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Mirvac Projects Pty Ltd

Former Hoxton Park Airport Development

Ecological Impact Assessment for Proposed Access Road and Bridge

September 2010

Revision 4

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Project Description

GHD has prepared this ecological assessment on behalf of Mirvac Projects Pty Ltd ("Mirvac") for the proposed construction of an access road and bridge within the development at the former Hoxton Park Airport, in Hoxton Park, NSW ('the Project'). The site for this assessment comprises the footprint for a proposed access road that joins the M7 in the west with Cowpasture Road in the east via the former Hoxton Park Airport development site and the vegetated riparian corridor associated with Hinchinbrook Creek ('the site'). The proposed access road would provide alternate flood free access and egress to the industrial development currently under construction and proposed future residential developments adjoining the site.

Development at 'the site' is to be assessed as a Section 75W Modification to existing Development Consents (DC 10_0007 and 10_0008) obtained under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act). Part 3A provides the assessment and approvals process for major infrastructure projects. This ecological assessment has been undertaken to determine the conservation significance of 'the site', identify ecological constraints to future development, confirm previous approvals associated with 'the project' and identify any likely impacts on flora and fauna.

'The site' adjoins the former Hoxton Park Airport Redevelopment area, which is subject to previous development approvals. Mirvac obtained approval under Development Consents (DC 10_0007, 10_0008, 10_0009 and 10_0010) for an 'employment zone development' as described in the GHD (2010a) *Report for the former Hoxton Park Airport Development Ecology Assessment*. The employment zone development falls within an area already rezoned by Liverpool City Council (LCC) for development. The Vegetation Management Plan (VMP) for the former Hoxton Park Airport Redevelopment (GHD 2007a) has been approved by the then Department of Water and Energy (DWE) and LCC. An offsets strategy for the former Hoxton Park Airport Redevelopment (GHD 2007a) has been approved by LCC and the Department of Environment, Climate Change and Water (DECCW). The outcomes/obligations for rehabilitation and management outlined in these plans were included in a Voluntary Planning Agreement (VPA). The project will require additional biodiversity offsets to mitigate impacts as described in this report.

GHD has been engaged to prepare an EIA Report which will provide an assessment of the impacts of the Project on flora and fauna to accompany an application for a modification to a Project under Section 75W Part 3A of the EP&A Act.

The purpose of this EIA Report is to:

- Describe the natural environment of the site, including the conservation significance of local biota and identify any likely impacts arising from the Proposal.
- Assess the significance of impacts of the Proposal on threatened flora and fauna, including whether a significant impact on threatened species / endangered populations / endangered ecological communities listed on the NSW *Threatened Species Conservation 1995 (*TSC Act) and their habitats is likely to result from the proposed works.

- Assess the potential impacts on any ecological Matters of National Environmental Significance (NES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); and determine whether the Proposal is likely to constitute a 'controlled action' and require Referral under the EPBC Act.
- Identify appropriate measures to manage the ecological impacts of the Proposal, including measures to avoid, mitigate and offset potential impacts on native biota.

1.2 Definitions

The Proposal	the development which is to be assessed, comprising the construction of an access road and bridge.
The site	the area to be directly affected by the Proposal, incorporating the development footprint for the access road.
The study area	the area covered by the current assessment, including the site, adjoining areas of the natural environment which are likely to be affected by the Project and the study areas for previous assessments in the vicinity of the site which were included in the literature review for this assessment.
The locality	the area within a 10 km radius of the site.
Threatened biota	threatened species, populations and endangered ecological communities listed on the schedules of the EPBC Act, TSC Act and/or FM Act.
CEEC	Critically Endangered Ecological Community, a threatened ecological community listed on the schedules of the EPBC Act, TSC Act and/or FM Act ;
EEC	Endangered Ecological Community, a threatened ecological community listed on the schedules of the EPBC Act, TSC Act and/or FM Act.
CPW	Cumberland Plain Woodland, a CEEC comprising both Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest which is listed as a CEEC under the EPBC Act (DEWHA, 2010) and Cumberland Plain Woodland (Ecological Community of the Cumberland Plain) which is listed as a CEEC under the NSW TSC Act (DECCW, 2010b).

1.3 Scope of Report

The project is a modification to an existing Major Project Approval and accordingly is subject to the development and assessment processes and requirements of Part 3A of the EP&A Act, with the Minister for Planning as the consent authority. The purpose of this EIA is to assist the Minister to assess the significance of impacts of the Proposal on native flora and fauna and especially threatened biota.

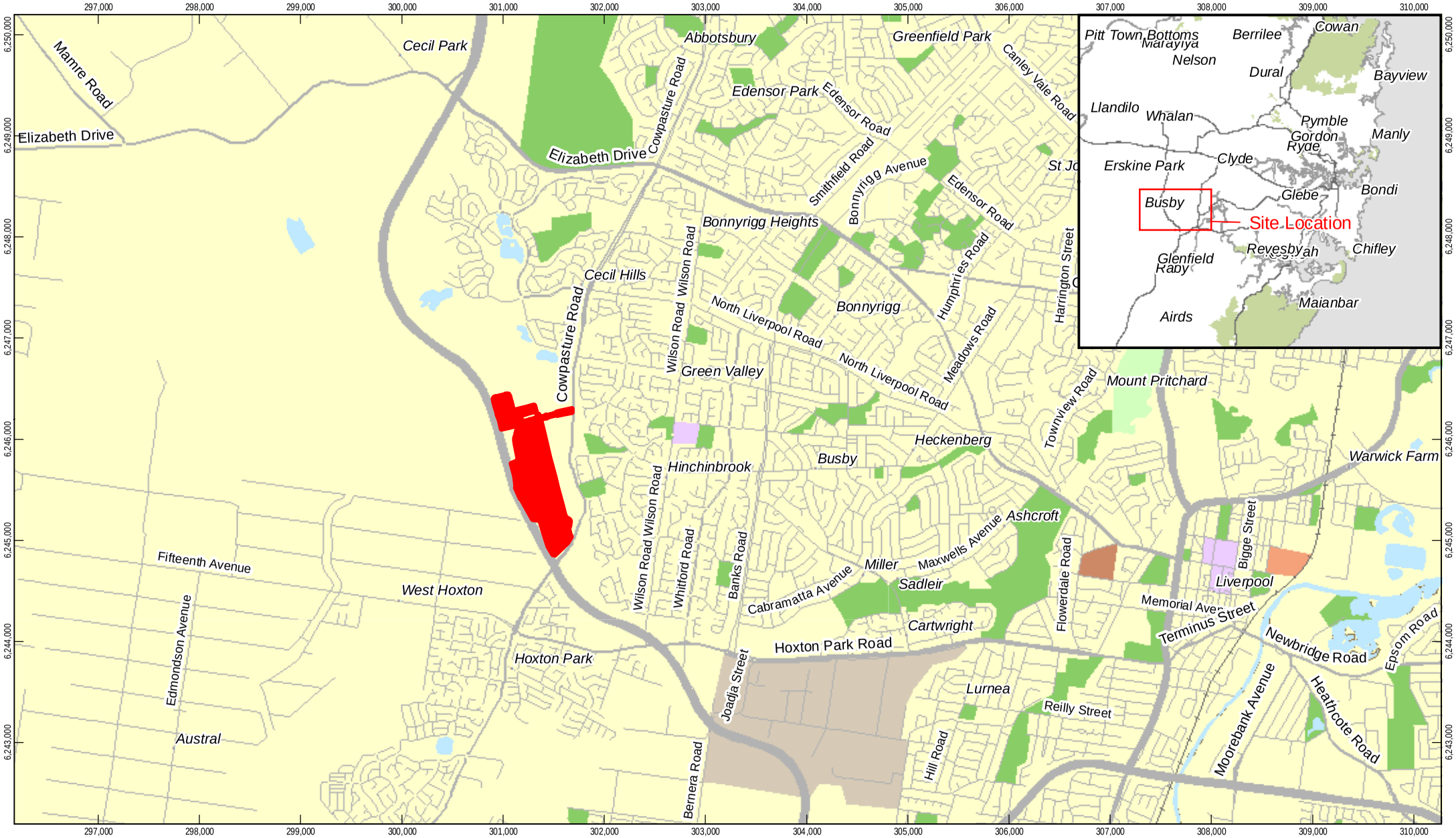
The key components and objectives of this ecological assessment include:

- Review of existing information including the earlier ecological assessments and environmental plans for 'the site', biodiversity databases, previous planning/environmental approvals and other relevant technical reports and investigations;

- Field surveys and assessment to build on the existing biodiversity information available for ‘the site’ and immediate surrounds;
- Description of the existing environment of ‘the site’ and surrounding area, including type and condition of vegetation communities, terrestrial and aquatic habitats and overall biodiversity values;
- Assessment of the likelihood of occurrence of threatened species, populations ecological communities and their habitats listed under the TSC Act, FM Act and EPBC Act within ‘the study area’;
- Assessment of the conservation significance of ‘the site’ and ecological constraints and opportunities to ‘the project’;
- Assessment of potential impacts of ‘the project’ on native flora and fauna, including threatened biota at ‘the site’; and
- Measures to avoid, minimise, mitigate and offset impacts on biodiversity values of ‘the study area’ in accordance with the Part 3A assessment guidelines.

The assessment is designed to provide information and analysis to demonstrate that measures to avoid impacts have been considered and where there are impacts, that adequate mitigation measures and biodiversity offsets are implemented.

Consideration was also given to the *Draft Threatened Biodiversity Survey and Assessment Guidelines* (DEC, 2004) with regards to the scope and timing of flora and fauna surveys.



1:50,000 (at A4)

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

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

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LEGEND

Study Area

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Site Location

Job Number	22 - 14911
Revision	B
Date	20 JUL 2010

Figure 1

G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z001_SiteLocation.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: DCDB, NSW Dept of Lands; Street Map, Navigate. Created by: Cwilson, qjchung, bahambly

301,000 302,000

6,246,000

DP1111381 DP875867 DP1042996 DP838730 DP829870 DP237890 DP868348 DP774970 DP816947 DP1115645 DP1111918 DP2475 DP413852 DP1049478 DP711938 DP381267 DP1044841 DP1078564 DP1089776 DP856142 DP849282 DP860568

M7 Motorway

Hinchinbrook Creek

Cowpasture Road

6,245,000

Image from Google Earth

301,000 302,000

Legend

- Study Area
- Cadastral Boundaries
- Cleared under previous approvals (Biosis 2006)
- Proposed Northern Basin and Spillway
- Employment Zone Development
- Proposed Access Road and Bridge (The Site)

1:5,000 (at A3)

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

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Mirvac Group Pty Ltd
Hoxton Park Airport Development -
EIA for Proposed Access Road and Bridge

Job Number 22 - 14911
Revision B
Date 17 SEP 2010

Site Layout

Figure 2

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2. Legislative Context

2.1 Commonwealth Legislation

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on matters of national environmental significance undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Commonwealth Minister for the Environment and Water Resources.

The EPBC Act identifies matters of national environmental significance as:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

The Administrative Guidelines for the EPBC Act (Department of the Environment & Heritage 2006) set out criteria intended to assist in determining whether an action is controlled and hence requires approval. In particular, the Guidelines contain criteria for determining whether a proposed action is likely to have a 'significant impact' on a matter of national environmental significance (MNES). Should the proponent deem the development likely to have a significant impact on a matter of MNES, a referral to the Commonwealth Minister for the Environment would be undertaken to obtain a determination as to whether the development is a 'controlled action' requiring Commonwealth approval.

In January 2007, the Commonwealth and NSW governments signed a Bilateral Agreement which allows DEWHA to accredit the assessment regimes under Part 3A, Part 4 and Part 5 of the EP&A Act for assessment purposes under the EPBC Act. The Bilateral Agreement applies only to proposals that the Commonwealth Environment Minister has determined are controlled actions under the EPBC Act, with the exception of nuclear actions (DoP 2007).

The EPBC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species or ecological communities that have been previously recorded within the locality of the site and hence could occur, subject to the habitats present;
- Targeted field surveys for species and ecological communities listed under the Act;

- Development of suitable impact mitigation and environmental management measures for threatened species, where required; and
- Assessment of potential impacts on threatened species.

NES matters of potential relevance to this development include nationally listed threatened species and ecological communities, and migratory birds.

An EPBC Act assessment was undertaken in accordance with the EPBC Act Significant Impact Guidelines for ecological matters of NES, and is discussed below in Section 6 and in more detail in Appendix C of this report.

2.2 NSW State Legislation

2.2.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

The EP&A Act forms the legal and policy platform for development assessment and approval in NSW and aims to, *inter alia*, 'encourage the proper management, development and conservation of natural and artificial resources'. Proposed developments and activities must address the provisions of the EP&A Act. Objective 5(a)(vi) of the EP&A Act encourages the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities and their habitats. The proposal is a Major Project according to *State Environmental Planning Policy (Major Projects) 2005* and as such, is to be assessed under the provisions of Part 3A of the EP&A Act, with the Minister for Planning as the Consent Authority for the Project Application.

A Section 75W modification for the proposed works by Mirvac is required to account for changes in the current approved project in accordance with the requirements of the NSW EP&A Act.

Section 5A of the EP&A Act (as amended by the *Threatened Species Legislation Amendment Act 2004* (TSLA Act) sets out the factors (known as the Assessment of Significance or Seven Part Test) to be considered when determining whether an action, development or activity is likely to significantly affect threatened species, populations or ecological communities, or their habitats. The ultimate objective of the application of Section 5A of the Act is to improve the standard of consideration afforded to threatened species, populations and ecological communities, and their habitats through the planning and assessment process, and to ensure this consideration is transparent.

The Assessment of Significance allows a determination of whether a proposed development or activity is likely to have a significant effect on threatened species, populations or ecological communities, or their habitats. It applies to threatened species, populations and ecological communities listed on both the TSC Act and the *Fisheries Management Act 1994* (FM Act). Assessments of Significance undertaken in accordance with Section 5A of the EP&A Act for each threatened species or endangered ecological community which may be directly or indirectly impacted by the current development are presented in full in Appendix C and summarised in Section 9.1 of this report.

2.2.2 Threatened Species Conservation Act 1995 (TSC Act)

.The *Threatened Species Conservation Act 1995* (TSC Act) provides legal status for biota of conservation significance in NSW. The Act aims to, *inter alia,* 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

- The listing of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A and vulnerable species and communities listed under Schedule 2;
- The listing of 'Key Threatening Processes' (under Schedule 3);
- The preparation and implementation of Recovery Plans and Threat Abatement Plans; and
- Requirements for the preparation of Species Impact Statements (SIS).

The TSC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the site and hence could occur subject to the habitats present;
- Targeted field surveys for threatened species listed under the Act;
- Development of suitable impact mitigation and environmental management measures for threatened species, where required; and

Assessment of potential impacts on threatened species including Assessments of Significance pursuant to Section 5A of the EP&A Act for threatened biota potentially affected by the development.

2.2.3 Fisheries Management Act 1994 (FM Act)

Marine and freshwater threatened species, populations and ecological communities of fish and vegetation are addressed in the FM Act. The objectives of the FM Act are to:

- Conserve biological diversity of fish and marine vegetation and promote ecologically sustainable development and activities;
- Prevent the extinction and promote the recovery of threatened species, populations and ecological communities of fish and marine vegetation;
- Protect the critical habitat of those threatened species, populations and ecological communities that are endangered;
- Eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities of fish and marine vegetation;
- Ensure that the impact of any action affecting threatened species, populations and ecological communities of fish and marine vegetation is properly assessed; and
- Encourage the conservation of threatened species, populations and ecological communities of fish and marine vegetation by the adoption of measures involving co-operative management.

Section 220ZZ of the FM Act, as amended by the *Threatened Species Legislation Amendment Act 2004*, lists the factors to be addressed in the Assessment of Significance of impact on threatened species, populations, ecological communities of fish and marine vegetation.

Threatened species, populations and ecological communities of fish and marine vegetation are addressed in Section 6.1.5 of this report.

2.2.4 Noxious Weeds Act 1993 (NW Act)

The *Noxious Weeds Act 1993* (NW Act) provides for the declaration of noxious weeds by the Minister of Agriculture. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act. As such, if present, noxious weeds on the site should be controlled in accordance with the control category specifications.

2.3 State Environmental Planning Policies (SEPPs)

2.3.1 SEPP 44 - Koala Habitat Protection

State Environmental Planning Policy 44 (SEPP 44) aims to encourage the ”proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline”.

As the project is a major project subject to Part 3A of the EP and A Act, SEPP 44 does not technically apply. Notwithstanding, the general principles of the SEPP have been considered.

SEPP 44 requires that, before granting consent for development a consent authority must be satisfied as to whether or not the land is ‘potential’ and ‘core’ Koala habitat.

Under the SEPP, potential Koala habitat is defined as “an area of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component”. Schedule 2 lists selected koala feed tree species.

Core Koala habitat, is defined as “an area of land with a resident breeding population of Koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population”.

As discussed in Section 4, the principles of SEPP 44 were addressed through NPWS Wildlife Atlas searches for the species, targeted surveys for Koalas and Koala feed trees and searches for signs of recent Koala activity.

2.3.2 SEPP 19 - Bushland in Urban Areas

The general aim of SEPP 19 is to protect and preserve bushland within the urban areas referred to in Schedule 1 of the Policy because of:

- Its value to the community as part of the natural heritage;
- Its aesthetic value; and

- Its value as a recreational, educational and scientific resource.

Under SEPP 19, development consent is required from the local council for the carrying out of a proposal that will disturb bushland zoned or reserved for public open space. SEPP 19 also applies to land adjoining land zoned or reserved for public open space.

Liverpool LGA is listed under Schedule 1 of SEPP 19 as an area to which the policy applies. The Hinchinbrook Creek corridor, in the eastern portion of the site, is zoned RE1- Public Recreation (LCC, 2010). Construction of the proposed access road would disturb bushland in this area. SEPP 19, Clause 6 notes “A person shall not disturb bushland zoned or reserved for public open space purposes without the consent of the council”. Construction of the proposed northern basin would disturb land adjoining bushland zoned or reserved for public open. SEPP 14, Clause 9 notes that the public authority must also consider effects of development of land adjoining bushland zoned or reserved for public open on that bushland.

