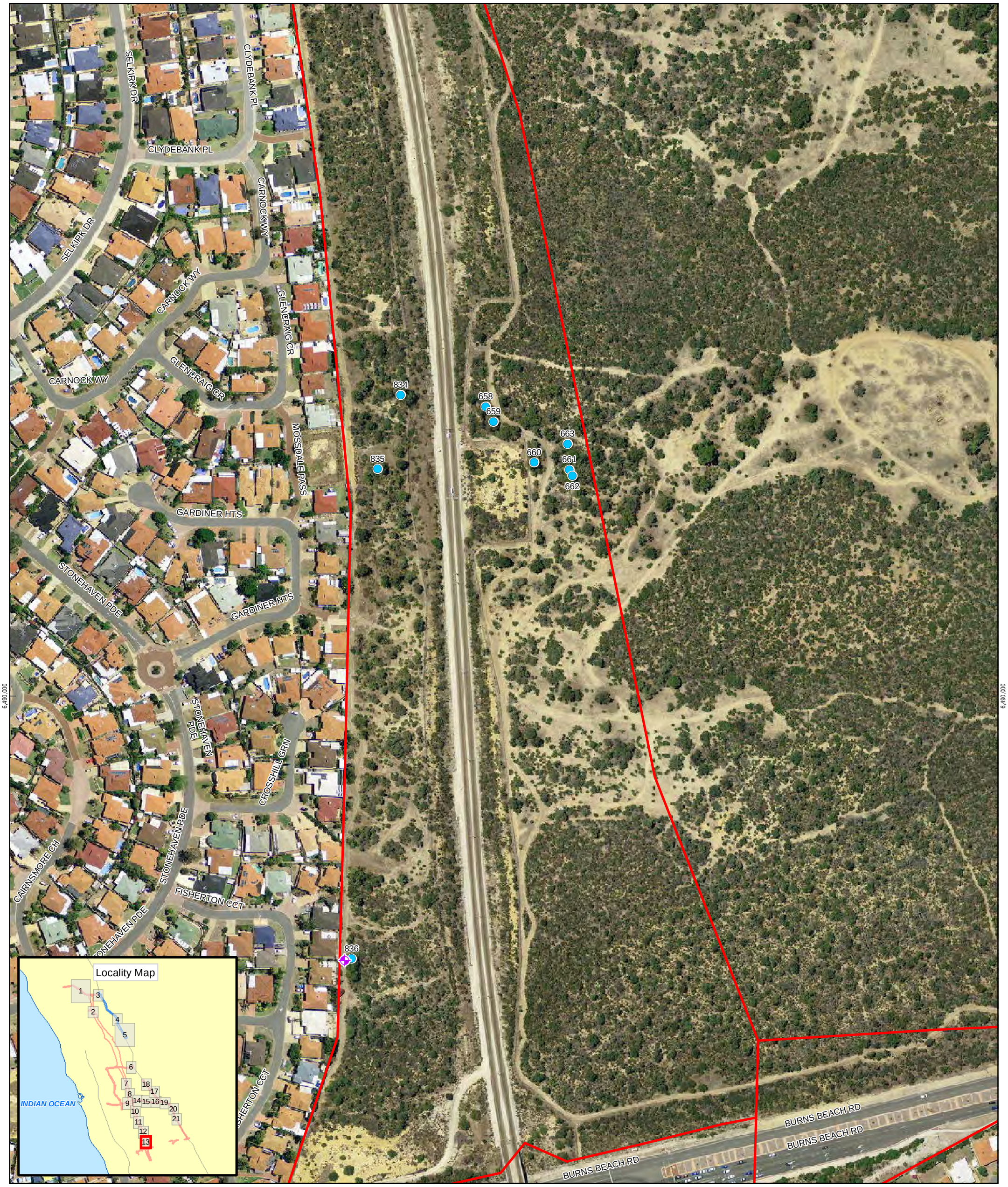

LEGEND

Tree Species

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Meters

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Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

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Significant Trees & Cockatoo Sightings

Figure 3

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381,000

6,493,000

379 383 378 384 377 380 381 387 385 390 393 376 382 386 388 389 391 392 373 374 375 372

Locality Map

INDIAN OCEAN

381,000

LEGEND

Tree Species

- Jarrah
- Marri
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Tree Caracteristics

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N

Main Roads Western Australia
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Significant Trees & Cockatoo Sightings

Figure 3

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6,493,000

6,493,000

Locality Map

INDIAN OCEAN

LEGEND

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Meters

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mainroads WESTERN AUSTRALIA

SLIP ENABLER

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

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Significant Trees & Cockatoo Sightings

Figure 3

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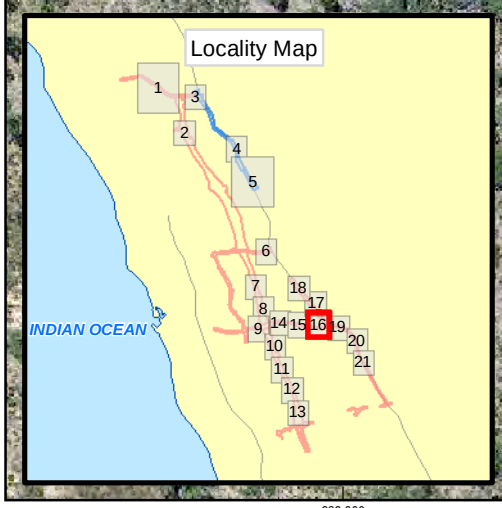
382,000

6,493,000

WANNEROO RD



LEGEND

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Meters

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Main Roads Western Australia
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Date 25 Sep 2013

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Significant Trees & Cockatoo Sightings

Figure 3

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382,000

6,494,000

WANNEROO RD

Locality Map

INDIAN OCEAN

382,000

LEGEND

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GHD

mainroads WESTERN AUSTRALIA

SLIP ENABLER

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Significant Trees & Cockatoo Sightings

Figure 3

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WANNEROO RD

WANNEROO RD

WANNEROO RD

WANNEROO RD

HALL RD

INDIAN OCEAN

6,494,000

6,494,000

Locality Map

LEGEND

Tree Species

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GHD

mainroads WESTERN AUSTRALIA

SLIP ENABLER

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Significant Trees & Cockatoo Sightings

Figure 3

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383,000

6,493,000

FLYNN DR

WANNEROO RD

WANNEROO RD

266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288

383,000

LEGEND

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GHD

mainroads WESTERN AUSTRALIA

SLIP ENABLER

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Significant Trees & Cockatoo Sightings

Figure 3

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WANNEROO RD
FLYNN DR
WANNEROO RD
BUSHLAND RTT
INDIAN OCEAN
Locality Map

LEGEND

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- Tuart
- Stag

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GHD

mainroads WESTERN AUSTRALIA

SLIP ENABLER

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Figure 3

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239 Adelaide Terrace Perth WA 6004 Australia **T** 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Data source: GA: Topo 250k Series 3 - 2006; GHD: Proposed Extention and Upgrade Areas - 20130527; Landgate: Metro Central Mosaic - 2013, Tree Caracteristics and Species - 20130730, Carnaby's Black Cockatoo - 20130730. Created by: vdinh

384,000

6,492,000

329
328
330
331
332
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480
479
478
BUSHLAND RTT
WANNEROO RD
CARRAMAR RD
KERLIN WY
MONALTRIE LOOP
MONALTRIE LOOP

Locality Map

INDIAN OCEAN

LEGEND

Tree Species

- Jarrah
- Marri
- Tuart
- Stag

Tree Caracteristics

- No hollows
- At least one medium or large sized hollow
- Provides suitable cockatoo hollows
- Potential roost site

Observations

- Carnaby's Black Cockatoo
- Evidence of foraging

Study Area

- Proposed Dual Carriage Way
- Proposed Extension and Upgrade Areas

1: 2,500 (at A3)

0 15 30 60 90 120

Meters

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

mainroads WESTERN AUSTRALIA

SLIP ENABLER

Main Roads Western Australia
Black cockatoo assessment for the Mitchell Freeway

Job Number	61-2943502
Revision	0
Date	25 Sep 2013

Map Sheet 21 of 21

Significant Trees & Cockatoo Sightings

Figure 3

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239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: GA: Topo 250k Series 3 - 2006; GHD: Proposed Extention and Upgrade Areas - 20130527; Landgate: Metro Central Mosaic - 2013, Tree Caracteristics and Species - 20130730, Carnaby's Black Cockatoo - 20130730. Created by: vdinh

Appendix B – Conservation category codes & definitions

Conservation categories and definitions for *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed flora and fauna species

Conservation Category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild	Taxa known to survive only in captivity
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term
Near Threatened	Taxa that risk becoming Vulnerable in the wild
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened

Migratory Species listed under the EPBC Act

The EPBC Act protects lands and migratory species that are listed under International Agreements. The list of migratory species established under section 209 of the EPBC Act comprises:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Conservation codes and descriptions for Western Australian Flora and Fauna

Code	Conservation category	Description
Wildlife Conservation Act 1950		
T	Schedule 1 under the WC Act	Threatened Fauna (Fauna that is rare or is likely to become extinct Threatened Flora (Declared Rare Flora – Extant) Taxa that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such. CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild. EN: Endangered – considered to be facing a very high risk of extinction in the wild. VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
X	Schedule 2 under the WC Act	Presumed Extinct Fauna Presumed Extinct Flora (Declared Rare Flora – Extinct) Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.
IA	Schedule 3 under the WC Act	Birds protected under an international agreement. Birds that are subject to an agreement between governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction.
S	Schedule 4 under the WC Act	Other specially protected fauna. Fauna that is in need of special protection, otherwise than for the reasons mentioned in the above schedules.
DEC Priority Listed		
1	Priority One: Poorly-known taxa	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
2	Priority Two: Poorly-known taxa	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. National Parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
3	Priority Three: Poorly-known taxa	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known

Code	Conservation category	Description
		threatening processes exist that could affect them.
4	Priority Four: Rare, Near Threatened and other taxa in need of monitoring	(a) Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. (b) Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
5	Priority 5: Conservation Dependent taxa	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Appendix C – Survey data results

Significant trees (Diameter at Breast Height >500 mm) recorded within the Study Area

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
1	Tuart	600	0	0	0				378145.4868	6500490.123
2	Stag	1100	1	2	1				378180.128	6500502.171
3	Tuart	1050	0	0	1				378217.1909	6500496.509
4	Tuart	1150	0	0	0				378222.2187	6500512.643
5	Marri	780	0	0	0				378211.9282	6500648.33
6	Marri	620	0	0	0				378214.4372	6500677
7	Marri	680	0	0	0				378227.8115	6500682.515
8	Tuart	780	0	0	0				378236.8943	6500663.036
9	Tuart	1140	0	0	0				378239.8875	6500650.507
10	Tuart	1300	0	0	0			3 Carnaby's flyover	378280.3459	6500665.394
11	Tuart	1150	0	0	?1			Potentially 1 hollow (broken branch)	378280.8006	6500667.063
12	Tuart	1980	0	0	0				378273.5519	6500691.922
13	Tuart	1070	0	0	0				378243.6033	6500509.199
14	Tuart	1400	0	4	5			1 beehive	378239.6325	6500483.838
15	Tuart	860	0	0	0				378288.0515	6500467.039
16	Stag	710	0	0	?1			1 possible hollow	378284.2795	6500451.658
17	Tuart	540	0	0	0				378278.0167	6500459.899
18	Burnt Stag	860	0	0	0				378269.0755	6500453.882
19	Jarrah	930	0	0	?2			2 possible hollows	378286.4605	6500440.967
20	Tuart	970	0	0	0				378371.2519	6500490.743
21	Tuart	770	0	0	0				378401.506	6500499.413
22	Tuart	670	0	0	0				379295.6999	6499118.901

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
23	Tuart	530	0	0	0				378477.6775	6500246.243
24	Jarrah	1130	0	0	3				379415.7919	6499014.61
25	Jarrah	620	1	0	0			Dead	379420.5906	6499023.35
26	Jarrah	600	0	0	0				379425.8507	6499006.043
27	Jarrah	830	1	0	0				379430.0764	6498996.114
28	Jarrah	750	0	0	0				379439.4513	6498991.973
29	Jarrah	940	0	0	0			Dead	379431.0345	6498981.713
30	Jarrah	1090	0	0	?1			Possibly 1 hollow	379433.3237	6498961.599
31	Jarrah	720	1	0	0				379454.612	6498966.097
32	Tuart	920	0	0	0				379455.4002	6498939.129
33	Tuart	1800	0	0	4			Half dead, burnt.	379490.48	6498872.28
34	Tuart	520	0	0	0				379493.8015	6498858.646
35	Tuart	570	0	0	0				379504.6385	6498837.523
36	Tuart	520	0	0	0				379526.6822	6498790.663
37	Tuart	830	0	1	1			Half dead, burnt	379576.2347	6498729.895
38	Tuart	660	0	0	0				379570.4714	6498708.948
39	Tuart	610	0	0	0				379568.1264	6498706.704
40	Tuart	1380	0	2	0			1 definite and 1 possible hollow	379573.5496	6498702.517
41	Tuart	870	0	1	1				379499.9544	6498696.672
42	Tuart	1060	1	0	3-4			Very big Tuart	379522.7251	6498723.175
43	Tuart	610	0	0	0				379502.3297	6498750.653
44	Jarrah	980	0	?1	0				379483.3729	6498790.343
45	Jarrah	920	0	0	0				379475.4131	6498808.728
46	Jarrah	540	0	1	0				379470.8317	6498808.49