Therefore SEPP 19 has been addressed in this assessment through consideration of the effect of the Proposal on bushland zoned or reserved for public open space purposes including disturbance of vegetation, effects on habitat connectivity, erosion of soils, the siltation of streams and waterways and the spread of weeds and exotic plants within the bushland. These matters are addressed in Section 7.

3. Existing Environment

3.1 Site Location & Layout

The study area is located adjacent to the former Hoxton Park Airport redevelopment at Hoxton Park, in the southwest of Sydney, NSW. It is situated between the M7 Westlink Freeway and Cowpasture Road and is entered via Cowpasture Road. To the immediate east of the former airport is the Hinchinbrook Creek riparian corridor which contains intact native vegetation and will be the subject of riparian rehabilitation works. The study area is located in the Liverpool Local Government Area (LGA), between the suburbs of Cecil Park, Cecil Hills, West Hoxton, Green Valley and Hinchinbrook (refer Figure 1).

The indicative layout of the development area is shown on Figure 2. For the purposes of this report 'the site' refers to the footprint of the proposed access road, which will run from Cowpasture Road, across Hinchinbrook Creek and join into the new approved road which forms part of the former Hoxton Park development.

The proposed access road passes through the Hinchinbrook Creek riparian corridor. The riparian corridor is within the RE1 Public Recreation Land and contains remnant and regenerating native vegetation. Vegetation within the riparian zone of the creek line is predominately Alluvial Woodland (consistent with the EEC River Flat Eucalypt Forest). These communities grade to Shale Plains Woodland (consistent with the CEEC Cumberland Plain Woodland) outside the riparian zone.

The site is adjoined by 'the employment zone development' to the south-west, which is subject to the existing Part 3A development approval granted to Mirvac and is currently under construction; and a future proposed 'northern basin and spillway' to the west, which will be subject to a separate development approval. These areas form the 'study area' referred to in this report.

The site for the future proposed northern basin is currently zoned SP2 Drainage and contains remnant and regenerating native vegetation, including a patch of Cumberland Plain Woodland. Two unnamed drainage lines run through the central portion of the basin footprint. The proposed spillway footprint contains derived grassland, wetland vegetation along a drainage line and regenerating Cumberland Plain Woodland.

When the employment zone development area was rezoned for development by Liverpool City Council (LCC), the rezoning included an offset strategy to compensate for impacts on native biota arising from those developments (GHD, 2007a; 2007b). This offsets strategy provides for the conservation and remediation or revegetation of an offset site within the western portion of the Hinchinbrook Creek riparian corridor. The western portion of the access road passes through, and will impact on this offset site.

To the east of the study area is Cowpasture Road and the suburb of Hinchinbrook which predominantly contains low density residential development. Immediately to the north is a future commercial/retail uses development which will eventually provide a buffer for the future 200 (approximately) dwellings which are planned for construction further north. Further north again is the Cecil Hills High School and beyond that the Cecil Hills residential sub-division.

The M7 adjoins the western boundary of the study area. The M7 is a 4 lane motorway connecting the M2, M4 and M5 motorways through the outer suburbs of Sydney.

Beyond the M7 is a Mirvac/Landcom joint venture called Parkbridge which will accommodate approximately 700 residential lots. The area to the northwest of the study area contains a large stand of remnant vegetation, known as the 'Spotted Gum Forest', and beyond that the Western Sydney Parklands. There is an underpass beneath the M7 immediately to the west of the proposed northern basin which contains a bike track, a pad for the western extension of the proposed access road and an artificial drainage line.

Cowpasture Road, which is currently being upgraded by the RTA, bounds the southern part of the study area. Beyond Cowpasture Road is vacant land which is zone RU1 – Primary Production.

3.2 Geology, Soils and Topography

The study area is located on a relatively level area of low topographic relief. The unnamed creek to the north contains a variety of channels and pools, with some eroded creek banks being moderately steeply inclined.

Reference to the 1:100 000 Blacktown soil landscape map (Hazelton et al. 1989) indicates that the subject site occurs on gently undulating rises on Wianamatta Group Shales. Hinchinbrook Creek is described as a fluvial landscape occurring on floodplains, valley flats and drainage depressions of the channels on the Cumberland Plain.

3.3 Hydrology

Hinchinbrook Creek runs through the eastern portion of the study area, and forms part of the wider Georges River catchment. The Project will intersect with this feature.

An unnamed drainage line runs through the central portion of the proposed northern basin area, from the M7 underpass in the west to a culvert and drain beneath the former airport runway and then eastwards to Hinchinbrook Creek. There are an additional two artificial ephemeral drainage lines and freshwater wetlands.

Numerous named creeks and unnamed tributaries also occur in the surrounding area as well as ephemeral drainage lines and freshwater wetlands. Most of the named creeks have narrow corridors of native riparian vegetation.

3.4 Climate

The Commonwealth Bureau of Meteorology website provides climatic information for the site taken from Bankstown Airport weather station (closest station to site). A review of this data indicated that the mean rainfall peaks in summer and ranges from 108.8 mm in February down to 44.6 mm in July and September. Mean daily maximum temperatures range from 28.1^{o}C in summer to 17.2^{o}C in winter with mean minimum temperatures ranging from 18.0^{o}C in summer down to 5.1^{o}C in winter (Bureau of Meteorology 2010).

4. Methods

4.1 Literature Review

This report comprises an extension to information presented in the GHD (2010a) *Report for the former Hoxton Park Airport Development Ecology Assessment* which was an appendix to the concept and Project Applications.

GHD has completed a review of ecological assessments and technical reports relevant to the former Hoxton Park airport site including the following resources:

- GHD (2007a) *Vegetation Management Plan for Hoxton Park Airport*, November 2007;
- GHD (2007b) *Offset Strategy Hoxton Park Airport*, November 2007;
- GHD (2007c) *Seven Part Test – Hoxton Park Airport*;
- Biosis Research (2006) *Flora and Fauna Assessment of the Stage 1 Subdivision, Hoxton Park Airport*, July 2006; and
- New South Wales National Parks and Wildlife Service (2002) *Native Vegetation Maps of the Cumberland Plain, Western Sydney*.

4.2 Database Searches

Records, and potential occurrences, of threatened species, populations and endangered ecological communities (threatened biota) were extracted from the following databases for a 10 km radius around the site:

- The NSW Department of Environment, Climate Change and Water's (DECCW) Wildlife Atlas for threatened biota listed under the TSC Act which have been recorded within the locality;
- The Commonwealth Department of Environment, Water and Heritage and the Arts (DEWHA) Protected Matters Search Tool for Matters of National Environmental Significance (NES) listed under the EPBC Act which may occur in the area;
- BioNet database (which comprises records from the Royal Botanic Gardens, Australian Museum, State Forests, DECCW and NSW Fisheries collections);
- Birds Australia's The New Atlas of Australian Birds (Barrett et al. 2003) and Birdata online database search tool; and
- The NSW Department of Environment, Climate Change and Water's (DECCW) Threatened Species Profile online database (Cumberland CMA sub-region).

4.3 Field surveys

Two field surveys of the study area were conducted:

- An initial two-day, one-night survey on 16th-17th December 2009 sampling the proposed locations for the access road and the future proposed sediment basin; and
- A supplementary three-day, two-night survey on 19th-21st January 2010 sampling the development footprint for an adjoining proposal.

An additional one-day site inspection was undertaken on 23rd July 2010 to assess the alignment of the proposed access road and bridge through the Hinchinbrook Creek corridor, which was altered on advice from the Roads and Traffic authority (RTA). This site inspection involved targeted searches for habitat trees and threatened flora, assessment of riparian and terrestrial habitats and opportunistic fauna sightings within the new alignment.

4.3.1 Flora Survey

Flora survey methods used during the current field surveys are described below.

Vegetation Mapping and Habitat Resources

Remnant vegetation in the study area was assigned a vegetation community type based on vegetation composition, soil type, and with reference to NPWS (2002) interpretive guidelines. Vegetation communities were verified through characterisation of all vegetation within 20 m x 20 m quadrats placed randomly within the vegetation communities, consistent with DEC (2004) survey guidelines. Random meander surveys were used to compile a species list for small or fragmented patches. Additional survey effort was performed in all vegetation patches with the potential to be threatened ecological communities, or where vegetation type or structure changed. All species present within each quadrat were recorded along with a cover abundance ranking. The locations of vegetation survey quadrats and random meander surveys are indicated on Figure 3.

Biophysical setting, including vegetation structure, geomorphology and habitat resources were described for each vegetation type. Notes were taken on canopy cover, numbers of tree-hollows, fallen debris, presence of wetland and aquatic habitat, the dominant species, soil type and condition and the level of weed invasion and any other signs of disturbance. Reference was made to DECCW (2010b) threatened species profiles and threatened ecological community identification guidelines to assess the presence of threatened Cumberland Plain communities, listed under the TSC and EPBC Acts and verify the conservation significance of vegetation (i.e. areas of core and support for core habitat) identified and mapped by DECCW (NPWS 2002). Vegetation maps were developed to map the native vegetation at the site in accordance with its condition (i.e. canopy cover, degree of disturbance) and conservation significance.

Targeted Flora Survey

Targeted flora surveys were undertaken in areas of threatened species habitat, via random meander transects. Any specimens that required verification, or for which identification was problematic were sent to the Herbarium at the Royal Botanic Gardens for verification. The data gathered has been used to help ascertain areas of high ecological at the site.

4.3.2 Fauna Survey

GHD utilised the following methods to detect native fauna on site and to determine the likelihood of threatened fauna species and/or their habitats occurring within the site. Assessments were also made to ascertain the potential value of these habitats for native fauna in general. Fauna survey techniques and locations are indicated on Figure 3.

Habitat Assessment

An assessment of the nature and condition of habitats, specific resources and features of relevance for native fauna such as arboreal mammals, bat species and macropods were undertaken throughout the site. In addition, indirect evidence of fauna (i.e. scats, shells, feathers, fur, tracks, dens, nests, scratches, chew marks and owl wash) was also recorded.

Mapping of Habitat Trees

'Habitat trees' are trees which are likely to have higher conservation significance for native fauna and include hollow-bearing trees, stags (standing dead trees) and large, mature trees. Hollow-bearing trees are an important habitat resource for many native fauna species, including threatened arboreal mammals, bats, forest owls and cockatoos. The locations of all habitat trees observed within the study area were captured with a hand-held GPS and mapped using GIS.

Targeted Searches for the Cumberland Land Snail (Meridolum corneovirens)

Targeted searches for the threatened Cumberland Plain Land Snail were undertaken across the site in areas of potentially suitable habitat. Searches included lifting fallen timber, woody debris and leaf litter at the base of trees in areas of remnant woodland vegetation.

Riparian Habitat Assessments

Rapid riparian habitat assessments were undertaken, involving an assessment of the extent and condition of watercourses in the study area, their conservation value and their potential value as habitat for threatened aquatic biota. There is a low likelihood of any threatened aquatic fauna occurring at the site and the proposed bridge design will avoid impacts on important aquatic habitat in Hinchinbrook Creek. Therefore a targeted aquatic survey is not considered necessary for this project.

Diurnal Bird Surveys

Diurnal bird surveys were conducted at dawn and dusk when birds are typically most active in areas of suitable habitat. Targeted surveys were conducted for at least 40 minutes, through approximately 2ha of habitat at dawn and dusk, as well as opportunistic observations recorded throughout the field surveys. Birds were identified from observations or call identification.

Herpetofauna

Targeted searches for frogs and reptiles, including threatened amphibian species such as the Green and Golden Bell Frog (*Litoria aurea*), were undertaken in areas of potentially suitable habitat. Surveys included diurnal searches for basking frogs and tadpoles, searches under rocks, logs and other ground debris, and nocturnal creek and dam side spotlighting. Inspections of waterbodies were also undertaken to detect the presence of Plague Minnow (*Gambusia holbrooki*). This species is known to prey upon the eggs and tadpoles of many native frogs, including the Green and Golden Bell Frog (DECCW, 2010b) and thus a viable population is less likely with the presence of Plague Minnow.

Spotlighting

Spotlighting for arboreal fauna, nocturnal avifauna and amphibians was carried out over three nights. Walked transects were conducted for at least one hour, over approximately one kilometre, targeting potentially suitable habitat for arboreal habitat for mammals and nocturnal birds. Waterbodies, woody debris, shedding-bark on tree trunks and other suitable substrate was systematically checked using a head lamp targeting frogs, small mammals and reptiles. Additional slowly-driven transects along access roads were performed for approximately one hour per evening between the locations of other nocturnal survey sites.

Call Playback

Call playback was undertaken over three nights during the field survey targeting Green and Golden Bell Frog (*Litoria aurea*), Barking Owl (*Ninox connivens*), Powerful Owl (*Ninox strenua*), Yellow-Bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolcensis*) and Koala (*Phascolarctos cinereus*).

Vocal imitations of the Green and Golden Bell Frog were made for a period of one minute, followed by two minutes of listening. This call playback cycle was performed every 30-50m through areas of suitable habitat for the species. Calls of all frogs were noted during all active searches and nocturnal streamside searches for herpetofauna.

Digital recordings of arboreal mammal and forest owl calls were broadcast using a megaphone. Calls were played for a period of five minutes per species, followed by a listening period of five minutes per species. Additional listening periods and spotlighting within the surrounding area was conducted for 10 minutes before and after the call playback period.

Anabat

The echolocation calls of insectivorous bats were recorded at six locations across the study area over three nights using ultrasonic detectors (Anabat II Bat Detectors, Titley Electronics, Ballina NSW) and stored on compact flash (CF) memory cards for later computer analysis. Prior to field placement, each detector was calibrated and set to operate at the same sensitivity level (7, the maximum is 10). Detectors were orientated at a 45 degree angle on the ground in suitable flyways near open water on each night of the study period. The Anabats were activated just before dusk and retrieved each morning.

Recorded calls were identified using zero-crossing analysis and AnalookW software (version 3.6g, Chris Corben 2009) by visually comparing call traits. Craig Grabham (GHD) undertook analysis of bat calls from the 15-16 December 2009 field survey and Glenn Hoye (Fly by Night) analysed calls from the 19-21 January 2010 survey. Due to variability in the quality of calls and the difficulty in distinguishing some species, the identification of each call was assigned a confidence rating (see Mills et al. 1996; Duffy et al. 2000) as summarised in Table 1. Nomenclature follows Churchill (2008).

Table 1 Confidence Rating Applied to Microbat Calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call types or species call lacks sufficient detail.
PO - Possible	Call characteristics are comparable with the species, but there exists a reasonable probability of confusion with one or more bat similar species or quality or length of call prohibits a confident identification.
Species Group	Call made by one of two or more species. Call characteristics overlap making it to difficult to distinguish between species e.g. *C. gouldii/M. ridei* *Nyctophilus spp.* The calls of *Nyctophilus geoffroyi* and *N. gouldi* cannot be distinguished during the analysis process and are therefore lumped together.

Incidental Records and Opportunistic Sightings

Any incidental sightings of fauna or records of fauna tracks and scats were noted and where necessary collected for further identification.

4.3.3 Survey Conditions

The weather from the 16th-17th December 2009 was generally hot, calm and fine. Temperatures reached around 43.1 degrees Celsius during the day, dropping to 20.7 degrees Celsius during the night. No rain was experienced during the field surveys.

Weather conditions were sub-optimal for the detection of frogs at the site, as temperatures were relatively high at night but no rainfall was experienced. Weather conditions were suitable for the detection of native reptiles and bats potentially present at the site. Wind during dawn bird surveys was light. There was a close-to-full moon throughout the survey period and moderate spill from the nearby operations of the M7 Motorway. Moderate to high noise levels were experienced. These background noise and light levels meant that conditions through the nocturnal surveys were not ideal for the detection of small nocturnal fauna, nocturnal birds or larger mammals.

The weather from the 19th-21st January 2010 was also warm, calm and fine with cooler nights. Temperatures increased across the survey period from approximately 29.1 to 40.4 degrees Celsius during the day and from 11.9 to 15.4 degrees Celsius at night. No rain was experienced during this survey period.

Weather conditions were not ideal for the detection of frogs at the site, as there was no rainfall during the survey period. Weather conditions were favourable for the diurnal detection of native reptiles, as daytime temperatures were high. Wind during dawn bird surveys was light.

Although the moon was less than quarter-full moon throughout the survey period there was moderate light spill from the nearby operations of the M7 Motorway. Moderate to high noise levels were experienced. Conditions through the nocturnal surveys were not ideal for the detection of small nocturnal fauna, nocturnal birds or larger mammals due to background light and noise.

Table 2 below shows the temperatures and rainfall data during the field surveys.

Table 2 Daily weather observations at Camden during the survey period (BOM, 2010)

Date	Minimum Temp (Degrees Celsius)	Max Temp (Deg Cel)	Rainfall (mm)
16/12/2009	20.7	35.2	0
17/012/2009	17.3	43.1	0
19/1/2010	10.6	29.1	0
20/1/2010	11.9	36.2	0
21/1/2010	15.4	40.4	0

4.3.4 Survey Effort

Survey techniques and effort over the two field surveys are detailed in Table 2. Survey locations are indicated on Figure 3.

Table 3 Survey Techniques and Effort

Target	Survey Technique	Survey Effort
Vegetation Communities	20m x 20m survey quadrats, random meander surveys of small patches of vegetation not suitable for quadrat sampling	7 Quadrats Mapping of vegetation communities across the site 4 random meander surveys
Threatened flora and incidental flora	Random meander searches	Throughout the entire site
Riparian Assessments	General assessment of riparian vegetation condition	Along identified watercourses and around dams
Arboreal Birds and Mammals	Habitat tree mapping	Throughout the site
	Spotlighting	Six person-hours over three nights
	Diurnal bird surveys	Five person-hours over three days
	Searches for tracks, scats and other traces of threatened fauna	Throughout site and around identified habitat trees

Target	Survey Technique	Survey Effort
	Call play-back targeting Green and Golden Bell Frog, Barking Owl, Powerful Owl, Yellow-Bellied Glider, Squirrel Glider and Koala	Three sessions in remnant vegetation and wetland areas over three nights
	Stag-watching.	One suitable habitat tree observed for ½ hour before dusk and one hour after dusk on one night.
Cumberland Plain Land Snail	Targeted searches in leaf litter, grasses at the base of trees and under ground debris in areas of potential habitat	Throughout site where suitable habitat was identified
Microchiropteran Bats	Anabat	Two Anabat units in three locations over three nights
Amphibians	Targeted diurnal and nocturnal searches for frogs, including Green and Golden Bell Frog	All dams and any identified watercourses
Reptiles	Active searches in suitable habitat	Throughout site

4.4 Conservation Significance

Conservation status of species and communities recorded across the study area were determined with reference to the following:

- The TSC and FM Acts for State significance;
- The EPBC Act for National significance; and
- The NPWS (1997) *Western Sydney Urban Bushland Biodiversity Survey* and NPWS (2002) Conservation Significance mapping for regional significance.

4.5 Staff Qualifications

Qualified GHD field ecologists undertook the field surveys. Staff qualifications and experience are presented in Table 4.

Table 4 GHD Personnel and Qualifications

Name	Position / Project Role	Qualifications	Relevant Experience
Ben Harrington	Ecologist / field surveys and reporting	Bachelor of Science, Masters of Science (Physical Geography), Macquarie University	6+ years
Jessica Walker	Environmental Scientist / field surveys and reporting	Bachelor of Environmental Science and Management (Living Systems), Newcastle University	2 + years
Rowena Hamer	Graduate Ecologist/ field surveys and reporting	Bachelor of Science (Hons) (Biological Science), University of New South Wales	1 + years

4.6 Survey Limitations

It may be possible that some species utilise the study area but were not detected during the survey period. These species are likely to include: flora species that flower after rainfall as well as annual, ephemeral or cryptic species; and frogs which call at other times of year or after rainfall. Some fauna species are also mobile and transient in their use of resources and it is likely that not all species (resident or transitory) were recorded during the survey period. The habitat assessment conducted for the site allows for identification of habitat resources for such species. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values on site in order to predict potential impacts of the proposal, with particular emphasis on endangered ecological communities, threatened species and their habitats.

Flora surveys are also limited in terms of the time of year surveys are undertaken, and the flowering times of some cryptic threatened plant species that may be present on the site(e.g. *Pimelea spicata, Pterostylis saxicola* etc). Notwithstanding this limitation the majority of the site has been disturbed by historic clearing and grazing and these species have a low potential to occur (refer Appendix B).

Finally, the presence of some threatened species on the site such as Large-footed Myotis (*Myotis macropus*), are tentative identifications based on spotlight detection and ultrasonic Anabat detection. In these cases it was assumed that the threatened species is present at the site in line with the precautionary principal as is appropriate for impact assessments.

301,000

302,000

6,246,000

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M7 Motorway

Hinchinbrook Creek

Cowpasture Road

Image from Google Earth

Legend

Survey Effort

- Anabat Recording
- Call Playback
- Vegetation Quadrat
- Random Meander Vegetation Survey
- Study Area
- Cleared under previous approvals (Biosis 2006)
- Proposed Northern Basin and Spillway
- Employment Zone Development
- Proposed Access Road and Bridge (The Site)
- Cadastral Boundaries

1:5,000 (at A3)

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

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Mirvac Group Pty Ltd
Hoxton Park Airport Development -
EIA for Proposed Access Road and Bridge

Job Number 22-14911
Revision B
Date 17 SEP 2010

Survey Effort

Figure 3

G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z003_Survey_Effort.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

5. Results

5.1 Flora

5.1.1 Flora Species

A total of 161 flora species were identified within the study area, however, given the seasonal limitations of the survey the total number of flora present is likely to be higher. Of the species identified approximately 35% were introduced species. No threatened plants were recorded.

A list of plant species recorded during the field surveys is presented in Appendix A.

5.1.2 Vegetation communities

The vegetation within the study area has been modified by historic clearing and ongoing activities. Vegetation communities include intact patches of native forest and partially disturbed and regrowth woodland, derived grassland and artificial wetlands. Vegetation communities were mapped within the study area according to the community descriptions provided in NPWS mapping of the Cumberland Plain (NPWS, 2002). Vegetation within the study area is shown on Figure 4.

The eastern end of the proposed access road and bridge alignment passes through the Hinchinbrook Creek Corridor, which contains the most extensive and highest quality native vegetation remnants of the study area as an intact riparian corridor. Vegetation in this corridor comprises two main communities: Alluvial Woodland, which borders Hinchinbrook Creek itself; and Shale Plains Woodland, which occurs on higher ground on either side of the Alluvial Woodland strip. These vegetation communities are consistent with the Endangered Ecological Communities (EECs) 'River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions' (RFEF) listed under the TSC Act, or the Critically Endangered Ecological Community (CEEC) 'Cumberland Plain Woodland – Endangered Community of the Cumberland Plain' (CPW), which is listed under the TSC Act and is also listed as the CEEC 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' under the EPBC Act.

The access road alignment and broader study area also contain areas of 'disturbed cleared land' associated with access tracks, runways and buildings. Not all disturbed cleared land was mapped in detail; for instance all exotic and native vegetation in the study area contains disturbance associated with access tracks, fence lines and other structures that would reduce overall area of vegetation cover. Therefore the vegetation mapping and area calculations included in this assessment are all approximate.

Vegetation communities present within the proposed access road and bridge alignment include:

Shale Plains Woodland

Shale Plains Woodland occurs on higher ground within the Hinchinbrook Creek riparian corridor and within the footprint for the northern basin.

Dominant canopy species include Spotted Gum (*Corymbia maculata*), Thin leaved Stringybark (*Eucalyptus eugenoides*), Broad-leaved Apple (*Angophora subvelutina*), Forest Red Gum (*Eucalyptus tereticornis*), and Grey Box (*Eucalyptus moluccana*).

The dominant mid-storey species are Blackthorn (*Bursaria spinosa*) and *Daviesia* species (*Daviesia genistifolia; Daviesia ulicifolia*). Other mid-storey species include Parramatta Green Wattle (*Acacia parramattensis*), Hickory Wattle (*Acacia implexa*), White Sallow Wattle (*Acacia floribunda*) with a mixture of native and exotic groundcover species.

The understorey is relatively sparse and patchy and is dominated by dense growth of Blackthorn and *Daviesia* species in many areas. Native groundcover species include native tussock grasses, such as Purple Wiregrass (*Aristida ramosa*) and Kangaroo Grass (*Themeda australis*), herbs such as Ivy Goodenia (*Goodenia hederacea*) and *Einadia trigonos* and scramblers such as *Glycine microphylla*.

The understorey was moderately infested by environmental weeds, the most abundant of which were African Love Grass (*Eragrostis curvula*), Purpletop (*Verbena bonariensis*) and Paddys Lucerne (*Sida rhombifolia*).

Drainage lines through the Shale Plains Woodland support dense patches of Cumbungi (*Typha orientalis*) and Common Reed (*Phragmites australis*) and more open areas covered with Tall Sedge (*Carex appressa*), *Juncus usitasis*, Pale Knotweed (*Persicaria lapathiphyllum*) and *Cyperus prismatocarpus*.

The community had good leaf litter but relatively little coarse woody debris. In many places the groundcover was disturbed by past grazing and drainage works.

Patches of woodland mapped as Shale Plains Woodland on Figure 4 qualify as the CEEC CPW as listed under the TSC Act (DECCW, 2010b). These areas also meet the DEWHA condition criteria for the CEEC listed under the Commonwealth EPBC Act.

Alluvial Woodland

Alluvial Woodland in the study area occurs as an intact riparian corridor along Hinchinbrook Creek and as small regenerating patches limited to un-mown portions within the employment zone development.

The vegetation along Hinchinbrook Creek is in excellent condition with high biodiversity, despite on-going grazing and encroaching development. This area demonstrates a diversity of age class in the canopy, which is uncommon in the remnant bushland of western Sydney.

The dominant canopy species are Cabbage Gum (*Eucalyptus amplifolia*) and Swamp Oak (*Casuarina glauca*) with occasional Spotted Gum and Rough-barked Apple.

The dominant mid-storey species include Prickly-leaved Paperbark (*Melaleuca stypheloides*) and Blackthorn. Other mid-storey species include Parramatta Green Wattle (*Acacia parramattensis*), Hickory Wattle (*Acacia implexa*), White Sallow Wattle (*Acacia floribunda*) and *Daviesia* spp.. The study area also contained species that indicated it had had not been impacted by fire for some time. These included Coffee Bush (*Breynia oblongifolia*), Hairy Clerodendrum (*Clerodendrum tomentosum*), Mock Olive (*Notelea longifolia*) and Rough-fruit Pittosporum (*Pittosporum revolutum*).

Understorey species composition varies with proximity to Hinchinbrook Creek. Higher portions of the levee support Blady Grass (*Imperata cylindrica*), Three-awned Spear Grass (*Aristida* sp.), Native Raspberry (*Rubus parviflorus*) and Spiny-headed Mat-rush (*Lomandra longifolia*).

Beneath the denser canopy closer to the drainage line the understorey is composed of shade tolerant species, including dense growth of the environmental weeds Wandering Tradescantia (*Tradescantia albiflora*) and Ehrharta (*Ehrharta erecta*) interspersed with native herbs such as Whiteroot (*Pratia purpurascens*) and Kidney Weed (*Dichondra repens*).

Away from the river there is a sparse, patchy cover of native shrubs, including *Pomaderris elata* and *Acacia* spp. There is a moderate to dense cover of shade-tolerant native sub-shrubs, ferns and grasses, including Fishweed (*Einadia trigonos*), Bracken (*Pteridium esculentum*), Kidney Weed (*Dichondra repens*) and Weeping Grass (*Microlaena stipoides* var*. stipoides*).

Within Hinchinbrook Creek there is in a diverse suite of native wetland and riparian species, including Tall Spike-rush (*Eleocharis sphacelata*), Pale Knotweed and Spike-sedges (*Juncus* spp.). Aquatic species within the creek channel include *Myriophyllum variifolium* and Swamp Lily (*Ottelia ovalifolia* subsp*. ovalifolia*).

Large-leaved Privet (*Ligustrum lucidum*), Blackberry (*Rubus fruticosus*) and Small-leaved Privet are present throughout the riparian strip and form dense stands completely suppressing native vegetation in some places.

This vegetation community is consistent with the TSC Act listed EEC 'River Flat Eucalypt Forest on Coastal Floodplains'.

Freshwater Wetlands

The footprint of the proposed access road intersects with an artificial drainage line adjacent to, and collecting runoff from, Cowpasture Road. This line feeds into a small flooded depression area, also within the access road footprint, and contains a mix of native wetland species such as Cumbungi and *Juncus usitatus* and exotic grasses and scramblers such as Blackberry and Kikuyu. Other small wetlands occur throughout the study area as drainage lines and associated flooded depressions.

Drains, sediment detention ponds and depressions throughout the study area support a variety of freshwater wetland vegetation species. Species composition and structure varies with inundation frequency, water depth and disturbance history. Deep, near permanent drains support dense patches of Cumbungi and Common Reed. Shallower, unlined drains and depressions support Tall Sedge (*Carex appressa*), *Juncus usitasis* and *Cyperus prismatocarpus*. The freshwater wetlands feature moderate infestation with exotic grasses, especially Kikuyu (*Pennisetum clandestinum*) and herbs, such as Fireweed and Inkweed (*Phytolacca octandra*).

It is likely that Freshwater Wetlands are a derived community formed from the clearing of Shale Plains Woodland and modification of site hydrology. Therefore this community does not qualify as the TSC Act EEC 'Freshwater wetlands on coastal floodplains'.

The deepest drains are in good condition and almost completely covered by native semi-aquatic plants. Shallower marshes are in moderate to poor condition, with localised degradation through grazing, trampling by livestock, and dumping of construction rubble.

Exotic Grassland

The majority of the grassland within the access road footprint and broader study area is heavily modified, regularly mown and dominated by exotic species. The most abundant species are the exotic pasture species and the weeds African Love Grass and Paspalum (*Paspalidium dilatum*).

There are occasional native tussock grasses, including Purple Wire Grass, Plains Grass and Kangaroo Grass. Herbaceous environmental weeds are locally abundant and include Spearthistle (*Cirsium vulgare*), Dandelion (*Taraxacum officinalis*) and Fireweed (*Senecio madagascariensis*).

Overall vegetation cover is dominated by exotic pasture species and herbaceous environmental weeds such that the Exotic Grassland does not comprise a native vegetation community. This community has little conservation value and limited potential for regeneration of native plants.

Derived Tussock Grassland

The broader study area also contains patches of Derived Tussock Grassland, mostly within the northern basin area, which are a product of historic removal of trees from areas that would probably have supported Shale Plains Woodland. The Derived Tussock Grassland features occasional shrubs and juvenile Eucalyptus, is in close proximity to intact woodland, and may have the capacity to regenerate into woodland vegetation. These areas would qualify as a highly degraded and modified form of the CEEC CPW as listed under the TSC Act (DECCW, 2010c). These areas do not meet the DEWHA condition criteria for the CEEC listed under the Commonwealth EPBC Act (DEWHA, 2010b). This community is described in detail in previous reports (GHD 2010a and b) and is not further discussed here as it will not be affected by the current proposal.

5.1.3 Noxious Weeds

The *Noxious Weeds Act 1993* provides for the declaration of noxious weeds in local government areas. Landowners and occupiers must control noxious weeds according to the control category specified in the Act. Public authorities must control noxious weeds according to the control category to the extent necessary to prevent their spread to adjoining land.

The study area contains six species declared as noxious weeds in Liverpool LGA as shown in Table 5 below.

Table 5 Noxious weeds recorded in the study area

Common Name	Scientific Name	Control Category
Bridal Creeper	*Asparagus asparagoides*	5
African Box Thorn	*Lycium ferocissimum*	4
Small-leaved Privet	*Ligustrum sinense*	4
Large-leaved Privet	*Ligustrum lucidum*	4
Blackberry complex	*Rubus fruticosus* sp. agg.	4
Green Cestrum	*Cestrum parqui*	3

For Category 5 weeds, 'the requirements in the *NW Act* for a notifiable weed must be complied with'. For Category 4 weeds, 'the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority' and for Category 3 weeds, 'the plant must be fully and continuously suppressed and destroyed'.

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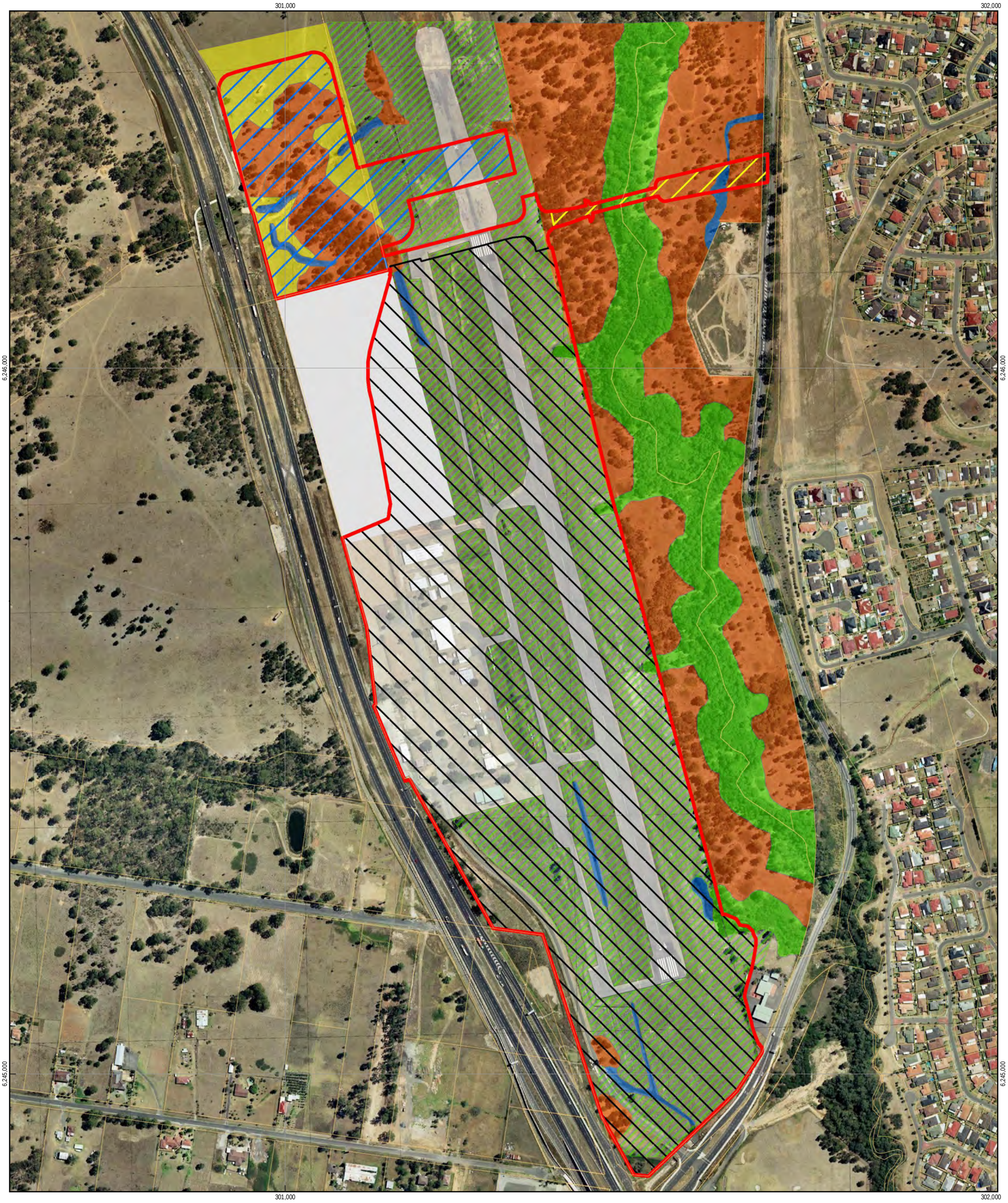
6,246,000



6,245,000

301,000 302,000

Legend

- Study Area
- Cleared under previous approvals (Biosis 2006)
- Access Road and Bridge
- Employment Zone Development
- Proposed Northern Basin and Spillway
- Alluvial Woodlands
- Derived Tussock Grassland
- Disturbed/ Cleared Land
- Exotic Grassland
- Freshwater Wetlands
- Shale Plains Woodlands

1:5,000 (at A3)

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

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Hoxton Park Airport Development -
EIA for Proposed Access Road and Bridge

Job Number 22 - 14911
Revision B
Date 17 SEP 2010

Vegetation

Figure 4

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: DCDB, NSW Dept. of Lands: Cadastre - 19/01/2010; Imagery: Nearmap - 19/01/2010. Created by: qjchung, bahambly, rphamer

5.2 Fauna

5.2.1 Fauna Species

A moderate diversity of native fauna species was recorded in the study area during the December 2009 and January 2010 field surveys, including 3 mammals, 56 birds, 5 reptiles and 4 frogs, as listed in Appendix A. Four threatened species were observed, all listed as Vulnerable under the TSC Act:

- The Grey-headed Flying Fox (*Pteropus poliocephalus*);
- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*);
- Large-footed Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

There were a further five exotic mammal and three exotic bird species recorded.