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
47	Jarrah	1040	0	0	0				379458.5667	6498843.639
48	Jarrah	540	0	0	0				379426.6381	6498884.102
49	Jarrah	650	0	0	0				379431.9722	6498901.163
50	Jarrah	1040	0	0	0				379402.7304	6498941.657
51	Jarrah	530	0	0	0				379383.9903	6498935.526
52	Jarrah	580	0	0	0				379383.373	6498961.387
53	Jarrah	1100	2	1	2				379375.7776	6498962.038
54	Jarrah	510	0	0	0			Dying back	379356.8555	6498985.099
55	Jarrah	520	1	?1	0				379343.1299	6499009.883
56	Jarrah	680	0	0	0				379334.6784	6499029.74
57	Jarrah	1150	3	1	1				379323.0057	6499027.572
58	Tuart	910	1	0	0				379559.4129	6498572.457
59	Tuart	840	0	0	0				379533.2014	6498637.932
60	Tuart	990	0	0	0				380060.5906	6497678.249
61	Tuart	630	0	0	0				380580.4758	6495443.71
62	Jarrah	500	2	0	0				380566.5482	6495459.255
63	Tuart	560	0	0	0				380562.7693	6495499.122
64	Tuart	670	0	0	0				380626.6432	6495332.086
65	Jarrah	630	0	0	0			?dieback	380273.0914	6495350.357
66	Jarrah	700	1	1	2				380289.2866	6495357.381
67	Jarrah	1250	0	0	0				380316.0125	6495355.658
68	Jarrah	670	0	?2	0				380329.1353	6495355.07
69	Jarrah	870	0	0	0			Half burnt	380242.8891	6495365.713
70	Jarrah	820	?1	0	0				380247.8043	6495364.292
71	Marri	530	0	0	0				381470.4647	6494355.107

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
72	Marri	970	0	0	0				381456.9862	6494373.06
73	Marri	620	0	0	0	Yes - chew markings			381446.5624	6494386.429
74	Tuart	830	0	0	0				381391.8664	6494457.494
75	Tuart	1560	2	0	0			Big Tuart	381303.8286	6494459.809
76	Jarrah	600	0	0	1			Burnt and dead	381344.4443	6494404.105
77	Tuart	510	0	0	0				381342.8548	6494391.152
78	Jarrah	890	2	0	0			Burnt and dead	381352.3139	6494379.251
79	Marri	590	0	0	0				381356.0154	6494373.381
80	Jarrah	620	1	1	0				381381.6803	6494353.72
81	Marri	720	0	0	0				381441.7183	6494340.366
82	Marri	670	0	0	0			evidence of feeding nearby	381415.6917	6494322.698
83	Marri	660	0	0	0				381425.285	6494285.3
84	Jarrah	730	0	0	0				381433.7303	6494279.114
85	Marri	610	0	0	0	Yes - chew markings			381429.1869	6494275.736
86	Marri	580	0	0	0				381447.9436	6494265.974
87	Jarrah	820	0	1	2			Burnt	381457.1152	6494265.34
88	Stag	500	0	0	?1			maybe 1 hollow - not sure how deep	381461.5609	6494249.685
89	Jarrah	1360	1	2	0				381479.924	6494232.897
90	Tuart	600	0	0	0				381504.083	6494234.282
91	Tuart	1560	0	0	0			Nice big tree!!	381504	6494213.956
92	Tuart	1310	1	0	0				381529.93	6494203.53
93	Jarrah	620	1	0	0			?dieback	381538.4147	6494189.037
94	Tuart	640	0	0	0				381560.3485	6494163.974

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
95	Tuart	760	0	0	0				381552.4691	6494148.363
96	Tuart	530	0	0	0				381565.2277	6494151.835
97	Tuart	760	0	0	0				381563.19	6494134.81
98	Tuart	700	0	0	0				381567.4346	6494124.699
99	Tuart	690	0	0	0				381545.2246	6494118.717
100	Tuart	1660	0	2	1				381589.9564	6494131.054
101	Jarrah	1450	1	1	?2			Burnt and dead	381598.0354	6494115.441
102	Tuart	600	0	0	0				381598.7499	6494108.243
103	Jarrah	770	0	2	0				381604.5247	6494086.876
104	Tuart	570	0	0	0				381623.5694	6494079.518
105	Tuart	550	0	0	0				381624.0666	6494077.492
106	Marri	580	0	0	0				381632.5997	6494077.404
107	Tuart	660	0	?1	0			1 possible hollow	381640.3889	6494087.102
108	Tuart	510	0	0	0				381642.8221	6494081.586
109	Marri	700	0	0	0				381641.9123	6494078.25
110	Tuart	1360	2	1	2			Partially dead, some new stems	381611.1994	6494055.911
111	Jarrah	690	1	0	2				381593.5851	6494062.545
112	Stag	830	0	0	1			Burnt	381630.6679	6494039.134
113	Tuart	990	1	0	0			Beehive	381646.5987	6494041.534
114	Tuart	630	0	0	0				381654.3766	6494066.013
115	Tuart	900	0	0	0				381666.7648	6494060.427
116	Tuart	620	0	0	0				381664.6799	6494049.317
117	Tuart	530	0	0	0				381646.5598	6494017.329
118	Tuart	1440	1	0	1				381635.9433	6494019.979

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
119	Tuart	1160	0	0	0				381672.6008	6494033.702
120	Tuart	630	0	0	0				381688.437	6494030.557
121	Tuart	640	0	0	0				381686.3648	6494018.338
122	Tuart	600	0	0	0				381705.5715	6494010.613
123	Tuart	960	0	0	0				381700.6677	6494011.111
124	Tuart	530	0	0	0				381698.9284	6493997.418
125	Tuart	620	0	0	0				381669.7357	6493994.128
126	Tuart	540	0	0	0				381682.0256	6493969.509
127	Tuart	660	0	0	0				381685.8658	6493965.303
128	Tuart	520	0	0	0				381711.9976	6493973.732
129	Tuart	720	0	0	0				381715.4557	6493989.108
130	Tuart	840	0	0	0				381721.1689	6493973.098
131	Tuart	1330	1	0	0			3 Carnaby's flyover	381700.6383	6493958.451
132	Tuart	540	0	0	0				381702.9219	6493952.195
133	Tuart	610	0	0	0				381692.426	6493944.314
134	Tuart	670	0	0	0				381681.7018	6493956.386
135	Tuart	650	0	0	0				381714.1037	6493927.748
136	Tuart	1610	?1	?0	2			Suitable cockatoo breeding	381742.06	6493950.88
137	Tuart	1240	1	1	4			Suitable cockatoo breeding, 3 Carnaby's flyover	381733.6563	6493958.829
138	Tuart	740	0	0	0				381767.025	6493928.538
139	Tuart	620	?1	0	0				381766.2605	6493926.312
140	Tuart	710	0	0	0				381767.5602	6493923.186
141	Stag	640	0	0	0				381753.5047	6493908.798
142	Stag	1060	0	?2	0				381748.5149	6493903.013

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
143	Tuart	710	0	0	0				381722.6754	6493910.477
144	Tuart	540	0	0	0				381731.7315	6493892.289
145	Tuart	520	0	0	0				381772.5173	6493904.211
146	Tuart	550	0	0	0				381776.3822	6493911.646
147	Tuart	1100	1	0	?1				381776.0964	6493895.198
148	Tuart	760	0	0	0				381774.3062	6493885.939
149	Tuart	730	0	?1	0				381775.5616	6493886.692
150	Tuart	560	0	0	0				381755.737	6493865.586
151	Tuart	590	0	0	0				381765.2665	6493861.261
152	Tuart	720	0	0	0				381770.2526	6493853.558
153	Tuart	820	0	2	0			Beehive	381782.7076	6493855.917
154	Tuart	1440	0	0	2			Burnt stag	381798.7686	6493860.72
155	Tuart	760	0	0	0				381810.5093	6493870.278
156	Tuart	750	0	0	0				381812.3865	6493858.104
157	Tuart	500	0	0	0				381809.741	6493854.563
158	Tuart	550	0	0	0				381819.1712	6493858.921
159	Tuart	630	0	0	0				381822.9986	6493855.824
160	Tuart	660	0	0	0				381818.4404	6493853.739
161	Tuart	510	0	0	0				381818.3226	6493850.227
162	Tuart	580	0	0	0				381796.8691	6493847.21
163	Tuart	660	0	0	0				381772.9979	6493834.557
164	Tuart	540	0	0	0				381784.6026	6493814.55
165	Tuart	590	0	0	0				381783.4355	6493819.895
166	Tuart	760	0	0	0				381827.6476	6493849.964
167	Tuart	550	0	0	0				381831.85	6493841.697

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
168	Tuart	1600	?2	?2	?4/5			Good future habitat	381835.5427	6493836.566
169	Tuart	570	0	0	0				381816.4239	6493809.001
170	Stag	620	1	1	0				381805.1699	6493798.34
171	Tuart	1600	1	1	0				381821.6359	6493781.53
172	Tuart	570	0	0	0				381834.4862	6493804.588
173	Tuart	1040	0	0	0				381842.6631	6493808.008
174	Tuart	720	0	0	0				381845.5553	6493803.791
175	Tuart	950	0	?1	0			No visible hollows but very big solid tree	381849.456	6493738.98
176	Tuart	1010	1	0	0			No visible hollows but very big solid tree	381850.9957	6493742.509
177	Tuart	1960	1	1	1			Very big tree - potentially more hollows	381892.8878	6493712.87
178	Tuart	540	0	0	0			Carnaby's cockatoos heard	381899.0377	6493741.58
179	Tuart	990	0	0	0				381893.9317	6493745.956
180	Tuart	520	0	0	0				381897.5691	6493759.486
181	Tuart	900	0	0	0				381905.8072	6493757.547
182	Tuart	600	0	0	0				381906.5407	6493734.829
183	Tuart	660	0	0	0				381908.9043	6493721.552
184	Tuart	710	0	0	0				381906.103	6493717.825
185	Jarrah	620	0	?2	0			Burnt	381897.8484	6493707.383
186	Tuart	810	0	0	0				381889.0168	6493692.131
187	Jarrah	690	1	0	0				381890.7778	6493690.119
188	Stag	530	0	?1	0			Burnt	381923.5235	6493672.755
189	Jarrah	550	0	0	0				381929.6765	6493659.706
190	Stag	600	0	0	0				381937.2295	6493676.237

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
191	Tuart	570	0	0	0				381948.8335	6493670.087
192	Tuart	630	0	0	0				381954.7438	6493678.285
193	Tuart	640	0	0	0				381954.4405	6493677.173
194	Tuart	780	0	0	0			Dead	381961.8632	6493677.442
195	Stag	740	0	?1	0				381966.5627	6493667.149
196	Tuart	650	0	0	0				381985.562	6493663.67
197	Tuart	920	0	0	0				381991.3251	6493657.084
198	Tuart	570	0	0	0				381993.3305	6493647.499
199	Tuart	620	0	0	0				381995.1104	6493643.824
200	Tuart	770	0	0	0				381965.6259	6493638.498
201	Tuart	500	0	0	0				381956.7581	6493640.245
202	Tuart	730	0	0	0				381961.001	6493600.752
203	Tuart	530	0	0	0				381979.5113	6493612.419
204	Tuart	630	0	0	0				381988.383	6493624.161
205	Stag	760	0	0	0				381984.7895	6493634.467
206	Tuart	540	0	0	0				382008.8019	6493620.883
207	Tuart	570	0	0	0				382020.8819	6493614.554
208	Tuart	540	0	0	0				382022.5143	6493609.954
209	Tuart	930	0	0	0				382022.0701	6493593.504
210	Tuart	1280	1	3	2			Very large tree, potentially more hollows	382003.3976	6493582.204
211	Tuart	800	0	0	0				382009.721	6493568.049
212	Tuart	910	1	0	0			Potentially 1 small hollow	381998.1868	6493568.102
213	Tuart	620	0	0	0				381997.6226	6493548.325
214	Tuart	810	0	0	0				382019.0147	6493528.984

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
215	Tuart	510	0	0	0				382017.3464	6493536.725
216	Tuart	1280	2	1	2			Potentially more hollows, huge tree	382033.3309	6493562.036
217	Stag	630	0	0	0				382028.0123	6493571.214
218	Tuart	1080	0	0	0				382041.1789	6493580.418
219	Jarrah	1310	0	0	0			Burnt and dead	382061.9732	6493516.54
220	Jarrah	510	1	1	0				382066.8978	6493514.194
221	Tuart	780	0	0	0				382079.0955	6493511.377
222	Tuart	550	0	0	0				382052.6888	6493485.577
223	Tuart	1140	1	0	0				382110.7052	6493468.87
224	Tuart	640	0	0	0				382092.0498	6493442.235
225	Tuart	850	0	0	0				382130.9511	6493425.31
226	Tuart	780	?1	0	0				382137.5017	6493418.918
227	Tuart	780	0	0	0				382151.953	6493454.004
229	Tuart	680	0	0	0				382197.2594	6493388.003
230	Tuart	540	0	0	0				382202.4639	6493374.944
231	Tuart	1080	0	0	0				382208.888	6493338.062
232	Stag	990	1	0	0			Burnt	382200.8019	6493326.699
233	Tuart	1460	0	2	0			Suitable breeding habitat	382251.7272	6493294.39
234	Tuart	1480	1	2	1			Suitable breeding habitat	382261.4285	6493274.915
235	Tuart	950	0	0	0				382267.6462	6493269.997
236	Tuart	650	0	0	0				382292.6919	6493276.564
237	Tuart	670	0	0	0				382268.3411	6493250.604
238	Tuart	1260	2	3	4			Maybe more hollows, suitable breeding habitat	382242.6404	6493246.061
239	Tuart	850	1	0	0				382291.3537	6493213.726

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
240	Stag	880	0	0	?2			Burnt	382300.4698	6493231.753
241	Tuart	830	1	0	0				382319.3205	6493213.491
242	Tuart	570	0	0	0			2 Carnaby's flyover	382329.1777	6493208.06
243	Tuart	690	0	0	0				382340.164	6493214.467
244	Tuart	600	0	0	0				382345.7011	6493199.933
245	Tuart	540	0	0	0				382337.021	6493185.237
246	Tuart	1010	?1	0	0				382354.2816	6493181.738
247	Tuart	1920	3	2	0			Dead	382347.9666	6493153.581
248	Tuart	590	0	0	0				382395.0916	6493149.683
249	Tuart	1140	2	1	0				382394.4823	6493119.928
250	Marri	520	0	0	0	FC			382357.9118	6493126.533
251	Tuart	650	0	0	0				382380.61	6493089.467
252	Tuart	630	1	0	0				382384.9214	6493085.451
253	Tuart	690	1	0	0				382403.4936	6493063.86
254	Tuart	680	1	?1	0				382414.9456	6493084.869
255	Tuart	970	0	0	0				382414.133	6493100.75
256	Tuart	590	0	0	0				382416.8791	6493081.565
257	Tuart	580	0	0	0				382437.9734	6493102.13
258	Tuart	650	0	0	0				382437.2631	6493081.243
259	Tuart	1020	1	1	0				382440.3507	6493073.702
260	Tuart	770	0	?1	0				382435.4432	6493074.57
261	Tuart	800	1	1	2				382472.628	6493055.592
262	Tuart	500	0	0	0				382494.4858	6493036.809
263	Stag	5100	0	0	0				382495.2853	6493008.179
264	Tuart	670	0	0	0				382505.5657	6493007.187

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
265	Tuart	540	0	0	0				382521.8698	6493004.416
266	Tuart	910	1	0	0			Dead	382537.6218	6492994.617
267	Tuart	970	0	0	0				382576.0699	6492975.653
268	Tuart	1250	0	0	0				382584.9438	6492987.21
269	Tuart	640	0	0	0				382602.8757	6492980.208
270	Stag	1390	1	3	2				382681.068	6492925.479
271	Tuart	610	0	1	3				382822.1767	6492895.115
272	Tuart	680	0	0	0				382810.5792	6492914.754
273	Tuart	540	0	0	0				382844.8557	6492887.427
274	Tuart	690	0	0	0				382886.6272	6492881.803
275	Tuart	800	0	0	0			Half chopped down	382894.8192	6492897.786
276	Tuart	840	0	0	0				382911.8835	6492897.61
277	Tuart	540	0	0	0				382925.4914	6492895.731
278	Tuart	540	0	0	0				382943.174	6492882.813
279	Stag	540	0	0	0			Dead	382946.1732	6492883.032
280	Tuart	840	0	0	0				382960.1902	6492886.886
281	Tuart	520	0	0	0				382961.6955	6492879.512
282	Tuart	580	0	0	0				382994.35	6492855.862
283	Tuart	730	0	0	0				383134.1529	6492801.088
284	Tuart	650	0	0	0				383157.0248	6492790.261
285	Jarrah	620	1	0	0			Burnt	383157.5037	6492775.854
286	Tuart	530	0	0	0				383168.1958	6492766.367
287	Tuart	850	0	0	0				383195.1182	6492760.573
288	Tuart	710	0	0	0				383212.5949	6492737.859
289	Tuart	122	0	0	0				383246.7772	6492690.759

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
290	Tuart	640	0	0	0				383270.8596	6492698.607
291	Tuart	570	0	0	0				383308.8757	6492661.713
292	Tuart	870	0	0	0				383327.6324	6492637.535
293	Tuart	620	0	0	0				383301.6998	6492639.644
294	Tuart	1430	0	0	0				383327.4693	6492610.002
295	Tuart	620	0	0	0				383342.2987	6492611.832
296	Tuart	720	0	0	0				383345.752	6492585.818
297	Tuart	510	0	0	0				383358.6864	6492573.585
298	Tuart	510	0	0	0				383378.3384	6492554.036
299	Tuart	670	0	0	0				383378.3921	6492563.275
300	Tuart	540	0	0	0				383374.5855	6492536.625
301	Tuart	620	0	0	0				383376.5352	6492531.843
302	Tuart	700	0	0	0				383387.4666	6492501.11
303	Tuart	710	0	0	0				383416.648	6492477.049
304	Tuart	500	0	0	0				383411.1992	6492455.924
305	Tuart	590	0	0	0				383424.7089	6492448.685
306	Tuart	1330	1	0	0				383436.1915	6492397.079
307	Tuart	640	0	0	0				383452.7023	6492389.874
308	Tuart	1250	1	2	1				383440.6736	6492363.871
309	Tuart	1440	0	1	1				383453.2421	6492342.025
310	Tuart	700	0	0	0				383467.3709	6492335.902
311	Tuart	790	0	0	0				383468.8821	6492327.974
312	Tuart	630	0	0	0				383451.9856	6492313.371
313	Tuart	510	0	0	0				383462.0697	6492315.702
314	Marri	560	0	0	0				383468.6717	6492276.605

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
315	Marri	670	0	0	0				383465.0762	6492273.238
316	Marri	540	0	0	0				383475.3999	6492254.323
317	Tuart	740	0	0	?1				383480.5836	6492242.926
318	Marri	610	0	0	0				383485.065	6492223.76
319	Marri	800	0	0	0			Dead	383479.2691	6492205.403
320	Marri	690	0	0	0				383481.545	6492199.7
321	Marri	620	0	0	0				383485.2759	6492191.058
322	Marri	660	0	0	0				383496.5034	6492176.034
323	Tuart	890	0	0	0				383495.1818	6492167.15
324	Marri	500	0	0	0				383493.461	6492165.652
325	marri	650	0	0	0				383499.2619	6492155.555
326	Tuart	710	0	0	0				383493.0355	6492147.355
327	Marri	600	0	0	0				383504.1359	6492143.6
328	Tuart	750	2	2	0			Dead	383496.968	6492134.835
329	Tuart	600	1	0	0				383495.4781	6492126.873
330	Jarrah	1110	2	1	0				383494.3724	6492126.86
331	Tuart	1380	1	2	1			Potentially more hollows, suitable breeding habitat	383531.7361	6492049.493
332	Tuart	610	0	0	0				383529.8453	6492035.059
333	Tuart	560	0	0	0				383527.0837	6492013.78
334	Marri	900	0	0	0				383546.4727	6491989.423
335	Marri	550	0	0	0				383538.05	6491980.27
337	Tuart	1000	1	0	0				377184.7493	6500593.663
338	Tuart	850	1	1	1			1 bee hive. Suitable breeding hollow	377183.0261	6500634.73
339	Tuart	650	0	0	0				377145.3575	6500584.953

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
340	Tuart	840	0	0	1			Very large hollow, 2 Carnaby's flyover	377157.7009	6500623.896
341	Tuart	1000	3	1	1			1 bee hive	377099.2211	6500632.36
342	Tuart	920	0	0	0				377120.8099	6500672.152
343	Tuart	670	0	0	0				377102.7435	6500669.712
344	Tuart	700	1	0	1			Suitable breeding hollow, 1 bee hive	377068.5778	6500636.677
345	Tuart	760	1	2	3			1 bee hive. Half stag/half alive. Suitable breeding	377078.4483	6500676.938
346	Tuart	530	0	0	0				377098.67	6500702.028
347	Tuart	700	0	1	?1			Potential hollow - 3-4 m up, burnt, half alive	377060.4676	6500730.568
348	Tuart	640	2	1	0				376966.3733	6500770.31
349	Tuart	600	1	?2	0			Potential small hollows	377002.52	6500801.371
350	Jarrah	850	2	0	0				377828.9317	6500489.096
351	Jarrah	1000	0	1	3			Half stag/half alive	377893.6927	6500501.308
352	Jarrah	800	2	2	1			Stag, with one young alive branch	377905.4156	6500508.871
353	Jarrah	1200	1	3	0				377904.775	6500511.716
354	Jarrah	1300	1	1	0				377986.0287	6500477.15
355	Jarrah	500	0	0	0				377987.2492	6500484.144
356	Tuart	800	0	0	0				377998.3486	6500481.008
357	Jarrah	700	0	0	0				377998.7601	6500468.616
358	Jarrah	500	0	0	0				378003.7189	6500472.728
359	Jarrah	600	0	1	0				378011.8617	6500486.791
360	Jarrah	600	0	0	0				378036.6819	6500489.118
361	Jarrah	600	1	0	0				378040.772	6500490.195

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
362	Jarrah	650	0	0	0				378032.1454	6500461.221
363	Jarrah	550	0	0	0				378043.9762	6500470.904
364	Stag	800	1	1	2				378056.8358	6500472.559
365	Jarrah	550	0	1	0			Recently died -dieback?	378052.4098	6500486.324
366	Jarrah	600	0	0	0				378070.0563	6500469.481
367	Jarrah	600	1	0	0				378081.9397	6500468.25
368	Jarrah	850	0	0	0				378095.3324	6500474.989
369	Tuart	650	0	0	0				378101.2499	6500472.33
370	Jarrah	1500	2	5	2				378081.9546	6500508.773
371	Tuart	650	0	0	0				380501.9079	6493009.488
372	Tuart	1000	2	0	0				380660.8576	6492966.552
373	Tuart	650	1	1	0				380747.2992	6493017.021
374	Tuart	550	1	2					380762.4809	6493001.766
375	Tuart	500	0	1	0				380774.8163	6493004.123
376	Jarrah	700	1	0	0				380819.6001	6493034.067
377	Jarrah	650	0	0	0			Burnt/half trunk burnt	380887.7535	6493055.263
378	Jarrah	900	1	2	0				380997.022	6493061.93
379	Tuart	550	0	0	0				381005.855	6493098.029
380	Jarrah	1000	1	4	0			Possible large hollow	381033.0566	6493044.584
381	Tuart	700	0	0	0				381087.0292	6493035.865
382	Jarrah	1600	1	0	0			Half burnt out	381084.339	6493035.289
383	Tuart	800	0	?1	0			1 possible hollow	381088.3753	6493084.607
384	Tuart	700	?1	0	0				381162.3418	6493061.717
385	Tuart	550	0	0	0				381174.4892	6493030.412
386	Jarrah	950	0	1	1			Suitable hollow and burnt	381148.3381	6493018.407

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
387	Tuart	1100	1	0	1				381186.1455	6493040.034
388	Tuart	600	0	1	0			Dead	381187.986	6493022.036
389	Tuart	1850	0	2	0			Very large tree	381217.0913	6493019.904
390	Tuart	1600	0	0	0				381243.7576	6493042.897
391	Tuart	>500	0	0	0				381255.1652	6493019.996
392	Tuart	>500	0	0	0				381255.2137	6493020.041
393	Tuart	>500	0	0	0				381294.1076	6493033.745
394	Tuart	>500	0	0	0			half burnt	381301.9494	6493040.265
395	Tuart	>500	0	0	0				381301.1312	6493039.563
396	Tuart	>500	0	1	0				381351.1253	6493047.09
397	Tuart	>500	0	0	0				381365.0538	6493037.017
398	Tuart	>500	0	0	0				381366.6231	6493034.086
399	Tuart	>500	0	0	0				381354.4073	6493019.247
400	Jarrah	>500	0	0	0				381346.905	6493028.278
401	Tuart	>500	0	0	0				381388.9929	6492994.548
402	Tuart	>500	0	0	0				381386.1514	6492998.35
403	Jarrah	>500	0	1	2			Huge, burnt	381431.5482	6492997.45
404	Jarrah	>500	0	0	1			Suitable hollow	381426.1016	6492990.772
405	Tuart	>500	0	0	0				381443.6862	6493013.156
406	Tuart	>500	0	0	0				381455.5894	6493006.506
407	Jarrah	>500	0	0	0				381459.6063	6493002.855
408	Jarrah	>500	0	0	0				381456.1953	6492999.277
409	Jarrah	>500	0	0	1 (maybe 2)			Suitable hollow	381508.5604	6492997.598
410	Tuart	>500	0	1	0				381520.1759	6492973.317
411	Jarrah	>500	0	0	0			Hollow/long slit in trunk 2 m	381541.2947	6493008.808

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
								from ground		
412	Tuart	>500	0	0	0				381549.3321	6493002.282
413	Jarrah	>500	0	0	1			Potential hollow 2 m from ground	381578.493	6492978.045
414	Jarrah	>500	0	0	0			Potential medium hollow	381638.4622	6492980.602
415	Jarrah	>500	0	1	3			Dead mostly, half burnt out	381674.2934	6492936.463
416	Tuart	>500	0	0	0				381669.8919	6492925.84
417	Jarrah	>500	0	0	0				381710.6676	6492950.715
418	Jarrah	>500	0	2	1			Half dead/burnt, hollow 2 m from ground	381735.7546	6492973.321
419	Jarrah	>500	0	1	1			Burnt stag	381741.0931	6492949.016
420	Jarrah	>500	1	1					381812.0006	6492896.914
421	Jarrah	>500	0	1	0				381819.6736	6492911.172
422	Jarrah	>500	0	0	0				381828.3174	6492910.164
423	stag	>500	1	1	1				381851.3019	6492918.108
424	Tuart	>500	0	0	0				381856.1317	6492922.105
425	Tuart	>500	0	0	0				381867.6499	6492926.436
426	Marri	>500	0	0	0				381826.1768	6492889.436
427	Tuart	>500	0	0	0				381834.5724	6492888.034
428	Jarrah	>500	0	0	?2			Dead	381878.326	6492903.404
429	Tuart	>500	0	0	0				381894.1093	6492917.177
430	Tuart	>500	0	0	0				381890.4752	6492922.044
431	Tuart	>500	3	4	0				381911.1473	6492882.671
432	Tuart	>500	1	3	3			1 beehive, suitable hollows	381956.1531	6492906.816
433	Marri	>500	0	0	0				381941.2904	6492923.641
434	Tuart	>500	0	0	0				381974.4961	6492905.353

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
435	Marri	>500	0	4	0				381992.9382	6492900.329
436	Marri	>500	0	0	0				382009.5094	6492889.935
437	Marri	>500	0	0	1				382016.7633	6492885.298
438	Tuart	>500	0	1	1			Half dead	382023.1272	6492880.713
439	Tuart	>500	0	3	1			Half dead	382029.4013	6492883.294
440	Marri	>500	0	?1	0			Half dead	381998.4849	6492861.744
441	Marri	>500	1	3	1			Possibly suitable, very tall half dead	382064.0667	6492856.958
442	Stag	>500	0	0	1			In trunk, no branches	382079.1681	6492859.895
443	Marri	>500	0	1	0			Galah in hollow	382131.5379	6492842.749
444	Tuart	>500	1	2	4			Some young growth mostly dead	382174.3177	6492873.434
445	Tuart	>500	1	2	0				382179.8123	6492887.85
446	Marri	>500	2	0	0				382189.3685	6492874.021
447	Jarrah	>500	0	1	1			Completely burnt	382182.2824	6492868.248
448	Marri	>500	0	0	0				382174.4386	6492835.115
449	Tuart	>500	0	0	3			Suitable hollow	382239.5968	6492847.375
450	Tuart	>500	0	0	0				382282.5152	6492862.588
451	Tuart	>500	0	0	0				382284.5112	6492872.245
451	Tuart	>500	0	0	0				382284.5112	6492872.245
452	Tuart	>500	0	0	0				382281.8955	6492876.774
453	Tuart	>500	0	0	0				382286.7507	6492880.905
454	Marri	>500	1	0	0				382312.4512	6492874.561
455	Marri	>500	0	0	0				382323.1553	6492878.389
456	Tuart	>500	1	4	1			Very large tree	382307.3905	6492836.176
457	Tuart	>500	1	1	0				382365.7775	6492879.671