Birds

A moderate diversity of native birds was recorded (56 species) from a range of guilds (i.e. species with different niches or behaviours). Guilds and species observed included:

- Small woodland insectivorous birds, such as several thornbill (*Acanthiza*) species, the White-browed Scrubwren (*Sericornis frontalis*), Spotted Pardalote (*Pardalotus punctatus*) and Striated Pardalote (*Pardalotus striatus*);
- Larger forest and woodland birds, including the Olive-backed Oriole (*Oriolus sagittatus*) and Red Wattlebird (*Anthochaera carunculata*);
- Open country species such as the Australian Magpie (*Gymnorhina tibicen*), Galah (*Eolophus roseicapillus*) and Pied Butcherbird (*Cracticus nigrogularis*);
- Birds of moist grasslands and wetlands, including the Australian Wood Duck (*Chenonetta jubata*), White-necked Heron (*Ardea pacifica*) and Masked Lapwing (*Vanellus miles*); and
- Raptors, including the Nankeen Kestrel (*Falco cenchroides*), Brown Goshawk (*Accipiter fasciatus*) and Black-shouldered Kite (*Elanus axillaris*).

The exotic pest bird species Common Myna (*Acridotheres tristis*) and the highly-competitive native Noisy Miner (*Manorina melanocephala*) were abundant within the study area, as is typical of disturbed urban bushland remnants. Moreover, across the majority of the study area only generalist or open country species were observed which are able to utilise cleared or disturbed areas. Although the overall number of both guilds and species recorded confirms that the study area contains valuable habitat resources, which support a diverse range of species requiring differing habitat attributes (Keast et al., 1985), these habitat resources are mostly confined to the Hinchinbrook Creek corridor and to small patches of regrowth vegetation surrounding drainage culverts.

Mammals

Only two species of native non-flying mammals were observed during field surveys, the Sugar Glider (*Petaurus breviceps*) and Eastern Grey Kangaroo (*Macropus giganteus*), and these were only recorded within the vegetation surrounding Hinchinbrook Creek.

Foraging Grey-headed Flying Foxes were heard within the Hinchinbrook Creek corridor during spotlighting. It is likely that this species would forage in flowering eucalypts and fruiting exotic species in the corridor. No roosting camps were observed at the site. An important roost camp for this species is located at Cabramatta Creek, approximately 10km away.

Anabat recordings allowed the definite identification of five microbat species of a possible 21 species known or expected to occur within the locality and the probable or possible recording of a further seven species (refer Table 5). Gould's Wattled Bat (*Chalinolobus gouldii*) was the most frequently recorded species. Three species listed as Vulnerable under the TSC Act were recorded as highly likely to occur at the site on the basis of probable Anabat recordings:

- Eastern Bentwing Bat;
- Large-footed Myotis; and
- Greater Broad-nosed Bat.

A fourth threatened microbat species, the Eastern Falsistrelle (*Falsistrellus tasmaniensis*), has the potential to occur within the study area based on possible call identifications. Although bat activity was recorded for each hour of sampling, overall bat activity for the survey period sampled was low: typically one to two calls per hour throughout the recording period.

Five common exotic mammal species were observed within the study area, the Dog (*Canis lupus familiaris*), Red Fox *(Vulpes vulpes*), domestic Cat (*Felis catus*), European Rabbit (*Oryctolagus cuniculus*) and domestic Cow (*Bos taurus*).

Reptiles and frogs

Five species of reptiles were observed, predominately within the Hinchinbrook Creek corridor and regrowth vegetation surrounding drainage culverts along the western boundary of the study area. The Pale-flecked Garden Sun-skink (*Lampropholis guichenoti*) and the Delicate Litter Skink (*Lampropholis delicata*) were observed foraging in leaf litter or under woody debris. The Eastern Long-necked Tortoise (*Chelodina longicollis*), Red-bellied Black Snakes (*Pseudechis porphyriacus*) and Eastern Water-skinks (*Eulamprus quoyii*) were observed both in and around Hinchinbrook Creek and moist habitats associated with drainage lines within the study area.

A low diversity of native frogs was recorded, probably due to the dry weather rather than a lack of suitable habitat. Eastern Dwarf Tree Frogs (*Litoria fallax*), Peron's Tree Frogs (*Litoria peronii*), Common Eastern Froglets (*Crinia signifera*) and Spotted Marsh Frogs (*Limnodynastes tasmaniensis*) were heard calling in low numbers in the marshy areas surrounding the artificial drainage lines and culverts within the study area. Database searches indicate the presence of amphibian species such as the Green Tree Frog (*Litoria caerulea*), Eastern Sign-bearing Froglet (*Crinia parinsignifera*), Smooth Toadlet (*Uperoleia laevigata*) and the Brown-striped Frog (*Limnodynastes peronii*) in the locality. It is likely that these frog species would also occur within the study area.

Invertebrates

No Cumberland Plain Land Snails were recorded within the study area, despite targeted searches through potentially suitable habitat at the site. During periods of drought this species can burrow into the soil to escape the dry conditions (DECCW, 2010b). The weather was very dry and hot throughout both site surveys and so the species cannot be reliably discounted as occurring in locations of suitable habitat within the study area. Given the presence of suitable Shale Plains Woodland habitat and large numbers of records of the species immediately to the west of the study area (refer Figure 6) the species is considered a high probability of occurring in the study area, particularly in habitat along the Hinchinbrook Creek corridor.

A moderate diversity and abundance of invertebrates were noted under ground debris that would appear to be typical of relatively healthy native vegetation. These invertebrates were not identified to species level nor recorded in detail.

Fish

Three fish species were observed opportunistically during aquatic habitat assessments. The majority of fish observed comprised two exotic pest species: the Plague Minnow (*Gambusia holbrookii*) was abundant in all aquatic habitats within the study area, including small drains and sediment ponds; and the Common Carp (*Cyprinus carpio*) was abundant in Hinchinbrook Creek. A single Long-finned Eel (*Anguilla reinhardtii*) was recorded in Hinchinbrook Creek. It is likely that aquatic habitats within the study area would support a number of other species, potentially including other native fish species.

5.2.2 Terrestrial Fauna Habitats

The study area contains areas of ‘Core habitat’ and ‘Support for Core habitat’ according to NPWS Conservation Significance mapping (NPWS, 2002). More detailed habitat assessments were undertaken during field surveys in order to refine the conservation significance of fauna habitats and to assess the potential presence of native fauna (especially threatened species) not directly observed during the surveys.

Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species previously recorded in the study area. Habitat assessments recorded most fauna habitat resources as occurring within the native woodland and forest habitats at the site.

Woodland and forest within the access road and bridge footprint is in good condition, occurring in large patches of Shale Plains Woodland and Alluvial Woodland within the Hinchinbrook Creek riparian corridor. These communities contain a low to moderate level of weed infestation, with species such as Blackberry and Wandering Tradescantia commonly occurring and inhibiting understorey plant species diversity across much of the study area. However, exotic weeds contribute to the overall structural diversity of the vegetation and would provide shelter and food resources for native fauna. Overall these communities contain good native plant diversity, moderate quantities of hollow-bearing trees and stags and moderate recruitment of juveniles and seedlings. Based on these habitat attributes woodland and forest within the study area would be expected to support a reasonable diversity of native fauna in addition to those species recorded during field surveys, potentially including threatened species.

Woodland habitats within the Hinchinbrook Creek Corridor

Connectivity:

The NPWS (2002) Conservation Significance mapping identifies the Hinchinbrook Creek riparian corridor as 'Core habitat - Regional' and 'Support for Core habitat'. This vegetation is also recognized in the Liverpool City Council Biodiversity Strategy (LCC & EcoLogical, 2003) as one of three bushland corridors intended to create three major biodiversity corridors, linking areas of core habitat across the Liverpool area. The patch of woodland within the northern basin footprint is identified as 'Other native vegetation'. The GHD field surveys and habitat connectivity assessments support these definitions.

The Hinchinbrook Creek riparian strip forms a continuous fauna habitat corridor for species which favour tall forest, dense undergrowth and riparian habitats. It would comprise an important refuge and wildlife corridor for many fauna species, including the regionally significant Eastern Grey Kangaroo and, potentially, the Powerful Owl (*Ninox strenua*).

Other woodland patches within the study area, including those within the northern basin footprint, are relatively small and are surrounded by extensive cleared areas. Fragmented woodlands typically have a lower diversity because cleared land and roads constitute a barrier for many native fauna species. Smaller patches of woodland at the site are only likely to support more mobile and adaptable woodland species able to traverse cleared areas and tolerate disturbance. These include species like the Eastern Rosella, Australian Raven and Noisy Miner, which were abundant in the study area and are widespread and abundant in the Sydney region. No species of honeyeater or thornbill were observed in these patches, which is probably attributable to fragmentation and edge effects. Woodland patches outside of the riparian corridor are probably too small and fragmented to support local populations of threatened woodland bird species known to require large tracts of intact habitat such as the Speckled Warbler (*Pyrrholaemus saggitatus*) and Black-chinned Honeyeater (*Melithreptus gularis gularis*).

The site is partially connected with habitat to the west via an underpass beneath the M7, which contains an artificial drainage line planted with native wetland species. The underpass would function as a habitat corridor for native reptiles, frogs, invertebrates and possibly microbats. It may also provide roosting habitat for microbats. The underpass would have limited value for native birds and terrestrial mammals due to the lack of native woody vegetation, shading and disturbance from lights, noise and bike traffic.

Hollow-bearing trees

Tree hollows are important for native fauna as diurnal or nocturnal shelter sites, for rearing young, for feeding, for thermoregulation, and to facilitate ranging behaviour and dispersal. An estimated 15% of all terrestrial vertebrate fauna in Australia are dependent upon tree hollows and for many of these species the relationship is obligate i.e. no other habitat resource represents an adequate substitute (Gibbons and Lindenmayer, 2002).

The riparian strip immediately adjoining Hinchinbrook Creek contains a number of very large Cabbage Gums, Spotted Gums and Swamp Oaks. Habitat trees were not counted outside of immediate development footprints however based on the age and structure of the riparian strip it is likely to contain good numbers of tree hollows. Overall the study area and locality is likely to contain sufficient quantities of these resources to support local populations of hollow-dependant fauna, providing potential roosting habitat for hollow-dependant threatened species, such as the Powerful Owl and Gang Gang Cockatoo (*Callocephalon fimbriatum*). Only one species of hollow-dependant arboreal mammal was recorded within the study area: the Sugar Glider. The study area is also likely to support the Common Brushtail Possum and Common Ringtail Possum as these species are common in urban bushland remnants. Forest and woodland within the study area may also support a range of threatened arboreal mammals, potentially including the Squirrel Glider (*Petaurus norfolcensis*).The Hinchinbrook Creek corridor would be used by these species as sheltering, travelling and foraging habitat.

The proposed footprint of the access road and bridge contains one identified hollow-bearing tree: a Grey Box (*Eucalyptus molluccana*) with at least 4 large (average 10cm diameter) limb hollows, and one Narrow-leaved Stringybark (*Eucalyptus eugenoides*) with a small, shallow trunk hollows was recorded immediately adjacent to the bridge alignment. None of the visible hollows show signs of use such as scratches in the bark, whitewash, scats, nesting material or other traces, but may support individual arboreal mammals, birds, frogs or reptiles on an opportunistic basis.


Hollow-bearing trees within or adjacent to the proposed access road and bridge footprint

Other habitat trees

The proposed alignment and surrounding area also contains foraging, roosting and breeding resources that would be utilised by local populations of threatened micro-bats. Woodland and forest in the study area would provide foraging habitat for the three threatened micro-bats species recorded in the January survey. The study area may also contain roost sites for the tree-roosting Greater Broad-nosed Bat, and hollow bearing trees may support the threatened Large-footed Myotis, which has been known to roost in hollows located close to suitable aquatic foraging habitat (DECCW, 2009b). Other mature trees within the proposed development footprint may provide additional diurnal roost sites for tree-roosting micro-bats as microbats are less dependant upon large, mature hollow-bearing trees than arboreal mammals and forest owls (Gibbons and Lindenmayer, 2002). The study area does not contain any caves or rock outcrops that would support cave-roosting micro-bats, such as the Eastern Bentwing-bat, however there are suitable culverts in the locality and these species may utilise the study area as foraging habitat.

The canopy species *Eucalyptus moluccana*, *Corymbia maculata* and *E. amplifolia* are nectar and seed-bearing and would provide a food resource for native fauna, including the Grey-headed Flying Fox (*Pteropus poliocephalus*) and arboreal mammals. Eucalyptus species may also provide seasonal nectar resources for migratory species, including the Regent Honeyeater. Eucalypts in the study area would also provide seasonal resources for the Swift Parrot. *Corymbia maculata* is recognised as a favoured winter flowering species and Grey Box is known as a commonly used lerp infested tree species (DECCW, 2010b). The Hinchinbrook Creek corridor contains large, mature trees in an intact corridor and so would provide good concentrations of these foraging resources in a context that is suitable for migratory use.

Additional habitat resources

Woodland and forest within the Hinchinbrook Creek corridor contain relatively dense patches of shrubs such as Blackthorn (*Bursaria spinosa*) which provide shelter, foraging and nesting areas for a variety of small birds, a good diversity of which were recorded at the site. Other midstorey plants and shrubs such as *Acacia* and *Melaleuca spp* provide nectar and pollen for a number of native birds, arboreal mammals and invertebrates.

Woodland and forest in the study area contains relatively small amounts of standing and fallen dead timber, which would limit shelter and foraging resources for reptiles, small terrestrial mammals and native invertebrates, including the Cumberland Plain Land Snail. Nonetheless, this species is very closely associated with intact Cumberland Plain vegetation communities (DECCW, 2010b) and so Shale Plains Woodland within the study area would comprise suitable habitat for the species and may support local populations not detected during the current survey.

The study area is composed of alluvial sediments on lower slopes and flats. There are no rock outcrops and no surface rock fragments in these areas. The study area would not support fauna that rely on rocky substrate for shelter. There are a number of threatened reptile and frog species predicted as occurring in the locality of the site (DEWHA, 2010a), including the Broad-headed Snake (*Hoplocephalus bungaroides*), Giant Burrowing Frog (*Heleioporus australiacus*), and Littlejohns Treefrog (*Litoria littlejohni*). Records of these species within the region are from Hawkesbury Sandstone substrates at higher elevations. These species depend on specific habitat resources from these environments and would not occur within the study area (DECCW, 2010b; Ehman, 1997).

SEPP 44 Assessment

The study area contains two Koala Feed Tree species listed on Schedule 2 of SEPP 44: Forest Red Gum and Grey Gum (*Eucalyptus punctata*). Forest Red Gum makes up approximately 50% of the canopy cover in the Shale Plains Woodland and approximately 20% of the canopy cover in the Alluvial Woodland. Grey Gum is sub-dominant comprising approximately 10% of the canopy cover in the Alluvial Woodland. Overall the majority of woodland and forest in the study area contains Schedule 2 feed trees comprising over 15% of the total number of trees in the upper or lower strata of the tree component and consequently constitutes 'potential koala habitat' as defined under the SEPP.

No Koalas or Koala scats were observed during field surveys. There are some previous records of the species in the locality, however these are associated with a population around the Georges River, 7-9km to the south-east of the site (DECCW, 2009a as shown on Figure 6). This population is isolated from the site by the M5 and several kilometers of suburban housing. There are no recent records to the north-west of these barriers. Therefore woodland and forest in the study area does not comprise "core Koala habitat" as defined under SEPP 44.

5.2.3 Aquatic and Wetland Habitats

Hinchinbrook Creek occurs in the study area, which forms part of the wider Georges River catchment further east. NPWS (1997) identify the riparian strip as a regionally significant wildlife regional corridor. The riparian corridor extends along Hinchinbrook Creek from Cecil Hills to Cabramatta Creek in Prestons (Biosis, 2006). Hinchinbrook creek is in good condition through the study area with intact channel and banks, healthy and diverse aquatic and fringing vegetation and excellent in-stream woody debris and riparian vegetation. There was locally severe weed infestation, particularly by Wandering Tradescantia, however the cover and diversity of native vegetation was still very good. There were moderate amounts of gross water pollutants (i.e. rubbish) but water quality appeared otherwise good (based on visual assessment).