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
458	Stag	>500	0	1	?2			2 m from ground	382395.6534	6492883.045
459	Tuart	>500	0	0	0				383549.8068	6491970.557
460	Tuart	>500	1	1	0				383602.8953	6491840.622
461	Tuart	>500	0	0	0				383606.213	6491846.06
462	Tuart	>500	0	0	0				383606.4237	6491834.372
463	Tuart	>500	0	0	0				383637.6869	6491841.112
464	Tuart	>500	0	0	0				383642.4303	6491851.385
465	Tuart	>500	0	1	1				383633.2121	6491854.956
466	Tuart	>500	0	0	0				383634.9236	6491855.031
467	Tuart	>500	0	0	0				383596.4712	6491917.27
468	Tuart	>500	0	0	0				383584.9881	6491932.438
469	Tuart	>500	0	0	0				383590.3428	6491940.473
469	Tuart	>500	0	0	0				383590.3428	6491940.473
470	Tuart	>500	0	0	0				383578.7531	6491965.795
471	Tuart	>500	0	0	0				383580.6474	6491971.943
472	Tuart	>500	0	0	0			Very large trunk, coppiced	383580.3312	6491987.944
473	Marri	>500	0	0	0			Fused branch/trunk	383525.2851	6492193.773
474	Marri	>500	0	0	0				383518.3983	6492207.848
475	Marri	>500	0	0	0				383513.7076	6492224.427
476	Jarrah	850	4	2	0				381422.8254	6490724.821
477	Jarrah	700	0	?2	0				381439.438	6490686.786
478	Tuart	500	0	0	0				383773.2643	6491604.665
479	Tuart	600	0	0	0				383755.4213	6491636.062
480	Tuart	550	0	0	0				383663.5813	6491803.908
481	Jarrah	600	0	0	0				377540.1236	6500255.308

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
482	Jarrah	500	0	0	0				377538.7409	6500249.624
483	Tuart	600	0	1	0				377535.2994	6499423.798
484	Tuart	800	0	0	0				377578.8307	6499457.899
485	stag	800	2	1	0			Beehive	377634.0763	6499429.67
486	Tuart	500	0	0	0				377558.2374	6499397.503
487	Tuart	600	0	0	0				377645.5918	6499411.839
488	Tuart	600	0	0	0				377669.3811	6499442.474
489	stag	700	0	0	4			Burnt out	377723.8954	6499436.254
490	Jarrah	500	0	0	0				377729.0747	6499427.656
491	stag	550	0	0	2			Burnt out	377734.9423	6499421.813
492	Tuart	900	0	4	3			Galahs nesting?, dead with regrowth at base	377771.8657	6499404.372
493	Tuart	800	0	0	0				377770.3574	6499360.309
494	Tuart	550	0	0	0				377756.7036	6499331.894
495	Tuart	650	1	0	0				377745.5039	6499290.451
496	Tuart	900	1	1	0				377766.9968	6499296.12
497	Tuart	600	0	0	0			Half sawn off	377780.0532	6499281.908
498	Tuart	550	0	0	1				377780.3282	6499258.606
499	Tuart	850	0	1	1			Termite ridden	377773.2836	6499246.174
500	Tuart	750	0	0	0				377771.5889	6499215.637
501	Tuart	500	0	0	0			3 stems	377770.1243	6499201.501
502	Tuart	700	0	0	0				377774.8371	6499198.26
503	Tuart	550	0	0	0				377778.7201	6499191.787
504	Tuart	500	0	0	0				377777.8788	6499190.473
505	Tuart	500	0	0	0				377798.5378	6499181.993

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
506	Stag	950	0	1	0			Beehive, arrow, burnt out	377797.7639	6499185.148
507	Tuart	900	0	0	0				377761.297	6499185.148
508	Tuart	500	0	0	0				377753.1886	6499204.455
509	Tuart	700	0	0	0				377755.2348	6499206.006
510	Tuart	550	0	0	0				377755.7994	6499218.98
511	Tuart	1000	0	0	1				377750.4193	6499251.296
512	Tuart	750	0	0	0				377753.0949	6499260.335
515	Tuart	700	1	0	0				377729.1654	6499345.248
516	Tuart	500	0	0	0				377700.4799	6499381.312
517	Tuart	500	0	0	0				377700.1643	6499399.747
518	Tuart	600	0	0	0				377774.0606	6499481.487
519	Tuart	500	0	0	0				377834.4468	6499438.645
520	Tuart	1000	0	0	1			Suitable hollow	377806.0805	6499390.581
521	Tuart	500	0	0	0				377826.196	6499369.1
522	Tuart	550	0	0	0				377846.3893	6499382.03
523	Tuart	500	0	0	0				377846.0927	6499389.348
524	Tuart	500	0	0	0				377845.2715	6499358.318
525	Stag	650	2	1	2				377862.5571	6499351.986
526	Tuart	500	0	0	0				377861.4618	6499331.85
527	Tuart	550	0	0	0				377858.3002	6499311.596
528	Tuart	500	0	0	0				377858.2403	6499311.585
529	Tuart	1000	0	0	0				377866.9929	6499293.543
530	Tuart	500	0	0	0				377893.3452	6499277.503
531	Tuart	600	1	1	0				377875.3967	6499269.679
532	Tuart	1100	1	2	1				377850.1036	6499288.126

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
533	Tuart	700	0	0	0				377845.3701	6499284.814
534	Stag	850	0	2	2				377816.0275	6499296.898
535	Tuart	1000	0	2	0				377810.5773	6499313.992
536	Stag	500	1	0	0				377805.0006	6499319.573
537	Tuart	1010	0	4	3			1 x beehive, suitable breeding habitat	377818.4967	6499344.479
538	Tuart	650	0	0	0				377827.5263	6499339.145
539	Stag	1000	0	0	1				377794.3797	6499352.854
540	Tuart	950	0	1	0			Hollows in dead part	377825.5079	6499278.27
541	Tuart	1100	0	0	3			2 x suitable, 1 potential x large	377847.5747	6499249.212
542	Tuart	500	0	0	0				377847.1492	6499185.167
543	Tuart	500	1	0	0				377829.0208	6499190.2
544	Jarrah	650	1	1	0				377995.7466	6499139.564
545	Jarrah	500	1	0	0				377991.5427	6499129.269
546	Jarrah	500	0	0	0				378021.7665	6499108.877
547	Jarrah	500	1	1	0				378032.5136	6499101.038
548	Jarrah	600	0	0	0				378047.8856	6499095.129
549	Jarrah	550	2	0	0				378047.5558	6499064.739
550	Jarrah	650	0	0	0				378065.2515	6499060.319
551	Jarrah	700	1	0	0				378071.5806	6499045.589
552	Jarrah	600	0	0	0				378055.5574	6499039.545
553	Jarrah	550	0	0	1			Beehive	378036.7724	6499030.833
554	Jarrah	550	0	0	0				378021.6004	6499022.987
555	Jarrah	500	0	0	0				378025.8921	6499009.985
556	Jarrah	550	0	0	2			Mostly dead trunk with epicormic growth	378042.4471	6498988.716

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
557	Jarrah	800	0	1	2			2 x potential, burnt out	380327.0643	6493564.004
558	Jarrah	900	0	0	0				380322.617	6493612.418
559	Tuart	650	0	0	0				380455.0016	6493137.161
560	Tuart	750	0	0	1			Stag with potential hollow	380410.6547	6493333.709
561	Tuart	550	0	0	0				380395.6603	6493361.085
562	Tuart	550	0	0	0				380393.1031	6493359.522
564	Jarrah	650	1	0	0				380366.8614	6493489.114
565	Tuart	750	0	1	1			Galahs nesting in hollow	380355.1465	6493525.249
566	Jarrah	650	1	0	1				380365.4762	6493518.699
567	Tuart	650	1	0	0			Stag	380327.0643	6493564.004
568	Tuart	750	1	1	0				380322.617	6493612.418
569	Tuart	550	0	0	0				380337.7379	6493613.739
570	Jarrah	550	1	1	0				380344.3789	6493654.244
571	Jarrah	500	0	0	0				380355.1709	6493651.45
572	Jarrah	550	1	1	0				380299.7785	6493836.875
573	Tuart	700	0	0	0				380253.0063	6494107.304
574	Tuart	800	1	2				Galahs nesting	380218.4245	6494176.378
575	Tuart	600	0	0	0				380202.2126	6494206.419
576	Tuart	650	0	0	0				380176.4281	6494309.852
577	Tuart	600	0	0	0				380160.4033	6494303.273
578	Tuart	600	0	0	0				380126.8674	6494361.088
579	Tuart	500	0	0	0				380107.6541	6494482.316
580	Tuart	500	0	0	0				380644.0586	6492534.768
581	Tuart	500	0	0	0				380721.2633	6492148.91
582	Tuart	500	0	0	0				380726.4395	6492150.744

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
583	Tuart	500	0	0	0				380764.947	6492117.098
584	Tuart	600	0	0	0				380759.7783	6492131.044
585	Jarrah	500	0	0	0				380741.1256	6492137.536
586	Tuart	500	0	0	0				380789.9774	6492095.934
587	Tuart	500	0	0	0				380804.0496	6492066.09
588	Tuart	600	0	0	0				380784.0536	6492068.538
589	Tuart	500	0	0	0				380760.0002	6492072.122
590	Tuart	500	0	0	0				380761.0186	6492072.855
591	Tuart	800	0	0	2				380896.095	6492084.391
592	Tuart	600	0	0	0				380866.7037	6492054.968
593	Tuart	500	0	0	0				380879.395	6492029.782
594	Tuart	500	0	0	0				380888.6827	6492021.648
595	Tuart	500	0	0	0				380892.9351	6492015.914
596	Tuart	600	0	0	0				380892.0374	6492008.827
597	Tuart	500	0	0	0				380911.0473	6491993.248
598	Tuart	500	0	0	0				380926.5361	6492002.185
599	Tuart	500	0	0	0				380928.1271	6492001.205
600	Tuart	500	0	0	0				380924.9219	6492006.545
601	Tuart	1000	0	0	1			Suitable hollow	380908.7542	6491967.427
602	Jarrah	500	0	0	0				380895.0879	6491968.951
603	Tuart	550	0	0	0				380885.6898	6491967.475
604	Jarrah	500	0	0	0				380881.5162	6491955.417
605	Tuart	500	0	0	0				380875.7626	6491958.455
606	Tuart	550	0	0	0				380847.7436	6491944.311
607	Tuart	500	0	0	0				380837.8676	6491950.036

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
608	Tuart	500	0	0	0				380829.5228	6491947.63
609	Tuart	500	0	0	0				380825.4655	6491948.784
610	Tuart	500	0	0	0				380835.6322	6491941.141
611	Tuart	500	0	0	0				380840.4709	6491932.512
612	Jarrah	500	0	0	0				380833.9	6491925.6
613	Tuart	500	0	0	0				380846.5402	6491919.907
614	Tuart	500	0	0	0				380855.8881	6491912.032
615	Tuart	500	0	0	0				380826.4104	6491924.386
616	Tuart	500	0	0	0				380826.0233	6491927.818
617	Tuart	500	0	0	0				380819.1195	6491926.482
618	Tuart	500	0	0	0				380841.9816	6491908.361
619	Tuart	900	1	2	4			Galah nesting, suitable cockatoo breeding	380873.0081	6491898.686
620	Jarrah	600	0	0	1				380880.0148	6491904.79
621	Tuart	700	0	0	2			Suitable cockatoo breeding	380885.1841	6491879.813
622	Tuart	500	0	0	0				380856.0991	6491873.195
623	Tuart	700	1	1	0				380852.4084	6491861.734
624	Tuart	500	0	0	0				380876.436	6491849.372
625	Tuart	500	0	0	0				380876.8404	6491847.178
626	Tuart	600	1	1	0				380887.3188	6491828.933
627	Jarrah	550	0	0	0				380920.9018	6491831.796
628	Tuart	500	0	0	0				380899.0463	6491810.59
629	Tuart	550	0	0	0				380882.61	6491805.763
630	Tuart	800	0	1	1			Australian Ringneck nesting	380911.0096	6491800.566
631	Tuart	500	0	0	0				380911.9459	6491807.044

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
632	Tuart	550	0	0	0				380956.2357	6491759.476
633	Tuart	550	0	0	0				380962.7903	6491729.415
634	Tuart	500	0	0	0				380962.2431	6491730.296
635	Tuart	500	0	0	0				380989.1033	6491698.27
636	Tuart	550	0	1	0				381009.4334	6491642.074
637	Tuart	600	1	1	1			Galahs nesting	381018.5267	6491620.616
638	Jarrah	500	0	0	0				381045.0991	6491553.184
639	Jarrah	500	0	0	0				381071.7325	6491528.454
640	Jarrah	500	0	0	0				381074.8733	6491531.428
641	Jarrah	500	0	0	0				381078.6376	6491529.642
642	Jarrah	500	0	0	0				381067.0975	6491486.494
643	Jarrah	550	1	0	0				381066.1806	6491486.557
644	Tuart	550	1	1	2			Australian Ringnecks nearby, suitable cockatoo breeding	381088.5313	6491481.179
645	Jarrah	500	0	0	0				381226.0876	6491224.209
646	Jarrah	600	1	1	1			Looks to have hollows	381264.1873	6491154.156
647	Marri	500	1	0	0				381268.3086	6491126.801
648	Marri	700	1	1	2			Good cockatoo hollows	381269.5834	6491123.084
649	Marri	500	0	0	0				381267.6844	6491124.762
650	Marri	500	0	0	0				381261.301	6491120.808
651	Marri	500	0	0	0				381245.8841	6491116.695
652	Marri	600	1	1	1				381258.3989	6491097.068
653	Marri	500	0	0	0				381271.1956	6491088.642
654	Marri	500	0	0	0				381282.876	6491093.506
655	Marri	500	0	0	0				381280.7946	6491073.952

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
656	Marri	500	0	0	1			Maybe hollow in top	381256.8523	6491090.084
657	Jarrah	500	2	0	0				381424.0128	6490832.011
658	Jarrah	500	0	0	0				381537.8864	6490205.199
659	Jarrah	500	2	0	0				381543.2214	6490194.488
660	Jarrah	550	0	0	0				381572.1556	6490165.681
661	Jarrah	500	0	0	0				381597.0132	6490160.405
662	Jarrah	500	0	0	0				381599.0831	6490156.197
663	Jarrah	500	0	0	0				381595.8557	6490178.703
664	Jarrah	500	0	0	0				379914.2055	6492813.228
665	Jarrah	500	0	0	0				379941.6923	6492810.739
666	Jarrah	600	0	0	1			Huge hollow	379982.0685	6492811.153
667	Jarrah	500	0	0	0				380001.8987	6492801.368
668	Jarrah	500	0	0	0				380040.3328	6492857.487
669	Jarrah	550	0	0	0				380051.6951	6492801.411
670	Tuart	550	0	0	0				380123.8211	6492822.702
671	Tuart	550	0	0	0				380141.212	6492843.414
672a	Tuart	550	0	0	0				380171.507	6492871.241
672b	Tuart	500	0	0	0				380180.8935	6492856.069
673	Tuart	550	0	0	0				380200.2034	6492882.974
674	Tuart	500	0	0	0				380290.7702	6492845.369
675	Jarrah	600	0	0	0				380292.1721	6492841.634
676	Tuart	600	0	1	0			Galahs nesting	380304.554	6492877.458
677	Jarrah	500	0	0	0				380316.6743	6492871.759
678	Jarrah	550	0	0	0				380349.9594	6492882.898
679	Tuart	500	0	0	0				380349.0271	6492893.826

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
680	Tuart	900	1	3	4			bees in small hollow, suitable breeding tree	380332.9155	6492893.566
681	Tuart	500	0	0	0				380325.7071	6492913.031
682	Jarrah	500	0	0	0				380326.2536	6492919.043
683	Tuart	500	0	0	0				380334.6118	6492923.075
684	Tuart	550	0	0	0				380356.3029	6492912.203
685	Tuart	550	0	0	0				380369.5242	6492919.211
686	Tuart	500	0	0	0				380371.1058	6492899.958
687	Tuart	500	0	0	0				380366.2825	6492893.545
688	Jarrah	500	0	0	0				380396.2836	6492894.946
689	Jarrah	600	2	1	0			Galahs nesting	380413.8991	6492879.924
690	Jarrah	500	0	0	0				380399.6348	6492840.181
691	Jarrah	500	0	0	0				380397.8687	6492845.353
692	Jarrah	500	0	0	0				380375.7039	6492838.481
693	Jarrah	500	0	0	0				380367.9892	6492852.564
694	Jarrah	500	0	0	0				380400.781	6492771.181
695	Jarrah	500	0	0	0				380401.8411	6492758.758
696	Jarrah	500	0	0	0				380437.7339	6492747.939
697	Jarrah	550	0	0	0				380527.6582	6492590.813
698	Jarrah	500	0	0	0				380523.6345	6492564.437
699	Jarrah	500	1	0	0				380547.6986	6492573.695
700	Jarrah	500	1	0	0				380559.9373	6492527.643
701	Jarrah	500	1	0	0				380563.8035	6492519.816
702	Tuart	500	0	0	0				380518.1544	6492467.275
703	Jarrah	500	0	0	0				380560.9219	6492437.005

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
704	Jarrah	500	0	0	0				380576.069	6492429.068
705	Jarrah	500	0	0	0				380567.1046	6492400.971
706	Tuart	500	0	0	0				380571.5711	6492379.478
707	Tuart	500	0	0	0				380602.2784	6492342.879
708	Tuart	500	0	0	0				380599.505	6492342.274
709	Tuart	500	0	0	0				380564.3122	6492325.477
710	Jarrah	500	1	0	0				380576.1157	6492311.59
711	Jarrah	500	0	0	0				380577.2481	6492291.518
712	Tuart	500	0	0	0				380598.9351	6492280.867
713	Tuart	550	0	1	0				380595.7261	6492257.807
714	Tuart	500	0	0	0				380586.7228	6492263.154
715	Tuart	350	0	0	0				380629.4579	6492221.926
716	Tuart	500	0	0	0				380607.1386	6492224.421
717	Tuart	500	0	0	0				380646.7263	6492212.203
718	Jarrah	500	0	0	0				380654.7032	6492202.705
719	Tuart	500	0	0	0				380659.1663	6492189.693
720	Tuart	500	0	0	0				380659.5195	6492187.831
721	Jarrah	550	0	0	0				380648.5528	6492170.336
722	Tuart	550	0	0	0				380638.3368	6492168.536
723	Tuart	500	0	0	0				380633.8996	6492149.232
724	Tuart	600	2	1	0				380645.3612	6492141.659
725	Tuart	500	0	0	0				380636.1118	6492132.775
726	Tuart	500	0	0	0				380674.5999	6492125.46
727	Tuart	500	0	0	0				380658.2952	6492099.625
728	Tuart	500	0	0	0				380652.8614	6492096.846

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
729	Tuart	500	0	0	0				380648.8268	6492096.023
730	Tuart	500	0	0	0				380648.3792	6492099.215
731	Tuart	500	0	0	0				380653.4637	6492077.525
732	Tuart	500	0	0	0				380652.6829	6492068.536
733	Tuart	500	0	0	0				380655.642	6492058.537
734	Tuart	550	0	0	0				380678.4046	6492055.918
735	Tuart	500	1	0	0				380674.8938	6492064.451
736	Tuart	500	0	0	0				380686.4657	6492059.633
737	Tuart	550	0	0	0				380672.8752	6492077.824
738	Tuart	500	0	0	0				380670.8402	6492078.946
739	Tuart	500	0	0	0				380688.6428	6492092.714
740	Tuart	600	0	0	0				380696.2589	6492096.663
741	Tuart	500	0	0	0				380697.3311	6492095.475
742	Tuart	500	0	0	0				380701.2604	6492079.426
743	Tuart	500	0	0	0				380708.949	6492074.36
744	Tuart	500	0	0	0				380709.1406	6492060.504
745	Tuart	500	0	0	0				380678.6689	6492019.354
746	Tuart	700	2	0	0				380687.6963	6492017.371
747	Tuart	600	2	1	0				380698.6499	6492008.628
748	Tuart	650	1	2	2				380725.8701	6491930.506
749	Tuart	500	0	0	0				380713.2368	6491924.651
750	Tuart	600	1	2	0				380738.4863	6491907.74
751	Jarrah	550	1	1	0				380744.8891	6491914.151
752	Tuart	550	0	0	0				380744.7539	6491906.703
753	Tuart	600	0	0	0				380737.6681	6491895.147

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
754	Tuart	550	1	0	0				380737.8497	6491891.731
755	Tuart	600	1	1	0			Galahs nesting	380762.4298	6491909.531
756	Tuart	500	0	0	0				380775.1994	6491909.05
757	Tuart	500	0	0	0				380772.3275	6491914.246
758	Tuart	500	0	0	0				380771.4911	6491916.916
759	Tuart	500	0	0	0				380763.6671	6491926.877
760	Tuart	500	0	0	0				380760.8318	6491937.118
761	Tuart	500	0	0	0				380750.5942	6491931.734
762	Tuart	550	0	1	0				380735.1631	6491956.13
763	Tuart	550	0	0	0				380726.169	6491960.72
764	Tuart	500	0	0	0				380709.8828	6491972.967
765	Tuart	500	0	0	0				380708.232	6491975.017
766	Tuart	800	0	1	2			Suitable breeding tree	380730.0167	6492009.193
767	Tuart	550	0	0	0				380714.2795	6492046.41
768	Tuart	500	0	0	0				380719.5132	6492041.888
769	Tuart	500	0	0	0				380775.5361	6491896.305
770	Tuart	500	0	0	0				380772.6109	6491888.326
771	Tuart	500	0	0	0				380770.3637	6491868.141
772	Tuart	500	0	0	0				380765.5872	6491863.171
773	Tuart	500	0	0	0				380785.2436	6491880.545
774	Tuart	500	0	0	0				380809.6573	6491804.608
775	Tuart	500	0	0	0				380789.6604	6491781.169
776	Tuart	500	0	0	0				380805.5631	6491745.987
777	Tuart	700	0	2	1			Suitable breeding tree	380831.3823	6491731.669
778	Tuart	600	1	0	0				380841.1922	6491727.551

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
779	Tuart	600	1	1	0				380812.9801	6491711.04
780	Tuart	500	0	0	0				380845.9351	6491701.202
781	Tuart	500	0	0	0				380850.54	6491696.395
782	Marri	550	0	0	0				380860.8897	6491692.043
783	Marri	500	0	0	0				380868.5773	6491700.724
784	Tuart	550	0	0	0				380841.2312	6491758.409
785	Marri	500	0	0	0				380888.4786	6491699.586
787	Marri	550	1	1	1				380883.5469	6491693.007
788	Jarrah	500	0	0	0				380863.6797	6491632.301
789	Jarrah	500	0	0	0				380914.3435	6491614.149
790	Tuart	500	0	0	0				380918.1991	6491615.413
791	Jarrah	500	0	0	0				380911.374	6491593.568
792	Jarrah	500	0	0	0				380914.3061	6491585.879
793	Tuart	`	0	0	0				380924.1216	6491583.996
794	Tuart	500	0	0	0				380927.9084	6491565.193
795	Tuart	800	0	2	4			Great cocky tree/hollows - suitable breeding	380925.7888	6491558.591
796	Jarrah	500	0	0	0				380922.4592	6491559.661
797	Tuart	600	1	0	0				380944.6534	6491592.548
798	Tuart	500	0	0	0				380952.2561	6491546.922
799	Tuart	500	0	0	0				380945.4141	6491545.735
800	Tuart	500	0	0	0				380944.0808	6491546.292
801	Tuart	700	0	0	4		Chews on main hollow	Suitable breeding tree	380943.7431	6491528.994
802	Marri	500	0	0	0				380960.5394	6491536.818
803	Jarrah	500	3	0	0				380944.4913	6491507.938

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
804	Tuart	600	1	0	0				380935.2768	6491516.609
805	Tuart	550	0	0	0				380948.9283	6491495.757
806	Jarrah	550	2	0	0				380951.3783	6491492.885
807	Jarrah	500	0	0	0				380970.3492	6491486.082
808	Jarrah	500	0	0	0				380963.7303	6491462.798
809	Jarrah	500	0	0	0				380970.7835	6491462.103
810	Jarrah	500	0	0	0				380977.6062	6491453.996
811	Jarrah	500	0	1	0				380991.1246	6491448.794
812	Jarrah	550	0	0	0			Bird nest in hollow	380986.19	6491441.106
813	Jarrah	500	0	0	0				380979.166	6491433.782
814	Jarrah	500	0	0	0				381009.1896	6491434.238
815	Jarrah	500	0	0	0				381018.504	6491429.228
816	Marri	900	0	2	1				381014.6108	6491444.944
817	Marri	500	0	0	0				381011.3607	6491455.568
818	Jarrah	600	1	0	0				381010.1173	6491464.774
819	Jarrah	500	0	0	0				380998.1646	6491476.276
820	Tuart	600	0	0	0				380989.7031	6491500.883
821	Jarrah	500	0	0	0				380978.334	6491533.402
822	Marri	500	0	0	0				381023.9349	6491355.436
823	Jarrah	500	0	0	0				381020.1665	6491374.036
824	Tuart	900	1	2	4			Galah nesting, suitable cockatoo breeding tree	381021.5567	6491383.624
825	Tuart	500	0	0	0				381007.9844	6491396.254
826	Jarrah	550	0	0	1				380997.4905	6491396.706
827	Jarrah	500	0	0	0				380992.6289	6491404.613

Tree ID No.	Species	DBH (mm)	Hollows			Signs of feeding	Chew markings on hollows	Notes	Easting	Northing
			Small (<5 cm)	Medium (5-12 cm)	Large (>12 cm)					
828	Jarrah	500	0	0	0				380998.8405	6491405.664
829	Jarrah	500	0	0	0				381009.2425	6491407.706
830	Tuart	500	0	0	0				381121.4303	6491127.532
831	Tuart	500	0	0	0				381165.4413	6491061.317
832	Jarrah	500	0	0	0				381330.7638	6490750.304
833	Jarrah	600	0	0	0			Fire impacted	381345.9473	6490744.437
834	Jarrah	600	0	0	0				381477.5833	6490213.45
835	Jarrah	500	2	0	0				381461.2224	6490160.99
836	Jarrah	500	0	0	0				381442.8429	6489813.978

DBH Diameter at Breast Height

Location of all observations and sightings of the Carnaby's Black Cockatoo within the Study Area

Observation	Easting	Northing
Carnaby's Black Cockatoo - sighting	380278.8755	6495355.782
Carnaby's Black Cockatoo - sighting	381498.7235	6494315.89
Carnaby's Black Cockatoo - sighting	377146.1812	6500634.972
Carnaby's Black Cockatoo - sighting	382363.8005	6492874.033
Carnaby's Black Cockatoo - sighting	378280.3459	6500665.394
Carnaby's Black Cockatoo - sighting	379612	6498378
Carnaby's Black Cockatoo - sighting	381700.6383	6493958.451
Carnaby's Black Cockatoo - sighting	381733.6563	6493958.829
Carnaby's Black Cockatoo - sighting	381899.0377	6493741.58
Carnaby's Black Cockatoo - sighting	382329.1777	6493208.06
Carnaby's Black Cockatoo - sighting	377157.7009	6500623.896
Carnaby's Black Cockatoo - sighting	376655	6501046
Potential roost site	380746.3287	6491903.026
Evidence of foraging	382315.4145	6493140.276
Evidence of foraging	383273.2922	6492679.049
Evidence of foraging	377907.7017	6499207.033
Evidence of foraging	380594.2228	6492907.398
Evidence of foraging	381515.5758	6490613.385
Evidence of foraging	380792.1316	6491762.776
Evidence of foraging	380897.2906	6491645.013
Evidence of foraging	381366.4404	6490686.118
Evidence of foraging	381437.9132	6489812.775

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Document Status

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		Name	Signature	Name	Signature	Date
A	E Lynch	G Gaikhorst		C Grabham		
0	J Kuiper	D Farrar		D Farrar		25/9/2013

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APPENDIX B

Glevan Consulting 2013 Phytophthora Dieback Occurrence Assessment and Management Plan

GHD

Mitchell Freeway Extension

Phytophthora Dieback occurrence assessment and Management Plan

Report compiled by Evan Brown of Glevan Consulting

GLEVAN CONSULTING

Disclaimer

This report has been prepared in accordance with the scope of work agreed between GHD and Glevan Consulting and contains results and recommendations specific to the agreement. Results and recommendations in this report should not be referenced for other projects without the written consent of Glevan Consulting.