Within the proposed bridge and access road footprint, the banks of Hinchinbrook Creek were generally fairly steep and earthen. The roots of large Swamp Oaks lend structural support and habitat complexity, which would provide shelter and foraging resources for a number of reptiles, fish and invertebrates. Fringing or overhanging understorey vegetation is dominated by Wandering Tradescantia and *Lomandra* spp., and in-stream vegetation was generally sparse or absent. The creek is between 3 and 6m wide at the site of the proposed bridge crossing, and is flanked by healthy stands of mature Swamp Oaks to a height of approximately 10m.


Hinchinbrook Creek at the site of the proposed bridge crossing

With reference to NSW Fisheries (1999) classification guidelines the creek qualifies as Class 2 – Moderate fish habitat: a named permanent or intermittent stream, creek or waterway with clearly defined bed and banks with semi - permanent to permanent waters in pools; freshwater aquatic vegetation present; and native fish observed inhabiting the area (NSW Fisheries, 1999).

The small artificial drainage line and wetland in the eastern end of the proposed access road footprint, adjacent to Cowpasture road, contain a variety of native and exotic grasses and aquatic plants. Several Common Eastern Froglets were heard calling in this area during the July survey, indicating that the area would potentially provide habitat for a number of frog species including other common and opportunistic species such as Striped Marsh Frogs, Peron's Tree Frog and Spotted Grass Frogs, as well as a number of reptiles and bird species.


Artificial drainage line adjacent to Cowpasture Road

Adjoining grassy wetland area

The footprints of the future proposed northern basin and employment development zone area contain a number of drainage lines and associated floodplain areas which also provide habitat resources for a range of native species. These features are discussed in detail in previous reports (GHD 2010a and b), and as they will not be affected by the current proposal they are not described here.

The study area contains potentially suitable foraging and breeding habitat for the Green and Golden Bell Frog (*Litoria aurea*) in vegetated pools along the drainage lines through the proposed northern basin, open drains and ponds and adjoining moist grass and sedge land. However this species has experienced a massive decline within its former range due to a complex range of factors including the influence of Plague Minnow (*Gambusia holbrookii*) and the Chytrid fungus (DECCW, 2010b; Ehman, 1997). The locations of remnant populations within the Sydney Basin are relatively well recognised. The present study and Biosis (2006) did not record the species, and there area no Wildlife Atlas records of the species in the vicinity of the site (DECCW, 2010a) nor any recognised local populations in the area (DECCW, 2010b; Ehman, 1997). Therefore despite the presence of potentially suitable habitat at the site, the Green and Golden Bell Frog is very unlikely to occur or be affected by the development.

5.3 Key Threatening Processes

A 'key threatening process' is 'a threatening process specified in Schedule 3' of the TSC Act. A 'threatening process' is 'a process that threatens, or may have the capability to threaten the survival or evolutionary development of species, populations or ecological communities'.

There is evidence of the following key threatening processes (KTPs) currently operating on site:

- Invasion of native plant communities by exotic perennial grasses;
- Predation by the European Red Fox;
- Predation by the Plague Minnow (*Gambusia holbrooki*) and
- Invasion and establishment of exotic vines and scramblers.

The following four KTPs would have operated previously, given the modified landscape and vegetation communities present at the site:

- Clearing of native vegetation;
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands;
- Loss of Hollow-bearing Trees; and
- Removal of dead wood and dead trees.

The development will directly contribute to the operation of these KTPs by affecting remnant native vegetation at the site. The extent and severity of the operation of these processes is described in Section 7.

6. Conservation Significance

6.1 TSC/FM Act Listed Biota

The literature review, flora and fauna surveys and habitat assessments were used to determine the likelihood of threatened biota occurring in the study area and being affected by the Proposal. Threatened biota which are known, or are highly likely to occur within the study area are presented in Table 6 along with their conservation status, the nature of previous records in the study area, the habitats in which they are likely to occur and the potential for impacts arising from the Proposal. Threatened biota recorded during site surveys are shown on Figure 5.

6.1.1 Flora

The literature review indicates twenty five threatened plant species which have previously been recorded (eighteen recorded), or are predicted (seven predicted) to occur in the locality of the site (DECCW, 2010a). Wildlife Atlas threatened species records from the locality are shown on Figure 6. None of these species were recorded during site surveys. The majority of these species are considered unlikely to occur as they have limited ranges and/or habitat requirements, which are not present within the study area. These include species associated with sandstone or shale-gravel transition environments since the site contains only shale-derived and alluvial soils.

There is potentially suitable habitat for a number of TSC Act listed plant species within the locality (refer Appendix B). However, given the intensity of targeted surveys for these species in the present survey and by Biosis (2006) they can be reliably excluded from occurring as adult plants in the footprint for the proposed development. These species of threatened plants may colonise habitat in the locality in the future or may exist in the soil seed bank or as dormant individuals.

The full list of threatened plant species considered in this assessment, including their habitat requirements and conservation status is presented in Appendix B.

6.1.2 Endangered Flora Populations

The literature review indicated known records for *Marsdenia viridiflora* subsp*. viridiflora* within 10km of the study site. This species is listed as an endangered population within the Hawkesbury/Nepean CMA (DECCW, 2010b). This species was not recorded during site surveys.

Table 6 Threatened Biota and their Habitats Likely to be affected by the Proposal

Scientific Name	Common Name	TSC Act	EPBC Act	Record Type	Habitat within Proposal Footprint	Likelihood of Impacts
Cumberland Plain Woodland (EC of the Cumberland Plain) / Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest'	Cumberland Plain Woodland (CPW)	CEEC	CEEC	Present.	Present within the Project footprint.	Certain. Proposed development will clear portions of this CEEC within the site.
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	River-Flat Eucalypt Forest on Coastal Floodplains	EEC	-	Present.	Present within the Project footprint.	Certain. Proposed development will clear portions of this EEC within the site.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Present. Recorded in Hinchinbrook Creek riparian corridor.	Potential foraging habitat in woodland across the study area. No camps noted within the study area.	High. Removal of foraging habitat for the species in woodland within the disturbance footprint.

Scientific Name	Common Name	TSC Act	EPBC Act	Record Type	Habitat within Proposal Footprint	Likelihood of Impacts
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	High likelihood. 'Probable' Anabat recording.	Potential foraging habitat in woodland across the study area. Potential diurnal roosting habitat within footprint. No preferred cave or crevice roosting habitat.	High. Removal of habitat in woodland within the disturbance footprint, including potential roost trees.
Myotis adversus	Large-footed Myotis	V	-	High likelihood. 'Probable' Anabat recording.	Potential foraging habitat in wetlands and drainage lines across the study area. Potential diurnal roosting habitat within footprint.	High. Removal of habitat in woodland within the disturbance footprint, including potential roost trees.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	High likelihood. 'Probable' Anabat recording.	Potential foraging habitat across the study area. Suitable roosting habitat within footprint.	High. Removal of habitat in woodland within the disturbance footprint, including potential roost trees.
Meridolum corneovirens	Cumberland Land Snail	E	-	High likelihood. Suitable habitat in Shale Plains Woodland in the site.	Potential habitat within Shale Plains Woodland within footprint.	High. Removal of habitat for the species in woodland within the disturbance footprint. Potential for mortality of individuals if they are sheltering within the disturbance area.

6.1.3 Endangered Ecological Communities

The literature review indicates thirteen threatened ecological communities listed under the TSC/EPBC Acts which are known from the surrounding region. The full list of threatened biota known from the region, including their habitat requirements and conservation status, is presented in Appendix B.

Of these communities two are present within the study area:

- River-Flat Eucalypt Forest on Coastal Floodplains (RFEF); and
- Cumberland Plain Woodland (CPW).

All intact native vegetation within the study area qualifies as either of these two threatened communities. The Proposal would involve the clearing of portions of these threatened ecological communities within the site (refer Section 7).

There is no potential for any other threatened ecological communities known from the region to occur.

6.1.4 Terrestrial Fauna

Threatened populations

No endangered fauna populations are known to occur in the locality of the site or in the Cumberland CMA sub-region (DECCW, 2010b).

Threatened fauna species

Threatened species recorded during the current site surveys are shown on Figure 5. The desktop review indicates the potential presence of additional threatened fauna species which are known or predicted to occur in the locality. DECCW (2010a) Wildlife Atlas threatened species records from the locality are shown on Figure 6. The full list of threatened fauna, including their conservation status, habitat requirements, the nature of previous records and likelihood of occurrence is presented in Appendix B. A review of the nature of specific habitat requirements of these species, and the habitat present within the study area allowed a number of these species to be eliminated as having a low likelihood of occurrence within the study area.

A total of five threatened fauna species are known, or are highly likely to occur within the study area based on field surveys, habitat assessments and/or recent observations of the species in the locality. Threatened fauna species which are known, or are highly likely to occur are presented in Table 6 along with their conservation status, record type, the habitats in which they are likely to occur and the potential for impacts arising from the Proposal.

The Grey-headed Flying-fox was heard feeding in the Hinchinbrook Creek corridor. Native woodland and forest in the site contains foraging habitat for the species in the form of flowering eucalypts. No roost camps for the species are present within the study area. The closest known roost camp is approximately 5km to the east of the study area in the Cabramatta Creek riparian corridor, Cabramatta (pers. obs.).

The Eastern Bentwing Bat is essentially a cave-roosting bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures (DECCW 2010b).The site contains foraging habitat for the Eastern Bentwing bat, which hunts in treed areas, catching moths and other flying insects above the tree tops (DECCW 2010b). There is foraging habitat for the Large-footed Myotis associated with wetland and aquatic habitats across the site and potential roost sites in hollow-bearing trees. There is foraging habitat for the Greater Broad-nosed Bat in riparian vegetation and the edges of woodland, and roost sites in hollow tree trunks and branches (DECCW, 2010b).

The Cumberland Land Snail was not recorded during site surveys but may be easily overlooked if dormant, is known from the locality (DECCW, 2010a) and has a very close affiliation with intact CPW habitats (DECCW, 2010b). The Cumberland Land Snail is considered a high likelihood of occurring in suitable habitat in Shale Plains Woodland in the study area.

A further 15 threatened fauna species may possibly occur within the study area based on the presence of potentially suitable foraging and roosting habitat. There is no evidence, such as recent records in the locality or specific important habitat resources that suggests the study area regularly supports local populations of any of these species, either on a permanent or seasonal basis. However these fauna species may occur in habitat at the site on an occasional or opportunistic basis. Threatened fauna species that may potentially utilise habitat at the site are presented below:

- *Falistrellus tasmaniensis* Eastern Falsistrelle
- *Callocephalon fimbriatum* Gang-gang Cockatoo
- *Glossopsitta pusilla* Little Lorikeet
- *Lathamus discolor* Swift Parrot
- *Ninox connivens* Barking Owl
- *Ninox strenua* Powerful Owl
- *Lophoictinia isura* Square-tailed Kite
- *Melithreptus gularis gularis* Black-chinned Honeyeater
- *Pyrrholaemus saggitatus* Speckled Warbler
- *Tyto novaehollandiae* Masked Owl
- *Xanthomyza phrygia* Regent Honeyeater
- *Chalinolobus dwyeri* Large-eared Pied Bat
- *Mormopterus norfolkensis* Eastern Freetail-bat
- *Petaurus norfolcensis* Squirrel Glider
- *Phascolarctos cinereus* Koala

There are areas of potential habitat resources for these species within the development footprint for the Proposal. There is relatively little risk of direct displacement or mortality of these species during construction as the Proposal will only affect a small area of habitat (<0.3ha) and there is no evidence of resident local populations. The Proposal would permanently remove habitat resources for transient populations of these species.

6.1.5 Aquatic Fauna

One species of threatened fish listed under the FM Act is predicted to occur in the locality of the site by the DEWHA (2010a) protected matters search engine: Macquarie Perch (*Macquaria australasica*). Based on known distributions and habitat requirements this species is unlikely to occur in aquatic habitats in the study area (refer Appendix B). Based on a general review of the distribution and habitat requirements of threatened fish of NSW it is very unlikely that any threatened fish species could potentially occur at the site.

301,000 302,000

6,246,000

6,245,000

Legend

- Eastern Bent-wing Bat
- Eastern Falsistrelle
- Greater Broad-nosed Bat
- Grey-headed Flying Fox
- Habitat tree
- Large-footed Myotis
- Study Area
- Access Road and Bridge
- Employment Zone Development
- Proposed Northern Basin and Spillway
- Cleared under previous approvals (Biosis 2006)
- Cumberland Plain Woodland (EEC)
- River Flat Eucalypt Forest on Coastal Floodplains (EEC)
- Freshwater Wetlands

1:5,000 (at A3)

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

GHD

CLIENTS | PEOPLE | PERFORMANCE

Mirvac Group Pty Ltd
Hoxton Park Airport Development-
EIA for Proposed Access Road and Bridge

Job Number	22-14911
Revision	B
Date	17 SEP 2010

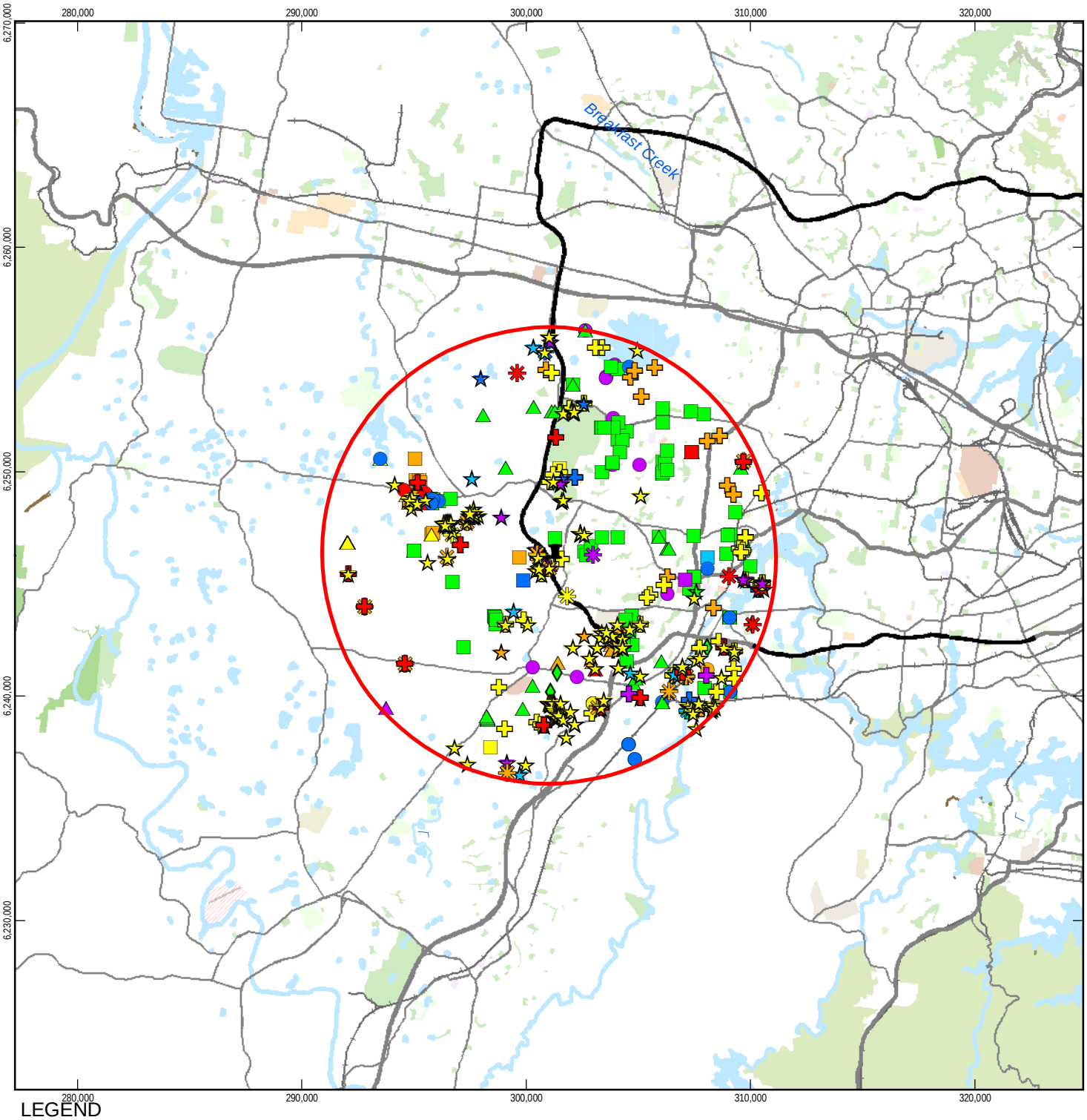
Threatened Biota and Habitat Resources

Figure 5

G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z009_threatened Biota and Habitat Resources.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: DCDB, NSW Dept. of Lands: Cadastre - 19/01/2010; Imagery: Nearmap - 19/01/2010. Created by: qjchung, bahambly, rphamer



LEGEND

Legend

- Site location
- 10km radius of site

DECCW threatened fauna

- Barking Owl
- Black-chinned Honeyeater (eastern subspecies)
- Bush Stone-curlew
- Cumberland Plain Land Snail
- Eastern Bentwing-bat
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Gang-gang Cockatoo
- Greater Broad-nosed Bat
- Green and Golden Bell Frog
- Grey-headed Flying-fox
- Koala
- Little Lorikeet
- Masked Owl
- Powerful Owl
- Regent Honeyeater
- Southern Myotis
- Speckled Warbler
- Spotted-tailed Quoll
- Square-tailed Kite
- Squirrel Glider
- Swift Parrot

DECCW threatened flora

- Acacia pubescens
- Callistemon linearifolius
- Cynanchum elegans
- Dillwynia tenuifolia
- Diuris aequalis
- Eucalyptus nicholii
- Eucalyptus scoparia
- Grevillea juniperina subsp. juniperina
- Grevillea parviflora subsp. parviflora
- Gyrostemon thesioides
- Leucopogon exolasius
- Marsdenia viridiflora subsp. viridiflora
- Persoonia hirsuta
- Persoonia nutans
- Pimelea spicata
- Pterostylis nigricans
- Pultenaea parviflora
- Pultenaea pedunculata
- Syzygium paniculatum

1:250,000(at A4)

0 2.5 5 10

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

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Mirvac Group Pty Ltd
Hoxton Park Airport Development - Ecology Assessment

DECCW threatened species recorded in the locality

Job Number	21-14911
Revision	A
Date	04 FEB 2010

Figure 6

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z006_Threatend_Species.mxd

Data source: Wildlife Atlas, DECC. Created by: Cwilson, cwilson, qjchung, bahambly

6.2 Matters of National Environmental Significance

6.2.1 Approach

A Protected Matters Search (DEWHA, 2010) was performed for a 10 km radius around the study area. A number of EPBC Act listed threatened or migratory species have previously been recorded or are predicted to occur in the locality. The NSW Wildlife Atlas (DECCW, 2010a) also revealed records of EPBC Act listed threatened species previously recorded in the study area (refer Figure 6). MNES listed under the EPBC Act of potential relevance to the study area include:

- Threatened species (e.g. Grey-headed Flying Fox, Swift Parrot);
- Threatened Ecological Communities (e.g. Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest);
- Migratory species (e.g. waterfowl); and
- Ramsar sites within the same catchments as the study area.