Procedures and guidelines stipulated in various Department of Environment and Conservation and Dieback Working Group manuals are applied as the base methodology used by Glevan Consulting in the delivery of the services and products required by this scope of work. These guidelines, along with overarching peer review and quality standards ensure that all results are presented to the highest standard.

Glevan Consulting has assessed areas based on existing evidence presented at the time of assessment. The *Phytophthora* pathogen may exist in the soil as incipient disease. Methods have been devised and utilised that compensate for this phenomenon; however, very new centres of infestation, that do not present any visible evidence, may remain undetected by dieback assessors.

Version Control

Document ID	Author	Date	Comments
Draft	EB	08/2013	
V1	EB	09/2013	Edits from EJ (Main Roads), added Management Plan.
V2	EB	09/2013	Amendments

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INTRODUCTION

Glevan Consulting was commissioned by GHD to conduct an assessment of the vegetation within and immediately adjacent to the proposed Mitchell Freeway Extension (Project Area) from Burns Beach Road to Romeo Road (Figure 1 - Project Area) for the presence of Phytophthora Dieback. The project area covers approximately 440 hectares and in general follows Wanneroo Road and the Northern Suburbs Railway Line easement.

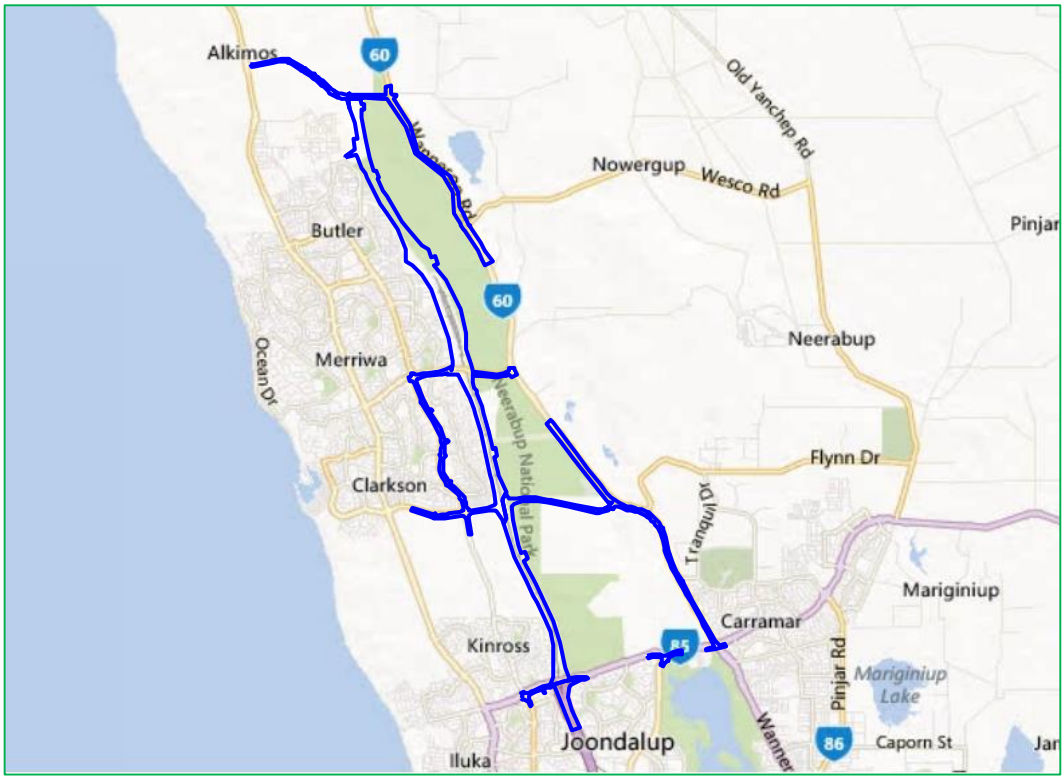

Figure 1 - Project Area

Study team

The assessment was conducted by Evan Brown and Liam Brown, and assisted by Matthew Stewart of Glevan Consulting in July 2013. The senior members of the project team are accredited by the Department of Environment and Conservation in the detection, diagnosis and mapping of the Dieback disease and this accreditation recognises the skills and experience in the general project area. Mr Brown has also

previously assessed areas immediately adjacent to the project area. Mr Stewart is currently undergoing the DEC accreditation process.

Background

Phytophthora Dieback is the name generally used in Western Australia to describe the disease symptoms of, and the causal agent, *Phytophthora cinnamomi*. This introduced soil-borne pathogen is a major threat to Australian vegetation, and in particular, the vegetation and dependent biota within the south west botanical province. This disease is listed as a key threatening process under the Environment Protection and Biodiversity Conservation Act 1999, with a subsequent threat abatement plan introduced in 2001 (Environment Australia, 2001).

It is generally believed that Phytophthora Dieback was introduced to Australia during the early European settlement. From 1921, patches of healthy jarrah forest were observed to be dying, with Frank Podger and George Zentmyer establishing in 1964 that *Phytophthora cinnamomi* was the causal agent for the forest decline (DWG, 2011).

The impact of the disease on the vegetation is dependent on climatic conditions along with host plant species and suitable soils (Keane & Kerr, 1997). This relationship, shown in Figure 1, describes all aspects required to create the disease.

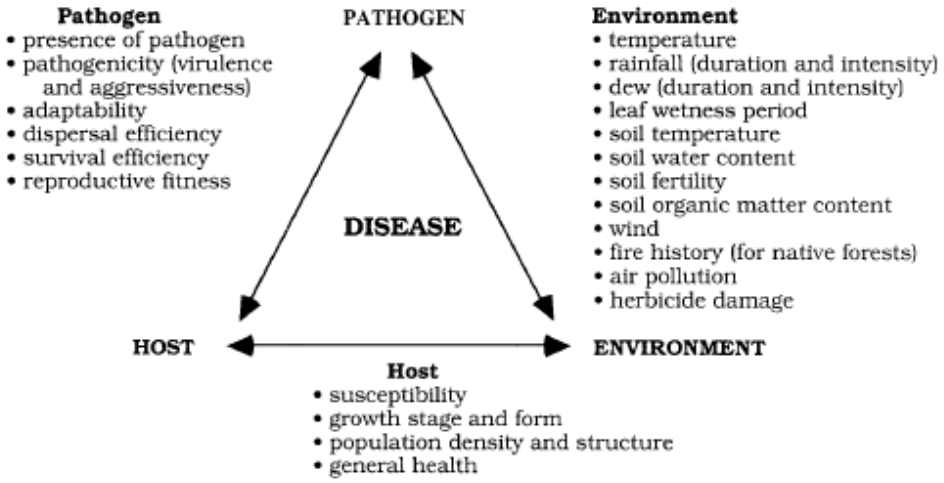

Figure 2 - Disease Triangle

This relationship is also described in Management of *Phytophthora cinnamomi* for Biodiversity Conservation in Australia Part 2 - National Best Practice Guidelines / Appendix 3 as the disease pyramid (O'Gara, Howard, Wilson, & Hardy, 2005). This figure includes the additional element of time to demonstrate the progressive impact of the disease on susceptible vegetation.

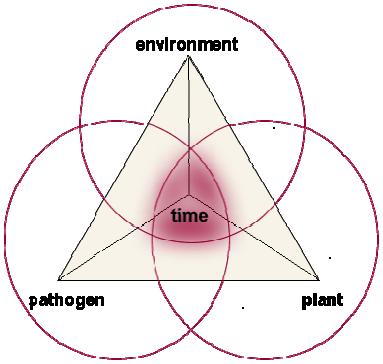

Figure 3 - Disease Pyramid

It is recognised that Phytophthora Dieback has a greater and more widespread impact in areas of Western Australia where the average annual rainfall exceeds 600mm and the soil structure has a more acidic composition (Hardy, Colquhoun, Shearer, & Tommerup, 2001). The impact of the disease can be significant (but less widespread) in areas of lower rainfall if there are extra-ordinary rainfall events, or the pathogen is situated in a rainfall aggregating site, e.g. creek lines, water shedding from granite outcrops.

The impact of the pathogen on the Australian economy is significant, and is estimated to cost between $160 million (Carter, 2004) and $200 million annually (EPA, 2011).

The impact of the disease on animals is less understood, however the greatest impact is likely to be on those species that require relatively dense species-rich shrub lands or have restricted diets. There is a growing body of evidence that the dramatic impact of Phytophthora Dieback infestations on plant communities can result in major declines in some animal species due to the loss of shelter or food sources.

METHODS

For the assessment, the interpreter is specifically looking for those areas that are:

- Possibly infested with Phytophthora Dieback;
- Possibly infested by other *Phytophthora* species;
- Uninfested – free of plant disease caused by Phytophthora Dieback, and;
- Uninterpretable – those areas where presence or absence of Phytophthora Dieback cannot be determined because the vegetation is naturally void of sufficient numbers of disease indicating species.
- Unmappable – those areas where presence or absence of Phytophthora Dieback cannot be determined at the time of the assessment, due to disturbance factors i.e. fire disturbance or forestry activity.

Detection of the plant pathogen Phytophthora Dieback involves the observation and interpretation of plant deaths (or reduction of biomass or perceived temporal change in vegetation structure) using a logical assessment of factors that imply pathogen presence above other possible causes of plant deaths or vegetation change.

The following table describes *Phytophthora Dieback* occurrence categories as defined by the Department of Environment and Conservation in the manual "*Phytophthora cinnamomi* and disease caused by it, volume 1, Management Guidelines, 2003". The superior categories "Mappable" and "Unmappable" definitions are not yet published by the department, but are in general use at this time.

Table 1 - Dieback Occurrence Categories

Unmappable Areas that are sufficiently disturbed so that Phytophthora Dieback occurrence mapping is	Further categorisation may be possible after variable regeneration periods for different types of disturbance.

not possible at the time of inspection.		
Mappable Natural undisturbed vegetation. Phytophthora Dieback occurrence mapping is possible. Three categories may result.	Infested	Areas that a qualified person has determined to have plant disease symptoms consistent with the presence of the pathogen Phytophthora Dieback.
	Uninfested	Areas that a qualified person has determined to be free of plant disease symptoms that indicate the presence of the pathogen Phytophthora Dieback.
	Uninterpretable	Areas where indicator plants are absent or too few to determine the presence or absence of disease caused by Phytophthora Dieback.

Pre survey desktop study

The database of known *Phytophthora* locations retained by Vegetation Health Services (Department of Environment and Conservation) was searched to determine previous recoveries of *Phytophthora* within the project area. No known samples positive to *P. cinnamomi* have been recorded immediately adjacent to the project area, however other Phytophthora species have been recorded. These species were recorded as *P. citricola* (now identified as *P. multivora*) (Scott, et al., 2009) and *P. nicotianae*.

Previous Phytophthora Dieback Occurrence reports and maps pertaining to the study area were also studied prior to undertaking the field work.

Demarcation of hygiene boundaries

The Infested hygiene category in the project area has been demarcated with 25mm day-glow orange flagging tape tied to the vegetation. The taping extends across the extent of the alignment.

Mapping

Phytophthora Dieback disease symptoms were recorded during the assessment on a hand-held GPS. The data collected forms an evidence collection set of locations of fresh disease expression, areas that are free of symptoms, and areas where the disease symptoms could not be determined, for example areas of significant disturbance or areas with minimal reliable disease indicating species.

Factors indicating the presence of Phytophthora Dieback

A combination of the following factors may indicate the presence of disease caused by *Phytophthora* Dieback or other *Phytophthora* species.

Deaths of disease indicating species:

An indicator species is a plant species, which is reliably susceptible to Phytophthora Dieback (i.e. will die). Common indicators include several species of *Banksia, Patersonia*, *Persoonia*, and *Xanthorrhoea*. The distribution and composition of indicator species will vary from place to place according to vegetation types.

Chronology of deaths:

As the pathogen spreads through an area, some or all susceptible plants become infected and die. Consequently there will be an age range from more recent deaths with yellowing or brown leaves through to older leafless stags to remnant stumps in the ground.

Pattern of deaths:

The topography, soil type, vegetation type and drainage characteristics of an area together with the influence of climatic patterns and disturbances will influence the shape or pattern of an infested area over time. A typical recent infestation may show a small cluster of dead indicator species which, in time, will spread to become a small circular shape 'the ulcer effect' and then begin lengthening towards natural drainage channels. A fringe of recent deaths is often seen around the edge of the infested area. Patterns may be further highlighted by a paucity of ground cover within the infested area.

Environmental factors:

Sites will vary in the way that disease is expressed both spatially and temporally. Environmental conditions can either favour or disfavour the growth and spread of the pathogen. Sites that are moist but not saturated are most favourable, sites that are well drained and mostly dry are least favourable.

Other causes of indicator species death:

Phytophthora cinnamomi is not the only agent to cause death of native vegetation. Other agents include, but are not limited to:

- other *Phytophthora* spp, *Armillaria luteobubalina*, various cankers, insects;
- drought, wind scorch, frost, salinity, water logging, fire and lightning;
- senescence, competition, physical damage;
- herbicides, chemical spills (for example fuel).

Sampling strategies

The sampling of suspicious Phytophthora Dieback indicating species can be undertaken to support the field decision and decision making process. The sampling strategy will take into consideration the following scenarios.

Supporting Infested Field Diagnosis

Positive sample results may be used to support an obvious field diagnosis, providing irrefutable evidence of *Phytophthora* presence. A negative result does not necessarily contradict the field decision, but rather indicates that the pathogen was not recovered from the sampled site.

Supporting Uninfested Field Diagnosis

This strategy involves testing apparently uninfested sites for cryptic and incipient disease. Targeting of sampled plants will always be towards species and locations that are more likely to give a positive result. Several negative results are needed to provide reasonable evidence of an uninfested area. Common scenarios involving this strategy include testing drought deaths, other possible pathogens and deaths in Unmappable areas.

If any samples return a positive results then a re-assessment of the area and field decision process is required.

Limitations of disease mapping

The assessment for the disease caused by Phytophthora Dieback is based on interpreting the vegetation for symptoms which can be ascribed to the disease presence. These observable factors must be present during the assessment period. Management recommendations may be included if it is considered that the disease may be cryptic, or the project area displays evidence of activities that are considered a high risk of introducing the disease.

The validity of the hygiene boundaries mapped for this project is twelve months from the completion of this project. All boundaries should be reassessed by 07/2014 if activities are still occurring beyond this time.

RESULTS

The Project Area has been determined to be a mosaic of Infested, Uninfested, and Unmappable vegetation shown in Figures 4 and 5 of this report. The following 'Table 2 - Occurrence Category Summary' shows the relevant areas of each hygiene category.

Table 2 - Occurrence Category Summary

Category	Area (hectares)	% of total area
Infested (with *P. cinnamomi*)	2.6 ha	0.6 %
Uninfested	171.8 ha	39.3 %
Unmappable	262.9 ha	60.1 %
Total	437.3	

The following 'Table 3 - Sample Summary' displays the location (GDA94 Zone 50) of each sample and the result from the laboratory analysis of the sample.

Table 3 - Sample Summary

Sample	Plant sampled	Easting	Northing	Result
1	*Xanthorrhoea preissii*	380948	6491818	Negative
2	*X. preissii*	381370	6493004	Negative
3	*X. preissii*	381364	6493047	Negative
4	*Banksia attenuata*	381977	6492920	Negative
5	*B. grandis*	382149	6492774	Negative
6	*X. preissii*	382405	6492895	Negative
7	*X. preissii*	382840	6492813	Negative
8	*X. preissii*	381913	6493711	Negative
9	*B. attenuata*	379423	6498841	Negative
10	*X. preissii*	377045	6500700	Negative
11	*X. pressii*	379434	6498983	Negative
12	*X. preissii*	380689	6491929	Negative

13	*X. preissii*	377923	6498928	Negative
14	*X. preissii*	377689	6499695	Negative
15	*B. attenuata*	378499	6497973	*Phytophthora multivora*

Seven known samples from the DEC database have been taken in the project area, five in a previous survey in 2000 and two in 2001. These samples are summarised in the following Table 4.

Table 4 - Sample results from previous surveys

Date	Sample Name from Database	Easting	Northing	Result
17/4/2000	Freeway Extension S1	381370	6490671	Negative
18/4/2000	Freeway Extension S2	380413	6492837	Negative
18/4/2000	Freeway Extension S3	379955	6495018	Negative
18/4/2000	Freeway Extension S4	378872	6497278	Negative
18/4/2000	Freeway Extension S5	378738	6497398	*P. citricola* (1)
21/3/2001	Yanchep S1	379940	6497695	*P. nicotianae*
21/3/2001	Yanchep S2	379840	6497899	Negative

(1) Recent advances in DNA analysis of Phytophthora species has determined that all previous recoveries of *P. citricola* are likely to be *P. multivora*.

DISCUSSION

The project area covers approximately 440 hectares of vegetated and cleared areas, and is generally immediately adjacent to the Neerabup National Park R27575 which includes the Bush Forever Site 383.

The project area lies predominantly within the Spearwood and Quindalup dune systems (Department of Environment and Conservation, 2012) which is a landform where the effect of *Phytophthora cinnamomi* on the vegetation would minimal (Department of Conservation and Land Management, 2003). During the assessment it was observed that the vegetation was generally overlaying calcareous soils with surface limestone in many places. Some isolated sites did however appear to have a Bassendean dune structure which is more suited to the presence and spread of *P. cinnamomi*.

Due to the limited expected Phytophthora disease expression on the calcareous soils, the vegetation in these areas could be uninterpretable to the disease. Due to the results of the samples from this assessment, and previous assessments, the areas that aren't Infested and Unmappable are considered Uninfested.

One site of vegetation that is suspected to be infested with *P. cinnamomi* was observed in the extension to Romeo Road portion of the project area. The suspected infestation has been demarcated using 25mm day-glow orange flagging tape across the extent of the alignment. The knot in the flagging tape faces the infestation. A sample of soil and root material taken from the site did not prove the presence of *P. cinnamomi*, however it is considered that the area should be treated and managed as being Infested.

Many sites within the project area are suffering from a decline in the vegetation, with some areas displaying an ulcer effect on the vegetation, with many deaths in Dieback susceptible species in a localised area. These sites were particularly near the proposed Carramar Road extension and adjacent to the rail alignment between Burns Beach

Road and Carramar Road. Samples were taken at these sites, and all returned negative results which supported the field decision. The Neerabup Management Plan also mentions that 'monitoring has revealed signs of long-term decline in the vigour and distribution of some wetland and terrestrial species in response to declining groundwater levels' (Department of Environment and Conservation, 2012).

Samples have also been taken in the project area during previous assessments, the locations (AMG84 Zone 50) are shown in Table 4. It should be noted that the sample previously identified as *P. citricola* is in all likelihood *P. multivora*.

One sample taken in the current survey, (S15), did prove positive to *Phytophthora multivora*. This sample is approximate to a previously taken sample (2000, Freeway Extension S5, Table 4) that was positive to *P. ciricola* (*P. multivora*). This general area, the eastern end of Lukin Drive, was described in a previous survey (Glevan Dieback Consultancy Services, 2000) as being a low-impact site affected by Dieback. The samples show that the pathogen responsible is *P. multivora* and not *P. cinnamomi*, which is more virulent and is the species referred to as 'Dieback'. The previous report should have more accurately described the area as being affected by Phytophthora.

Phytophthora multivora generally has a reduced impact on the vegetation, and the affected area may be managed using hygiene measures.

All sections of the project area to the west of the rail alignment are considered Unmappable, with the vegetation either disturbed or non-existent. These areas are considered Unprotectable. The vegetation adjacent to Burns Beach Road and on the Eastern side of Wanneroo Road is also considered Unmappable and Unprotectable. Deaths of Phytophthora susceptible species, particularly *Banksia attenuata* and *Xanthorrhoea preissii* were noted along the edge of the road and representative samples were taken. All vegetation within the existing rail easement has been disturbed to a degree to warrant it being Unmappable and Unprotectable.

The vegetation on the western side of Wanneroo Road, although Unmappable is considered Protectable as it abuts Neerabup National Park.

All vegetation adjacent to Hester Avenue and the proposed Carramar Road extension is Uninfested and Protectable.

The vegetation within the project area on the eastern side of the rail alignment, and the proposed extension of the alignment to Romeo Road is generally Uninfested with small patches of Unmappable areas. This area should be managed as Protectable.

Phytophthora Occurrence Maps

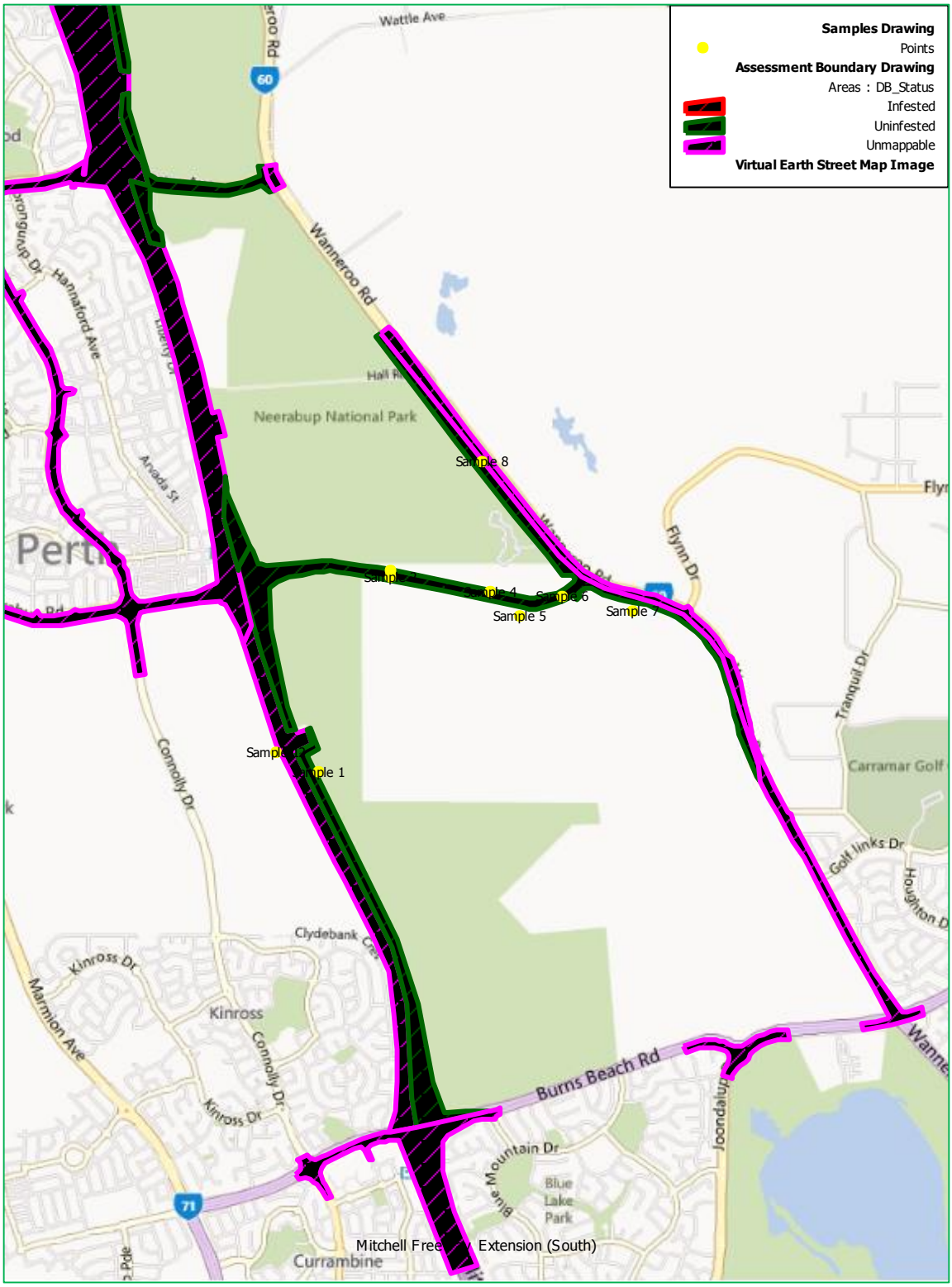

Figure 4 – Mapping of Dieback within the Project Area (South)

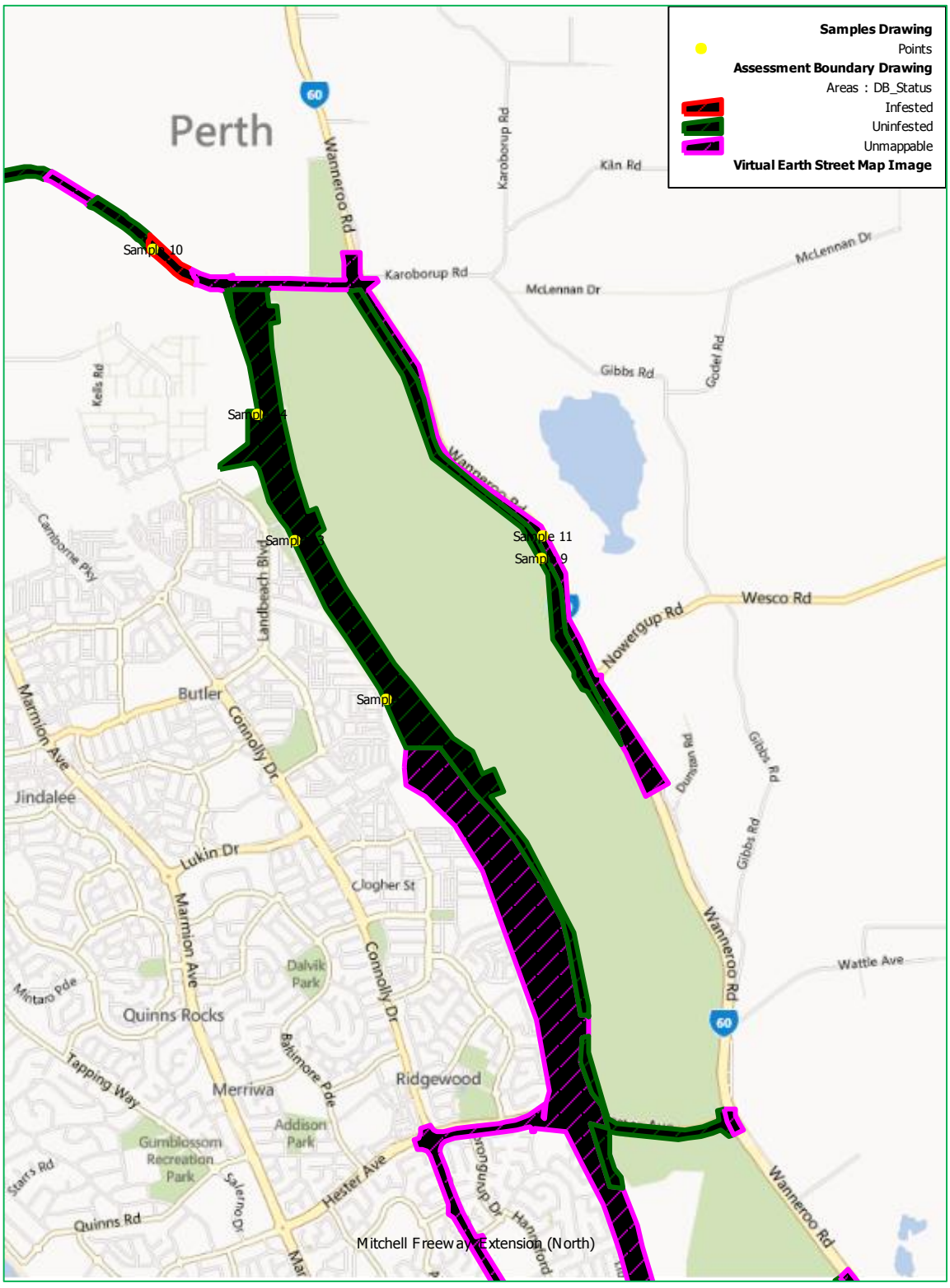

Figure 5 – Mapping of Dieback within the Project Area (North)

HYGIENE RECOMMENDATIONS

A Dieback Management Plan (DMP) should be developed to cover all activities associated with the development of the project. This plan should be considerate with the current management plan for Neerabup National Park and will be finalised once the construction design has been finalised.