EPBC Act listed biota known from the study area are presented in Appendix B along with an assessment of their habitat requirements, likelihood of occurring in the study area and potential for impacts arising from the Proposal. A number of the EPBC Act listed biota may potentially occur at the site and be affected by 'the project'. Potential impacts on these biota, or their habitats, comprise an impact on a MNES. Potentially affected MNES are discussed below.

6.2.2 Threatened Flora Species

There is potentially suitable habitat for a number of EPBC Act listed plant species within the broader study area (refer Appendix B). However, given the intensity of targeted surveys for these species in the present survey and by Biosis (2006) they can be reliably excluded from occurring in the footprint for the Proposal. These species of threatened plants may colonise habitat in the broader study area in the future or may exist in the soil seed bank or as dormant individuals

6.2.3 Endangered Ecological Communities

The DEWHA (2010b) search engine predicts that four threatened EECs listed under the EPBC Act may occur within the study area (refer Appendix B). One of these EECs is present within the study area: 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' which is listed as a Critically Endangered Ecological Community under the EPBC Act. The local population of this community is ecologically equivalent to the CPW EEC, listed under the TSC Act and so for the purposes of this assessment Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest at the site is also referred to as 'CPW'. However, the criteria for identifying the community differs between the forms listed under the two Acts. Derived Tussock Grassland is consistent with the TSC Act definition of CPW, but does not meet the condition criteria for the EPBC Act definition of CPW (DEWHA, 2010b). Only areas mapped as Shale Plains Woodland within the study area qualify as the CEEC listed under the EPBC Act. The Proposal would involve the clearing of CPW (consistent with both the TSC and EPBC Act definitions) within the site (refer Section 7).

6.2.4 Threatened fauna Species

One EPBC Act listed fauna species was recorded during site surveys – the Grey-headed Flying Fox. There is no evidence such as recent records or important habitat resources to suggest that permanent local populations of any other EPBC Act listed fauna occur within the study area.

Based on desktop and habitat assessments four EPBC Act listed fauna species are likely to occur within the study area on an occasional or opportunistic basis:

- *Lathamus discolor* Swift Parrot
- *Xanthomyza phrygia* Regent Honeyeater
- *Chalinolobus dwyeri* Large-eared Pied Bat
- *Dasyurus maculatus* Spotted-tailed Quoll

There are areas of potential habitat resources for these species within the development footprint for the Proposal. There is little potential for direct displacement or mortality of these individuals during construction since the Swift Parrot and Regent Honeyeater breed outside the Sydney region; the Large-eared Pied Bat is a cave-roosting species; and the Spotted-tailed Quoll would rarely, if ever, occur in small urban bushland remnants (DECCW, 2010b). The Proposal would permanently remove foraging habitat resources for transient populations of these species.

6.2.5 Migratory Species

The site provides potential habitat for migratory bird species protected under the provisions of International treaties and/or the EPBC Act. These include the Wood Duck, White faced Heron and Masked Lapwing, which were observed during field surveys. Native vegetation and wetlands at the site are likely to be used by a range of these migratory species on a periodic basis. This would potentially include use of foraging resources by threatened migratory species, including the Swift Parrot and Regent Honeyeater.

The Proposal would remove potential habitat resources for these migratory species within construction footprints. An assessment of the importance of habitat at the site and significance of the removal of these resources is provided in Section 9.2.3.

6.2.6 Threatened Aquatic Species

The desktop review revealed two threatened fish species which are predicted to occur in the locality (Macquarie Perch *Macquaria australasica* and Australian Grayling *Prototroctes mairaena*) however a review of the distribution, specific habitat requirements of these species, and the habitat present led to the conclusion that these fish species have a low likelihood of occurrence at the site (Appendix B).

6.2.7 Wetlands of International Importance (Ramsar Wetlands)

The site is within the same broad catchment as the Towra Point Nature Reserve Ramsar Wetland (DEWHA, 2010a). The Ramsar Wetland site is located many tens of kilometres downstream of the study area and is separated by the expanse of Botany Bay. Therefore the Proposal is highly unlikely to affect the Ramsar Wetland as described in Section 6.2.7.

7. Impact Assessment

This Section assesses the potential impacts of the Project on native biota and their habitats. The impact assessment provided below is based on indicative infrastructure locations and construction footprints supplied by the proponent.

7.1 Vegetation Clearing and Construction Impacts

7.1.1 Vegetation Communities

Construction for the Project would require the clearing or permanent modification of native vegetation within the development footprints for the access road and bridge. It is assumed that no additional vegetation clearing would be required for temporary construction features. It is also assumed that construction compounds, laydown areas and access roads would be located within infrastructure disturbance footprints or previously cleared and disturbed land.

The vegetation to be removed includes approximately 0.87 ha of intact native woodland and forest that is consistent with a threatened ecological community listed under the EPBC Act and/or the TSC Act. Part of the development footprint falls within an offset site established along with the rezoning of other portions of the former Hoxton Park Airport Redevelopment site (GHD, 2007a; 2007b).

The proposed bridge (see Appendix D) would span the Hinchinbrook Creek channel and banks and so would not permanently remove vegetation or habitat beneath the bridge span. This area would be permanently modified through the removal of mature trees and through increased shading and rainfall interception. Vegetation in this area is closed forest. Understorey species in this area, such as *Commelina cyanea* and *Adiantum aethiopicum*, are adapted to low light levels and competing for moisture with mature trees. It is likely that the majority of native understorey species would readily persist in the environment beneath the bridge. Similarly, any in-stream vegetation would be currently heavily shaded by the overhanging closed canopy and the impact of overshadowing from the bridge should be minor and localised.

The remainder of the development footprint (the western end) is exotic grassland or disturbed cleared land with little conservation value.

The area and TSC/EPBC Act status of each vegetation type to be removed for construction of the proposal is summarised in Table 7. Table 6 also includes an estimate of the extent of native vegetation types in the locality (10 km radius around the site) based on NPWS (2002) vegetation mapping and the estimated extent of vegetation clearing as a percentage of the total. These must be treated as estimates since the NPWS (2002) mapping is broad scale and some vegetation clearing would have occurred since this data was published. However the estimates presented do not include patches with canopy cover of less than 10 percent nor small ‘urban vegetation’ remnants in the NPWS (2002) mapping. Much of this modified vegetation would qualify as threatened ecological communities (DECCW, 2010b; NPWS, 2002) and would have similar value to vegetation within the disturbance area. Therefore the figures provided in Table 6 would still provide a conservative estimate of the extent of these communities in the locality.

Based on this approach the Proposal would remove less than 0.05 % of the overall extent of equivalent woodland and forest vegetation communities in the locality.

Table 7 Vegetation Removal for Construction of the Proposal

Vegetation Type	TSC Act Status	EPBC Act Status	Area of Vegetation Removal (ha)	Extent in the Locality (NPWS (2002)	Percentage of Extent in the Locality (NPWS (2002)
Shale Plains Woodland	CEEC	CEEC	0.79	1059.7	0.074
Alluvial Woodland	EEC		0.08	974.5	0.008
Total Woodland			***0.87***	***2034.2***	***0.082***
Exotic Grassland			0.33	-	-
Disturbed/Cleared Land			0.18		
Total			**1.38**		

7.1.2 Flora Species

The Proposal would not remove any known individuals or populations of threatened plants. Vegetation clearing for the Proposal would remove a number of mature native trees. Mature trees have value within plant populations as sources of seed. There are extensive areas of species equivalent to those in the disturbance footprint in retained vegetation in the locality, including an extensive vegetated patch in the Hinchinbrook Creek riparian corridor. The removal of a proportion of mature individuals is unlikely to threaten the persistence of local populations.

Construction for the Proposal would damage or remove understorey plants that are within the surface disturbance area at the time of the operations. Any vegetation clearing required in these areas would remove non-threatened native plants and noxious and environmental weeds. It is likely that flora populations would persist in alternative habitat outside the surface disturbance area. Reproduction at the population scale is unlikely to be disadvantaged by damage to individual plants within the construction footprint. Populations of extremely rare plants, or those with restricted distributions would be more vulnerable to negative effects arising from direct removal. The proposed construction is highly unlikely to remove a significant proportion of any threatened plant populations since no local populations were detected or have previously been recorded in the study area (DECCW, 2010a; Biosis, 2006).

The proposed construction may remove potential habitat for threatened plant species likely to occur at the site and potentially dormant individuals or seeds though no species are considered to be a high likelihood of occurring (refer Appendix B).

7.1.3 Fauna

The Proposal would remove habitat resources for native fauna within the 0.87 ha of native vegetation within the construction footprint.

The Proposal would cause displacement or in some cases possible mortality of fauna that are within the surface disturbance area at the time of construction activities. The Proposal may also interrupt or prevent breeding for one season if species are breeding within or near the disturbance footprint during construction. Given the extent of native vegetation in the broader study area it is likely that populations of any species directly affected would persist in alternative habitat outside the surface disturbance area. The magnitude of likely impacts would vary between types of fauna. Overall, impacts are likely to be minor since the Proposal would affect only a minor proportion of habitat available in the locality.

Birds are relatively mobile and so most individuals would be able to avoid vegetation clearing or construction operations. Most individual animals directly affected by the Proposal would be displaced rather than killed. Some mortality of less mobile individuals, such as nestlings, old or sick birds may occur. Birds breeding in, or in the vicinity of the surface disturbance area may have breeding disrupted for one season. These direct impacts would affect limited numbers of individuals and so would be unlikely to threaten the survival of any local populations of any bird species. Appropriate mitigation measures (described in Section 8) would limit these impacts.

Macropods and other large terrestrial mammals are likely to readily avoid vegetation clearing or construction operations and so any individuals present would likely be displaced rather than killed. There may be some mortality of mammals less able to avoid the disturbance. These may include smaller terrestrial mammals, nocturnal species and especially arboreal mammals and microbats which may be sheltering in trees. There may be mortality of individuals sheltering in woody debris, tree hollows, crevices or under bark. Displaced individuals would be vulnerable to predation since they would be disturbed in daylight hours and would experience energy costs, increased risk of predation and increased competition for resources (especially for alternative hollows). This may result in impacts beyond the disturbance area by favouring aggressive or generalist species.

Tree-roosting microbats are vulnerable during vegetation clearing or construction operations. At the population scale the mobility of microbats and low energy cost of flight would facilitate successful dispersal after disturbance and recolonisation of regenerating areas. The Proposal will remove potential roosting habitat for microbats in 0.87 ha of native woodland, including one hollow-bearing tree. Based on available NPWS (2002) mapping the Proposal would remove less than 0.05 % of the overall extent of equivalent native woodland and forest vegetation communities in the locality, which would also be expected to contain roost sites. This is therefore likely to comprise a minor proportion of habitat resources available in the locality and would not be expected to affect a significant proportion of local bat populations. Therefore, although individual bats would be susceptible to short term impacts from vegetation clearing and especially removal of roost sites, bat populations would probably be resilient to these effects.

Displacement or mortality due to construction impacts would affect limited numbers of individuals. Local populations are likely to persist in alternative habitat outside the site and regenerating vegetation within the site. Therefore the proposed construction would be unlikely to threaten the survival of local populations of any fauna species.

More significant negative effects on fauna populations may arise from removal of habitat for permanent project infrastructure, or from changes to vegetation structure and the quality of habitat in regenerating vegetation. Impacts on habitats are discussed below.

There are likely to be ongoing impacts on fauna utilising adjacent areas of habitat during construction associated with noise and other disturbances. There are already disruptive human activities in the study area associated with the M7, Cowpasture Road and ongoing road upgrades and warehouse construction. The majority of fauna currently occupying the study area are likely to be adapted to these disturbances.

7.1.4 Terrestrial Habitats

The vegetation clearing described above will remove minimal habitat resources for native flora and fauna within the 0.87 ha of native vegetation to be removed. This clearing will have additional negative effects on the quality of habitats in the broader locality through edge effects, fragmentation of habitat and the disruption of fauna habitat corridors. However, as described above, these effects would result in minimal disturbance to the local populations of any fauna species.

Native vegetation to be removed will remove habitat resources including one hollow-bearing tree, flowering eucalypt species, woody debris and leaf litter, and shrubby areas which would support a range of native fauna. As discussed above, the proportion of such habitat to be removed is minimal in terms of equivalent habitat in the locality.

Edge effects refer to the impact of clearing on the surrounding areas of remnant vegetation. Negative impacts may include an increase in incursion of weeds, sedimentation or access for predators. Edge effects may also disrupt native bird communities by favouring aggressive edge-specialists like the Noisy Miner, which can displace other small native birds. Disturbance may also favour predatory species such as the Australian Raven and Pied Currawong, which can affect breeding success of smaller birds through predation of eggs and young. Edge effects are already having pronounced negative effects on habitat in the study area. Existing disturbance associated with the former airport site has resulted in clearly visible edge effects in native vegetation such as infestation with exotic species around the margins of the Hinchinbrook Creek riparian corridor. In this context the proposal is unlikely to significantly increase the action of edge effects in the study area. To further mitigate increased impacts of additional edge effects the recommended actions in Section 9 in this report should be implemented to reduce the impact of additional edge effects on these areas.

The Hinchinbrook Creek riparian corridor is significant at a local and regional scale, connecting woodland and forest south of the study area with other remnant vegetation to the north. The proposed access road would create new edges along areas of retained vegetation within the riparian corridor, which would be exposed to additional edge effects. Measures recommended in Section 9 should be implemented to minimise the potential for these impacts. The existing riparian corridor is 50-100m wide and provides foraging, shelter and travelling habitat.

This area of intact vegetation is likely to be sufficient to maintain ecological functions such as pollination of plants, seed fall from mature trees, maintenance of soil mycorrhizal associations and movement of the majority of fauna that contribute to the community.

The proposed access road would have an impact on the integrity of this habitat corridor by removing an area of habitat and by creating a direct obstacle to movement of less mobile fauna species. After construction, traffic along the access road would increase the risk of vehicle collisions with native fauna. Traffic noise and headlights may also disturb or displace fauna in the vicinity. This magnitude of impacts would not completely compromise the value of the wildlife corridor. The DECCW (2009) methodology for assessing connectivity at the landscape scale considers a site linked to adjoining habitat where woody vegetation is separated by less than 100 m and is not separated by a 'hostile gap' such as a dual carriageway or wider highway. The access road would be a standard two-lane single carriageway and native woody vegetation would be maintained adjacent to the road corridor. The gap thus created would be under 20 m wide. The proposed M-lock bridge design (see Appendix D) should ensure that fauna passage is not interrupted within the immediate riparian zone. The route underneath the bridge would also provide an alternative, safer route for fauna passage to crossing the road directly. The remainder of the access road through the Hinchinbrook Creek corridor would be built up approximately 1.5 m above the ground surface and would include culverts to provide for surface water flows across the floodplain. These culverts would be approximately 4.2 m wide and 1.2 m high and also provide an alternative, safer route for passage of smaller fauna to crossing the road directly.

Birds and microbats would readily traverse the access road. Intact forest will be maintained on either side of the access road and so gliders are also likely to readily traverse the gap. The majority of aquatic fauna, reptiles, frogs and small terrestrial mammals would readily traverse the road via the creek line beneath the bridge or the culverts. Larger terrestrial fauna and arboreal mammals would be most affected since they would not necessarily use the riparian strip under the proposed bridge. Therefore the proposed access road would create a partial potential barrier to the movement of some larger fauna species through the Hinchinbrook Creek riparian corridor but would not completely isolate any areas of habitat.

7.1.5 Aquatic Habitat

Hinchinbrook Creek provides good habitat resources for aquatic species. The proposed M-lock bridge design (see Appendix D) will ensure minimal disturbance to Hinchinbrook Creek- the only direct disturbance will be the installation of the in-stream piles. This disturbance will be minor and will not significantly affect the natural flow of the creek.

The construction of the access road will remove aquatic habitat in the form of a small artificial drainage line, which provides habitat for a number of frogs and reptiles. Species likely to utilise this area are generally common, adaptable species such as Common Eastern Froglets, Striped Marsh Frogs and Water Skinks. Similar habitats are widespread throughout the area and impacts on these species are unlikely to be significant.

Provided standard environmental management practices are adopted through the construction process the proposal is unlikely to result in significant indirect impacts as described below.

7.2 Indirect Impacts

7.2.1 Sediments, Dust and Runoff

Potential indirect impacts to terrestrial flora and fauna from construction activities would include dust and vehicle exhaust emissions generated from construction vehicles and equipment. This would have a very minor effect in the context of background emissions from the M7 and Cowpasture Road.

Potential sources of impacts to surface water within the study area include:

- Runoff from areas stripped of vegetation;
- Runoff from soil stockpiles;
- Runoff from hardstand areas, including roads, processing areas and site facilities;
- Leakage or spillage of hydrocarbon products from vehicles, wash down areas and workshops; and
- Refuelling bays and fuel, oil and grease storages.