Until development of the DMP, the following Clean on Entry (COE) Points are recommended for access to the project site.

Table 5 - COE Point Summary

COE Point	Figure	Comments
1	Figure 7	Entrance to Neerabup National Park from Wanneroo Road. Primary consideration COE Point placement to be traffic safety.
2	Figure 7	Entrance to Neerabup National Park from Burns Beach Road. COE Point to be placed (with permission) at entrance of DPAW gated track, and the track to be utilised for internal access.
3	Figure 7	Entrance to Neerabup National Park from Wanneroo Road. Primary consideration COE Point placement to be traffic safety and only to be used if required.
4	Figure 7	Entrance to Neerabup National Park south from Hester Road. Primary consideration COE Point placement to be traffic safety.
5	Figure 7	Entrance to Neerabup National Park north from Hester Road. Primary consideration COE Point placement to be traffic safety.

6	Figure 6	Exit from Phytophthora infested area for traffic travelling west along the alignment. COE point to be located on track at day-glow orange flagged demarcation line.
7	Figure 6	Exit from Phytophthora infested area for traffic travelling east along the alignment. COE point to be located on track at day-glow orange flagged demarcation line.
8	Figure 6	Entrance to Neerabup National Park south from Romeo Road.
9	Figure 6	Entrance to Uninfested area for traffic moving east from the Unmappable area.
10	Figure 6	Entrance to Uninfested area for traffic moving west from the Unmappable area.
11	Figure 6	Entrance to Neerabup National Park from Wanneroo Road. Primary consideration COE Point placement to be traffic safety and only to be used if required
12	Figure 6	Entrance to Neerabup National Park from Wanneroo Road. Primary consideration COE Point placement to be traffic safety and only to be used if required

At all COE Points, vehicles will be cleaned on soil and plant material prior to accessing the Uninfested vegetation. All material removed from the vehicles will be captured such that affected material does not wash into Uninfested areas.

It is recommended that all activities adjacent to Neerabup National Park be conducted in dry-soil conditions with no soil movement. Under these conditions, it may be acceptable to use a brush to remove soil, minimising the requirement for water wash downs.

All public areas are considered Unprotectable and may be accessed prior to the development of the DMP, however any activity within these areas that may indirectly

impact the Reserve are forbidden. These activities may include storage of materials or vehicles where run-off may enter the Reserve.

Recommended Hygiene Point Locations

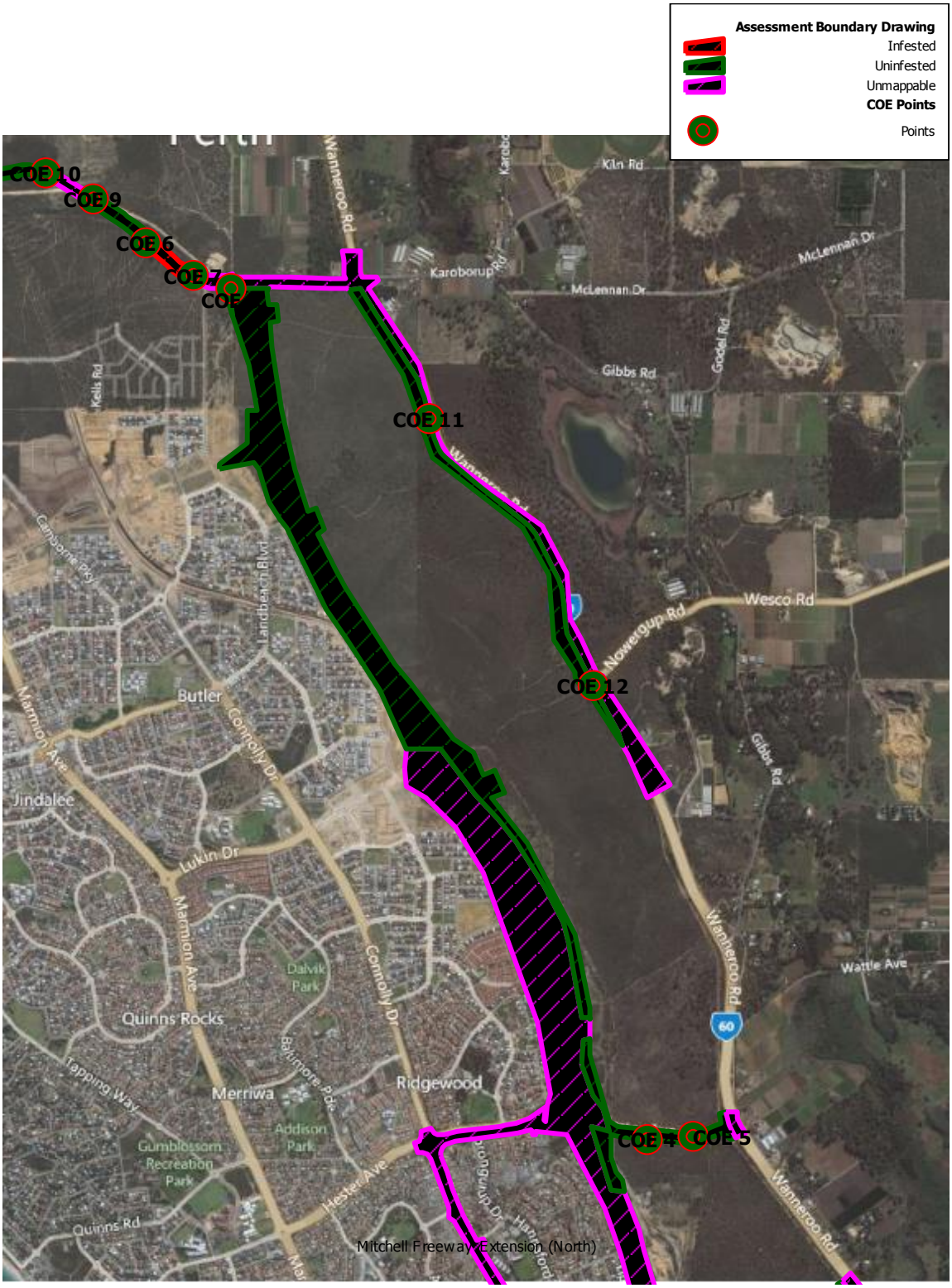

Figure 6 - Hygiene Point Locations (North)

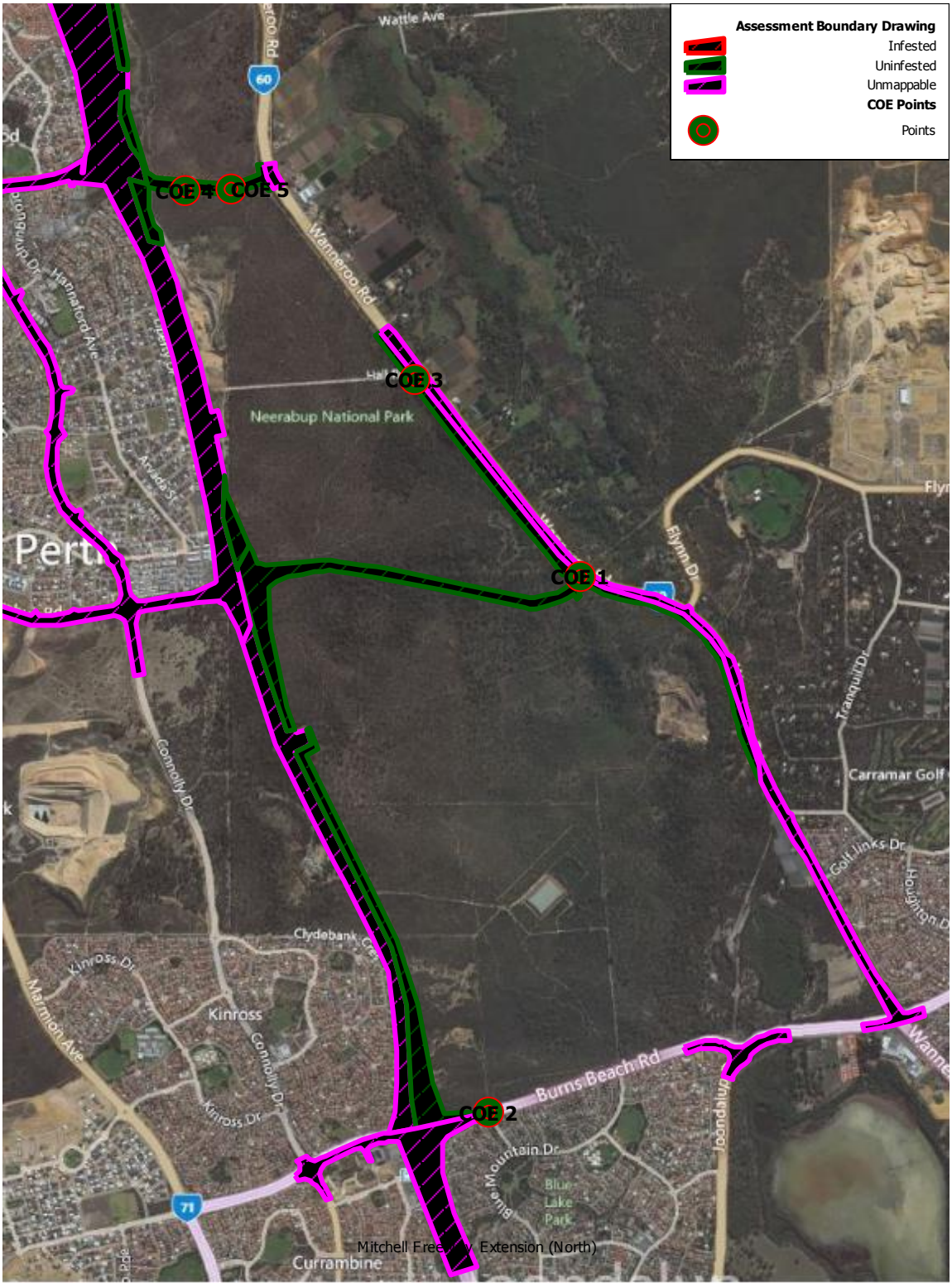

Figure 7 - Hygiene Point Locations (South)

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APPENDIX C

List of Contacts for Local Fauna Specialists

Organisation Name	Contact
Kaarakin Black Cockatoo Conservation Centre	(08) 9390 2288 (Business Hours) or Vet Nurse on 0448 046 202
Department of Parks and Wildlife 24 hour emergency number	(08) 9474 9055
Kanyana Wildlife	(08) 9291 3900
Darling Range Wildlife Shelter	0400 802 409
Native Animal Rescue	(08) 9249 3434
Native ARC Animal Rescue Centre	0487 922 484
Chittering Wildlife Carers (Inc.)	(08) 9571 2435

APPENDIX D

DotE Approval Letter BCAMP

Australian Government
Department of the Environment

Our reference: EPBC 2013/7091

Mr Kugan Kugananthan
Project Manager
Main Roads Western Australia
PO Box 6202
EAST PERTH WA 6892

Dear Mr Kugananthan

Approval of Black Cockatoo Avoidance and Mitigation Plan
Mitchell Freeway Extension between Burns Beach Rd and Hester Av, Neerabup, WA (EPBC 2013/7091)

I refer to your letter dated 14 October 2014 from you, to Nikki Ward of this department, which enclosed a copy of the Black Cockatoo and Avoidance Mitigation Plan – Mitchell Freeway Extension, as required under condition 2 of the approval decision dated 2 September 2014.

The Black Cockatoo and Avoidance Mitigation Plan – Mitchell Freeway Extension has been reviewed by officers of the department and has been found to meet the requirements of the condition. On this basis, and as delegate of the Minister for the Environment, I have decided to approve the Plan.

In accordance with condition 2 of EPBC 2013/7091 each approved plan must be implemented. Under condition 8, if the approval holder wants to act other than in accordance with the approved plans, the approval holder must submit a revised plan for approval. Until the Minister (or his delegate) has approved the revised plan, the approval holder must continue to implement the original plan.

As your project is now in the post-approval phase, the Approvals Monitoring South Section will be the point of contact for further communication with the department. To avoid any potential delays in responding to future requests of the department relating to the above project please refer all future correspondence to:

Approvals Monitoring South Section
Compliance and Enforcement Branch
Environment Assessment and Compliance Division
Department of the Environment
GPO Box 787
CANBERRA ACT 2601
Email: post.approvals@environment.gov.au

The Department has an active monitoring program which includes monitoring inspections, desk top document reviews and audits. As part of this program we will be undertaking a review of our records to ascertain the present status of this project in relation to its conditions of approval. We will contact you again if we require further information.

Please ensure that you maintain accurate records of all activities associated with, or relevant to the conditions of approval, so that they can be made available to the Department on request. Such documents may be subject to audit and used to verify compliance.

Summaries of results of audits may be published by the Department. Information about the monitoring and audit program can be found on the Department's website at www.environment.gov.au/epbc/compliance/auditing.html.

We would appreciate if you could advise us of any changes to the project e.g. contact officer, company address, commencement date etc.

You should note that any transfer of this approval to another person must have the consent of the Minister under section 145B of the EPBC Act.

If you have any enquiries please contact the Approvals Monitoring South Section or the assessment officer, Nikki Ward, on 02 6274 2082 or nikki.ward@environment.gov.au and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Dr Simon Banks
Assistant Secretary
West Assessment Branch
Environment Assessment and Compliance Division

26 October 2014

Note: Under s 491 of the *Environment Protection and Biodiversity Conservation Act 1999* it is an offence to knowingly provide false and/or misleading information to a departmental officer.