There are sensitive environmental receptors adjacent to the development footprint, including the Hinchinbrook Creek riparian corridor and associated native vegetation. There are a number of sensitive aquatic habitats within close proximity of project infrastructure, including Hinchinbrook Creek, smaller drainage lines and intermittent marshes. These areas are all sensitive receptors for adverse impacts on water quality potentially arising from the proposed construction.

Potential water quality impacts of the Proposal may be associated with runoff from disturbed areas, including vegetation clearing areas, construction laydown areas and access roads if risks are not effectively managed and appropriate mitigation measures implemented. Concentrated and/or altered water movement within the construction corridor could increase the potential for sediment mobilisation and transport. Negative effects on aquatic habitats may include increases in stream sediment load, changes in channel form, changes in stream hydrology and a variety of changes in stream faunal populations and communities.

Soil protection measures and techniques would be implemented during and following construction as outlined in Section 8. Any localised increases in erosion hazard as a result of construction would be limited to the immediate construction footprint and there would be appropriate control devices and buffers between the disturbance footprint and sensitive receptors as described below.

The site is very flat and is a depositional environment, which would limit the overall risk of significant soil erosion and water pollution arising from the proposed construction. Construction of the proposed access road will require careful management to avoid impacts on Hinchinbrook Creek. The proposed M-lock Bridge design should ensure that there are no major earthworks within the immediate riparian zone. This should avoid direct impacts on the channel or banks and maintain a vegetated buffer between the disturbance footprint and aquatic habitats. Sediment control devices should ensure that unstable sediments or other sources of water pollution are confined to the disturbance footprint.

7.2.2 Vehicle Collisions

Collisions with wildlife (such as macropods and arboreal mammals) within the site are possible, particularly during dusk and dawn when macropods are active. The construction phase of the Proposal would represent a relatively minor increase in traffic volumes at the site, which currently experiences traffic from ongoing construction activities, particularly in the context of very heavy traffic on the M7 and Cowpasture Road. Vehicle movements would be low-speed, since roads on site would be temporary gravel access tracks and subject to speed restrictions. Therefore the increase in traffic is unlikely to significantly increase the risk of vehicle collisions with fauna utilising habitats in the local area.

7.2.3 Noise and Light

Night-time security or operational lighting can potentially discourage habitat use where diffuse light penetrates into adjoining areas of vegetation. The foraging regimes of some nocturnal native mammals and birds can be disrupted by lighting and make them vulnerable to predation by cats, dogs and foxes. The eyesight of nocturnal species (such as owls, gliders and possums) is hindered by bright lights, and where they are affected by this, they become more susceptible to predation.

Such lighting should be designed as ‘down lights’ wherever practicable and be directed inwards so as to not spill into adjoining areas of intact vegetation.

Construction activities and traffic along the proposed access road may also discourage habitat use where noise penetrates into adjoining areas of vegetation. The magnitude of impacts would be low, as resident fauna are likely to have adapted to conditions at the site which include noise and light spill from the M7, Cowpasture Road and construction activities within the former airport area. Other proposed developments within the former airport area will generate noise and light spill 24 hours a day, including street lights, security lighting and warehousing activities. In this context, the proposed activity will make a very minor contribution to human-generated noise and light.

7.3 Duration of Impacts

The Proposal would result in permanent removal of native vegetation and habitats within the construction footprint. There would also be continuous and permanent indirect impacts including edge effects noise, light and traffic.

The development would, however, result in a positive long term improvement within the study area through implementation of the proposed offset strategy. The location of the preferred offsite site would improve the condition of vegetation to the east of Hinchinbrook Creek riparian zone, providing additional ecological outcomes to those rehabilitation and management initiatives already committed to by the development on the western side of Hinchinbrook Creek. The proposed offset site comprises suitable habitat to that being removed by the proposed road and bridge alignment, in accordance with the ‘like for like’ rule, and would provide a more continuous landscape in the eastern portion of Hinchinbrook Creek riparian corridor (refer to Section 8.3).

GHD promotes an offset package that delivers environmental outcomes within the subject site, restores vegetation representative of the community being impacted, includes a net increase of vegetation on the subject site and allows for management of the offset in perpetuity. These outcomes are all promoted and endorsed by DECCW.

7.4 Key Threatening Processes

The project will directly contribute to the operation of three KTPs:

- Clearing of native vegetation;
- Loss of hollow-bearing trees; and
- Removal of dead wood and dead trees.

The extent of clearing of native vegetation is presented in Table 7.

The proposal will remove one hollow-bearing tree within the construction footprint. None of the visible hollows in this tree shows signs of use, but may provide occasional shelter for a number of different species. This tree will be felled according to the fauna management protocol in Section 8.2.1 to minimise risk of harm to individuals sheltering in these trees. This tree represents a minor proportion of such habitat resources in the area and its loss is unlikely to significantly decrease the sheltering or breeding habitat available to local fauna populations.

The proposal will disturb a small amount of fallen dead trees within the construction footprint. In line with the groundcover clearance protocol outlined in Section 8.2.1 this is likely to result in short term impacts on the value of these habitat resources in the locality. Fauna sheltering beneath woody debris during the construction period would be disturbed and displaced. The habitat value of the timber will be retained and so this measure would partially mitigate against the operation of the KTP by retaining the value of woody debris in the longer term.

The following KTPs may also be of relevance to the Proposal:

- Invasion of native plant communities by exotic perennial grasses; and
- Infection of native plants by *Phytophthora cinnamomi.*

Provided the soil and weed management measures outlined in Section 8 are followed, the project should not result in the operation of, or increase the impact of, any of these KTPs. The likelihood of these KTPs operating is also minimised by the limited extent and duration of the proposed works.

Therefore, based on the above considerations the Proposal is not likely to significantly increase the operation of any KTPs at the site or in surrounding areas.

8. Impact Mitigation

The mitigation of adverse effects arising from the development has been presented according to the hierarchy of avoidance; mitigation and offsetting of impacts, consistent with the approach outlined in the DEC and DPI (2005) guidelines.

8.1 Avoidance of Impacts

8.1.1 Project Location & Scope

Much of the development area falls within land which is extensively modified by historical disturbance. Impacts on native flora and fauna are substantially less than would be associated with an undisturbed 'green field' site. Remnant vegetation and habitats could not be avoided further without substantial changes to the proposed development, which are not practical or warranted by the magnitude of the residual impacts.

The alignment of the proposed access road was selected to avoid large trees and minimise the removal of mature trees. There is one defined habitat tree in the footprint of the access road.

The overall water management strategy will utilise the existing channel to return flows to Hinchinbrook creek, reducing vegetation clearing and earthworks. Temporary construction features, such as laydown areas and stockpiles, would be located within infrastructure disturbance footprints or previously cleared and disturbed land. There are extensive areas of cleared land within the former airport runway and surrounds that could accommodate construction laydown areas and access.

8.1.2 Hinchinbrook Creek Crossing

DWE (2008) guidelines for watercourse crossings note the following:

- In order to minimise the effects of structures on the hydrologic, hydraulic and geomorphic functions of the watercourse the crossing would be designed and constructed in order to maintain the integrity of the existing channel as well as being sympathetic with the ecological values of the watercourse and its riparian corridor; and
- Bed level crossings or bridges which fully span the watercourse channel provide the best opportunities for maintaining these channel functions.

The accordance with these guidelines the proposed access road would include an M-lock Bridge to fully span the Hinchinbrook Creek channel, banks and associated riparian vegetation (see Appendix D).

8.2 Mitigation of Impacts

8.2.1 Construction Planning

GHD understands that a Construction Environmental Management Plan (CEMP) is being developed for the Proposal and will include as a minimum the impact mitigation measures and principals outlined below.

Construction Staging

The vegetation to be removed for the proposed access road is within a large patch of intact native vegetation. There is considerable scope for native fauna to evade injury and/or seek alternative habitat in an extensive area of native vegetation to the north and south of the disturbance footprint. Vegetation clearing should progress from one end of the construction footprint in a single direction to maximise the opportunity for fauna to evade injury.

Soil and surface water management

The CEMP should include a 'Soil and Water Management Plan' for the site. Specific surface water management measures will be outlined in this plan, which would include as a minimum the following principles to manage surface water:

- Minimise the area of disturbance, thus minimising the volume of 'dirty' surface water runoff. The clearing and construction method should ensure that soils are only exposed immediately prior to construction, with the remainder of the site covered by permanent infrastructure or retained or replanted vegetation;
- Minimise handling of soils through direct replacement onto landscaped open space areas and careful selection of soil stockpile locations;
- Ensure the fullest separation possible of 'clean' and 'dirty' surface water runoff;
- Install appropriate surface water and erosion control devices (i.e. silt fences or equivalent) around the disturbance footprint;
- Runoff from disturbed and rehabilitated areas will be diverted into sediment ponds and not discharged into the natural system;
- Soil and water management practices are to be employed onsite in line with standard industry practices; and
- Ensure water management systems adopted on site do not adversely affect water quantity or quality in downstream water courses.

Site Management

The following mitigation measures are recommended in order to minimise construction impacts of the site:

- Set appropriate speed limits for construction traffic to limit dust generation and reduce the risk of fauna road fatalities;
- Applying water to internal haul roads during construction, where required to limit dust generation; and

- Restrict access into adjacent remnant vegetation during construction by appropriate marking and/or fencing of the surface disturbance footprint.

Fauna Management

Mitigation measures for fauna are required as the proposed works involve the removal of habitat in native vegetation. Due care during clearing is recommended to reduce direct impacts to any fauna species which may be utilising the disturbance area. A pre-clearance survey by the site Environmental Management Representative (EMR) will be required prior to clearing of any native vegetation within the proposed construction area. This should involve:

- Searches for birds, nests and roosts;
- Active searches for micro bats, including checking under exfoliating bark;
- Identification and marking of habitat trees during pre-clearing surveys (habitat trees include: trees with a DBH > 70cm; trees with resident fauna or associated signs of occupation; and/or any trees with hollows);
- Habitat trees should be avoided as far as is practicable by postponing clearing through these areas as long as is practicable;
- Habitat trees should be monitored for fauna by the EMR during clearing operations and sensitive construction techniques used to minimise the risk of mortality of resident fauna; and
- During clearing operations, all habitat trees should be retained as intact as practicable and placed on the surface of nearby revegetation areas. Where it is practical to separate any leaves, branches and seeds from native species, these items should used for brush mulching in re-vegetation areas. The transfer of seeds from non-native species through contaminated soil and vegetative material to revegetation areas should be avoided.

The CEMP should include appropriate protocols for managing any fauna detected during pre-clearing surveys or during clearing. Appropriate actions should be documented according to type and conservation significance of the fauna in question. It would be necessary to notify DECCW if roosting threatened species are detected within the construction footprint and construction may have to be modified or delayed to further reduce the risk of injury.

Groundcover Clearance Protocol

Groundcover substrate, especially large woody debris, provides important habitat for native fauna, including threatened species. It is recommended that the following protocols be included in the CEMP:

- The site EMR is to perform a pre-clearing survey for Cumberland Land Snails and if any individuals are found relocate them, along with relevant shelter substrate, to the nearest area of intact suitable habitat outside the disturbance footprint. Translocation of the species should only be performed subject after notifying DECCW and obtaining relevant approvals;
- As part of the pre-clearing survey, the site EMR will identify large woody debris with habitat value (excluding exotic weed material) that warrants relocation; and
- During construction, remove identified large woody debris using excavator grabs, where practicable and place within nearby areas of retained vegetation or revegetation areas.

Weed and Pest Management

It is recommended that the following measures be adopted to manage environmental weeds during construction:

- Stockpiles of fill or vegetation should not be placed in areas of adjoining remnant vegetation but instead within existing cleared areas;
- To limit the spread of weeds into adjoining remnant vegetation the surface disturbance footprint, existing fencing around the Hinchinbrook Creek riparian corridor should be maintained and extended and construction activities completely excluded from this area;
- Incorporate control measures, such as appropriately placed silt fences in the design of the proposed works to limit the spread of weed propagules downstream of the site;
- Monitor and control Noxious Weed species in line with legislative obligations; and
- Perform ongoing monitoring of weed infestation on and adjoining the site as part of the management of the site and adjoining offset lands proposed in Section 8.3.

Revegetation and Habitat Enhancement

The overall development strategy for the broader study area includes provision for the retention of remnant vegetation and habitat resources within areas set aside for conservation. Areas specifically set aside as biodiversity offsets for the Proposal are described in Section 8.3 below. The western portion of the Hinchinbrook Creek riparian corridor is set aside as an offset for development of other lands within the former Hoxton Park airport site (GHD, 2007b).

Habitat enhancement should include the placement of logs and tree trunks for ground fauna shelter sites in retained and regenerating vegetation. All hollow-bearing trees identified in the pre-clearing surveys and removed during construction are to be relocated into revegetation areas within the proposed offset sites to mitigate the loss of habitat resources. All significant woody debris identified during the pre-clearing survey is also to be relocated into the revegetation areas to provide further shelter habitats for ground fauna. Woody debris would provide potential habitat resources for the Cumberland Land Snail and other small native fauna.

8.3 Offsetting of Impacts

8.3.1 Need for offsetting

The project would result in residual impacts on native flora and fauna, including removal of approximately 0.87 ha of native vegetation, all of which comprises a threatened ecological community under the TSC and/or EPBC Acts. Therefore biodiversity offsets are recommended to accompany the Development Application for the Proposal.

A biodiversity offset comprises one or more appropriate actions that are put in place to counterbalance specific impacts on biodiversity. Appropriate actions are considered to be long-term management activities that aim to improve biodiversity conservation. This can include legal protection of land (i.e. an offset site) to ensure security of management actions and remove threats (DECC, 2008).

Other portions of the former Hoxton Park Airport Redevelopment have been assessed and approved including an appropriate offset strategy to compensate for impacts on native biota (GHD, 2007a; 2007b). Additional offset contributions will be required for impacts associated with the development of the Proposal as well as to compensate for portions of the existing offset site that will affected by the proposed access road.

The preliminary biodiversity offset strategy outlined in this report was prepared with reference to the *Principles for the Use of Biodiversity Offsets in NSW* (DECC, 2008) and includes the identification of:

- A potentially suitable offset site;
- Appropriate management actions to improve the biodiversity value of the site; and
- Titling options to ensure legal protection of the site and achieve conservation in perpetuity.

Offsets are negotiated on a 'case by case' basis between the client, DECCW and the approval authority(s) for the development. DECCW is the lead government agency in negotiating suitable offsets but does not necessarily give final approval to such proposals. GHD presents the offsets strategy proposed in this assessment in order to provide the DECCW and Council and any additional approval authority(s) with the necessary information to assist in making a balanced decision on the Proposal.

8.3.2 Offset site

The preferred offset site is located in the eastern portion of the Hinchinbrook Creek riparian corridor, to the northern or 'upstream' end of the site. The approximate size of the area is 4.3ha and offset works would involve both bush regeneration and hand planting in the areas deemed as low – medium flood risk. It is anticipated this offset would achieve the same objectives and outcomes as the Offset Strategy already prepared for the approved development footprint (GHD 2007b).

The eastern portion of the Hinchinbrook Creek corridor, incorporating the preferred offset site, was surveyed as part of the current study via a rapid vegetation and habitat assessment. It is dominated by intact and regenerating native vegetation. The proposed offset site would comprise a suitable biodiversity offset for habitat to be removed within the development footprint, based on the following considerations:

- The presence of appropriate 'like for like' vegetation communities, including Shale Plains Woodland and Alluvial Woodland;
- The presence of threatened ecological communities comprising intact Shale Plains Woodland and Alluvial Woodland in good condition, with relatively high plant species diversity and minor weed infestation;
- The ability to improve the condition of aquatic and riparian habitat associated with Hinchinbrook Creek;
- Part of a larger patch size and superior habitat connectivity than the majority of the habitat to be removed within the disturbance footprint; and

- Continuity with existing rehabilitation and conservation lands to yield a continuous patch of conserved native woodland and riparian forest habitats within a regionally significant habitat corridor.

This proposed offset site is under the care and control of Council, and following initial discussions and consultation with executive planners the land has been made available for the proponent for the purposes of implementing the offset accompanying this Proposal.

Details of the Offset Strategy, site conditions and proposed rehabilitation and management actions are included as Appendix E in this report.

8.3.3 Management

The DECC (2008) offsetting principals require the improvement of condition and biodiversity values at offset sites through ongoing management of the offset area. Ongoing environmental management would be conducted under a Vegetation Management sub-plan of the site CEMP. The VMP would be prepared to clearly outline the works required on conservation lands, recommended implementation time frames, rehabilitation and management cost estimates and other associated information.

Improvement of the condition and biodiversity value of the offset site would be achieved through:

- Maintenance of site boundaries and exclusion of potentially damaging activities;
- Monitoring of planted and intact native vegetation and supplementary planting or targeted management actions as appropriate; and
- Management of weeds and pest fauna.

The Offset Strategy will be implemented in the Hinchinbrook Creek Corridor over a five-year period, under the management of Mirvac. At the completion of the initial three (3) year management period, the management will be handed over to Liverpool City Council. The principle goals of the strategy are to improve the condition and conservation of existing vegetation and promote a net increase in vegetation cover across the site. The Offset Strategy includes three distinct management actions to mitigate vegetation clearing for the development, being:

- Conservation of existing remnant vegetation outside the RFI Zone;
- Rehabilitation of existing remnant vegetation; and
- Revegetation activities (hand planting) as deemed necessary to achieve the total offset area of 4.3 ha based on an offset compensation ratio of 1:5.

8.3.4 Titling

The DECC (2008) offsetting principles state that offset areas must be 'enduring' and they must be enforceable; that is, the offset area must be protected in perpetuity by a planning instrument and/or by changes to the title of the property. In the current legislative context, available titling options include:

- A restriction on use of land under Section 88D of the NSW *Conveyancing Act*;
- An appropriate Planning Agreement or Voluntary Conservation Agreement with the relevant landowner; or
- Acquisition of the land by the National Parks and Wildlife Service (NPWS).

In this case a Planning Agreement will be entered into with LCC on lands zoned for environmental protection.

9. Assessments of Significance of Impacts

9.1 NSW TSC & FM Act Listed Threatened Biota

9.1.1 Threatened Flora Species

The proposed development will not directly impact any known populations of threatened flora species. A general evaluation of the magnitude, extent and significance of impacts of the proposal on threatened flora species and their habitats following the assessment criteria identified in Section 5A of the EP & A Act (the 7-part test) was performed.

The outcome of this assessment is that the project is not likely to have a significant negative effect on local populations of any threatened plants based on the following considerations:

- No threatened flora species were detected during site surveys or are known from the immediate vicinity of the site (DECCW, 2010a; Biosis, 2006). Construction is highly unlikely to remove or disturb any individuals or critical habitat resources that are important for maintaining the life cycles of local populations;
- The access road footprint would reduce the extent of habitat at the site by a total of 0.87 ha (the area of Shale Plains Woodland and Alluvial Woodland). Woodland and forest within the footprint of the access road is contiguous with a large area of habitat in the Hinchinbrook Creek corridor. Ecological functions such as pollination, seed fall and seedling recruitment are likely to occur across the gap created by the access road and so the riparian corridor is likely to continue to function as a single, viable patch. A 0.87 ha reduction in the extent of habitat available within the Hinchinbrook Creek corridor is unlikely to significantly affect the viability any local populations of threatened flora;
- The Proposal would not significantly fragment or isolate any areas of habitat, given the limited scale of the disturbance footprint and existing fragmentation of habitat at the site;
- There is no recommended or declared critical habitat of relevance to this assessment (DECCW, 2009e, DPI, 2009b);
- The broader Proposal, incorporating design and the offsets strategy, is consistent with specific recovery objectives presented in the DECCW (2009) *Draft Recovery Plan for the Cumberland Plain*; and
- The proposal will not significantly increase the operation of any KTPs (refer Section 5.3).

9.1.2 Threatened Ecological Communities

Two threatened ecological communities listed under the TSC Act are present at the site and will be affected by the project. 7-part tests were performed for these communities and are included as Appendix C. The outcomes of these assessments are summarised below.

Cumberland Plain Woodland

The Proposal will remove or modify a total of approximately 0.79 ha of native vegetation consistent with this CEEC as defined under the TSC Act within the footprint of the bridge and access road.

The access road footprint would affect a viable patch of CPW within the Hinchinbrook Creek riparian corridor, but would remove a very minor portion of its overall extent (0.79ha). Ecological functions such as pollination, seed fall, seedling recruitment and fauna movement are likely to occur across the gap created by the access road and so the riparian corridor is likely to continue to function as a single, viable patch. Therefore the Proposal is not likely to have a significant negative effect on the local occurrence of CPW.

The viability of CPW within the Hinchinbrook Creek Corridor would be also be maintained through the proposed offset strategies for this Proposal and other developments at the former Hoxton Park airport site (GHD, 2007b). The offset strategies would provide for the conservation and management of the majority of CPW in the vicinity of the site.

River Flat Eucalypt Forest

The Proposal would remove or modify a very small proportion of the local population of the RFEF EEC (0.08 ha, with a maximum disturbance footprint width of less than 20 m). The habitat directly affected would have relatively minor value to populations of species within the EEC. Standard environmental management measures are likely to avoid any impacts on the EEC outside the immediate access road construction footprint. An extensive continuous patch of the EEC would be retained along Hinchinbrook Creek. This area of retained habitat is likely to be sufficient to maintain local populations of the vegetation community and species that comprise the EEC. The Proposal would not significantly affect the continuity of the EEC, disrupt any ecological processes or isolate any areas of habitat. Therefore the Proposal is not likely to have a significant impact on local populations of River Flat Eucalypt Forest.

The viability of RFEF within the Hinchinbrook Creek Corridor would be also be maintained through the proposed offset strategies for this Proposal and other developments at the former Hoxton Park airport site (GHD, 2007b). The offset strategies would provide for the conservation and management of the majority of RFEF in the vicinity of the site.

9.1.3 Threatened Fauna Species

A total of five threatened fauna species are known, or are highly likely to occur at the site based on field surveys, habitat assessments and/or recent observations of the species in the locality. Threatened fauna species which are known, or are highly likely to occur at the site are presented in Table 6 along with their conservation status, the nature of their previous occurrence in the study area, the habitats in which they are likely to occur and the potential for impacts arising from the Proposal.

A further 18 threatened fauna species may possibly occur at the site based on the presence of suitable foraging and roosting habitat. These fauna species may occur in habitat at the site on an occasional or opportunistic basis.

7-part tests have been undertaken for these NSW TSC listed threatened fauna and are provided in Appendix C. Where appropriate, multiple species of threatened fauna are grouped according to similar ecological characteristics and impacts on common habitat resources are presented together.

The outcome of these assessments is summarised below.

Threatened Microbats

The development would have an impact on these species through removal of potential roosting and foraging habitat within the development footprint. The proposed habitat removal would have a minor effect on the availability of resources within the likely home ranges of these highly mobile species and would not fragment or isolate any areas of habitat.

The proposed development may also disturb some individuals through increased light, noise and traffic. However these impacts are likely to be minor in the context of existing disturbance at the site, including the adjacent M7 motorway.

Based on the above considerations the development is not likely to have a significant negative effect on local populations of the Eastern Bentwing Bat, Large-footed Myotis or Greater Broad-nosed Bat.

Grey-headed Flying Fox

The development would have an impact on the species through removal of roosting and foraging habitat within the development footprint. The proposed habitat removal would have a minor effect on the availability of habitat within the likely home ranges of the local population of this highly mobile species. Impacts would include the loss of 0.87 ha of foraging habitat (Shale Plains Woodland and Alluvial Woodland within the development footprint) but would not fragment or isolate any areas of habitat for this highly mobile species.

The proposed development may also disturb some individuals through increased light, noise and traffic. However these impacts are likely to be minor in the context of existing disturbance at the site, including the adjacent M7 motorway.

Based on the above considerations the development is not likely to have a significant negative effect on local populations of the Grey-headed Flying Fox

Cumberland Land Snail

The development will remove approximately 0.87 ha of native woodland and forest that comprises potentially suitable shelter and foraging habitat for this species. No individuals of have been recorded on site, though Cumberland Land Snails may be present, buried in loose soil or leaf litter. The remainder of the development footprint is exotic grassland or disturbed cleared land that does not comprise suitable habitat for this species.

The 0.87 ha of woodland and forest within the footprint of the access road is contiguous with a large area of habitat in the Hinchinbrook Creek corridor. No individuals of the species were recorded in the proposed construction footprint and there are only small amounts of suitable woody debris shelter sites. Cumberland Land Snails may be present, buried in loose soil or leaf litter. The Proposal is unlikely to remove a significant proportion of either individuals or habitat resources due to the limited area directly affected (0.87 ha). The remainder of the Hinchinbrook Creek corridor is likely to contain sufficient amounts of both individuals and habitat resources to maintain local populations.

The proposed construction would include a pre-clearing survey, including salvage of any snails or woody debris in construction footprints and their placement in adjacent areas of retained vegetation. This would partially mitigate impacts on local populations.

Therefore the proposed action is unlikely to have a significant negative effect on the local population of the Cumberland Land Snail.

Other Mobile Threatened Fauna

The Proposal will remove potential habitat for additional threatened fauna species which may utilise habitat at the site, at least on occasion or on an opportunistic basis. An evaluation of the magnitude, extent and significance of impacts of the proposal on local populations of these species and their habitats following the assessment criteria of the 7-part test has been undertaken, based on a general consideration of the likelihood of impacts on these species.

The project is not likely to have a significant negative affect on any mobile threatened fauna based on the following considerations:

- The proposed construction may displace or disturb some individuals if they are within or near the disturbance area. This disturbance would be short-term and is likely to affect a small proportion of any fauna populations. Based on available NPWS (2002) mapping the Proposal would remove less than 0.05 % of the overall extent of similar native woodland and forest vegetation communities in the locality. The disturbance footprint is highly unlikely to contain an ecologically significant proportion of any fauna populations or of any critical foraging, breeding or roosting resources that are important for maintaining the life cycles of local populations;
- The access road footprint would reduce the extent of habitat at the site by a total of 0.87 ha (the area of Shale Plains Woodland and Alluvial Woodland within the footprint), and remove one identified hollow-bearing tree. Woodland and forest within the footprint of the access road is contiguous with a large area of habitat in the Hinchinbrook Creek corridor. This vegetation would have considerable value for local populations given the overall patch size and habitat connectivity. A 0.87 ha reduction in the extent of habitat available within the Hinchinbrook Creek corridor is unlikely to significantly affect the viability any local populations of mobile threatened fauna;
- The Proposal would not significantly fragment or isolate any areas of habitat, given the limited scale of the disturbance footprint and existing fragmentation of habitat at the site;
- There is no recommended or declared critical habitat of relevance to this assessment (DECCW, 2009e, DPI, 2009b);
- The broader Proposal, incorporating design and the offsets strategy, is consistent with specific recovery objectives presented in the DECCW (2009) *Draft Recovery Plan for the Cumberland Plain*; and
- The proposal will not significantly increase the operation of any KTPs (refer Section 5.3).

9.1.4 Critical habitat

There is no recommended or declared critical habitat on the DECCW NSW Critical habitat register (DECCW, 2009e) or the DPI critical habitat register (DPI, 2009b) in the locality or of relevance to the assessment of the project.

9.2 Matters of National Environmental Significance

9.2.1 Approach

The Commonwealth *Environment Protection & Biodiversity Conservation Act, 1999* (EPBC Act) establishes a process for assessing the environmental impact of activities and developments where 'matters of national environmental significance' may be affected. Under the Act any action, which "has, will have, or is likely to have a significant impact on a matter of national environmental significance" is defined as a "controlled action", and requires approval from the Minister for the Environment, Water, Heritage and the Arts.

The matters of national environmental significance (MNES) listed under the EPBC Act of potential relevance to the Forest are described in Section 6.2. A detailed assessment of the significance of these impacts on MNES is provided below prepared in accordance with the DEH (2006) *Significant Impact Guidelines*.

9.2.2 Potential Impacts on Nationally Listed Threatened Biota

Flora

No EPBC Act listed flora species were recorded at the site or are considered likely to occur at the site and potentially be affected by the Proposal. Therefore based on a general consideration of the likelihood of impacts pursuant to the DEH (2006) guidelines the Proposal is not likely to have a significant impact on any threatened flora species or their habitats.

Endangered Ecological Communities

The Proposal would involve the clearing of 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' which is listed as a Critically Endangered Ecological Community under the EPBC Act. The proposed clearing of CPW comprises an impact on a matter of NES. The local population of this community is ecologically equivalent to CPW, listed under the TSC Act. However, the criteria for identifying the CEEC differs between the forms listed under the two Acts. Derived Tussock Grassland is consistent with the TSC Act definition of CPW, but does not meet the condition criteria for the EPBC Act definition of CPW (DEWHA, 2010b). Only areas mapped as Shale Plains Woodland at the site qualify as the CEEC listed under the EPBC Act. Therefore a separate AoS for the EPBC Act listed form of CPW at the site was performed. A detailed assessment of the significance of impacts on CPW pursuant to the DEH (2006) guidelines is presented in Appendix C.

The Proposal will reduce the extent of this community by removing or modifying a total of approximately 0.87 ha of native vegetation. The removal of the CEEC includes: a patch of 0.04 ha of Shale Plains Woodland near the edge of the northern basin footprint; and a further 0.75 ha of Shale Plains Woodland within the footprint of the bridge and access road.

This is a minor proportion of the local population of the CEEC, which includes: an extensive area within the Hinchinbrook Creek riparian corridor; large, but disjunct patches to the west of the M7; and small fragmented patches within the former Hoxton Park Airport redevelopment area.

The access road footprint would affect a viable patch of CPW within the Hinchinbrook Creek riparian corridor, but would remove a very minor portion of its overall extent.

Ecological functions such as pollination, seed fall, seedling recruitment and fauna movement are likely to occur across the gap created by the access road and so the riparian corridor is likely to continue to function as a single, viable patch.

Consideration of the above assessment criteria concludes that the development is considered unlikely to have a significant impact on CPW.

Terrestrial Fauna

One EPBC Act listed species was recorded at the site and is likely to be affected by the Proposal: the Grey-headed Flying Fox. This species is also listed under the NSW TSC Act. A 7-part test was performed for this species and is included in Appendix C. This is considered an appropriate assessment of significance of impacts on the species with regards to its status as a MNES. The outcome of this assessment is that the Proposal is not likely to have a significant impact on the local population of the Grey-headed Flying Fox.

A number of other threatened fauna species listed under the EPBC Act are known or predicted to utilise habitat at the site on an occasional or opportunistic basis. The project will remove potential habitat for these species. An evaluation of the magnitude, extent and significance of impacts of the proposal on local populations of these species and their habitats following the assessment criteria identified in Section 5a of the EP&A Act has been undertaken, based on a general consideration of the likelihood of impacts on these species. This assessment is included above in Section 6.1.4. The outcome of this assessment is that the project is not likely to have a significant negative affect on any threatened fauna.

9.2.3 Potential Impacts on Migratory Species

The study area provides habitat for a number of EPBC Act listed migratory species, including waterfowl (Anatidae species) and the Cattle Egret and Masked Lapwing which were observed during field surveys. Native vegetation and wetlands at the site are likely to be used by a range of these migratory species on a periodic basis. This would also potentially include use of seasonal foraging resources by threatened migratory species, including the Swift Parrot and Regent Honeyeater.

Habitat within the footprint of the proposed access road is not likely to comprise important habitat for migratory species as defined by the DEH (2006) guidelines, nonetheless it has habitat value in terms of its condition and integrity and its recognition in Regional biodiversity strategies (EcoLogical, 2003; NPWS, 2002). This vegetation would have considerable value for local populations given the overall patch size and habitat connectivity. The Proposal is unlikely to significantly reduce the value of this habitat due to the limited area directly affected (0.87 ha). The extent of habitat would be reduced through the removal of a single strip approximately 20 metres wide. It is likely that sufficient numbers of mature trees and vegetation would be retained in the remainder of the corridor to maintain its function as a fauna movement corridor.

Aerial habitat would not be affected and so migratory species are likely to traverse obstacles and gaps in habitat created by permanent project infrastructure. The project does not involve any structures that would pose a significant obstruction or hazard in the context of existing land uses in the locality.

The proposed construction would result in very minor modification of remnant vegetation outside of the project footprint through noise, light-spill and other secondary effects. This would comprise a minor effect in the context of existing fragmentation and modification of habitat in the locality.

The Proposal is thus unlikely to create a barrier to migration, increase the risk of injury or mortality or otherwise impact on migratory species. Therefore the Proposal is unlikely to impose “a significant effect” on any of the listed migratory fauna species, which could possibly occur in the study area on occasion.

9.2.4 Potential Impacts on Ramsar Sites

The site is within the same catchment as the Towra Point Nature Reserve Ramsar Site. The Ramsar Wetland site is located many tens of kilometres downstream of the site and is separated by the expanse of Botany Bay. Provided standard environmental management measures are adopted at the site the Proposal would be very unlikely to result in any surface water contamination. Even if any such contamination did occur the proposal site is so far removed from the Ramsar site that any such contamination would be diluted and would have no discernible effect. The proposal would not result in any other impacts on the natural environment beyond the immediate construction footprint. Therefore the proposed works would not impose “a significant effect” on the Towra Point Nature Reserve Ramsar Site.

10. Conclusions

10.1 Part 3A Key Thresholds

Pursuant to DEC/DPI (2005) assessment guidelines development applications under Part 3A must contain a justification of the preferred option based on the following key thresholds.

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.

Specific impact mitigation and environmental management measures have been recommended for implementation to increase the certainty of the long term maintenance of the biodiversity values of the site during construction and operation of the proposal. This would substantially avert offsite impacts on surface waters, native vegetation and fauna habitats. The project will not mitigate all impacts on native flora and fauna within the proposed surface disturbance area. There are residual impacts on native biota, including threatened species and EECs. These impacts will require commensurate biodiversity offsets to ensure the project would "improve or maintain biodiversity values". The Offset Strategy is included as Appendix E in this report.

The key areas that the project seeks to improve or maintain biodiversity values, through the implementation of an appropriate offset strategy are:

- Impacts to existing vegetation will be minimal, with a total of 0.87 ha of intact native vegetation to be removed and 4.3 ha being rehabilitated and managed for conservation. This includes a net increase in vegetation cover, through time, of approximately 2 ha;
- Compensation for this removal by rehabilitating approximately 4 ha of native vegetation in the eastern portion of Hinchinbrook Creek riparian corridor, which has been recognised by NPWS (2002) as 'Core habitat - Regional' and 'Support for Core habitat'. This vegetation is also recognised in the Liverpool City Council Biodiversity Strategy (LCC & EcoLogical, 2003) as one of three bushland corridors intended to create three major biodiversity corridors, linking areas of core habitat across the Liverpool area;
- The proposed offset area would greatly enhance the connectivity of the Hinchinbrook Creek riparian corridor, which forms a continuous fauna habitat corridor for species which favour tall forest, dense undergrowth and riparian habitats. It would comprise an important refuge and wildlife corridor for many fauna species, including the regionally significant Eastern Grey Kangaroo and, potentially, the Powerful Owl (*Ninox strenua*);
- Improving habitat values through bush regeneration and revegetation (hand planting) and providing additional habitat; and
- Minimising additional edge effects be rehabilitating a large continuous area.

The comparison of ecological impacts, mitigation and offsets associated with the application of the "improve or maintain" test to the project are summarised in Table 8.

Table 8 Comparison of ecological impacts, mitigation and offsets

Impact	Mitigation	Offset
Removal of native vegetation and habitats within the disturbance footprint including: ◗ Clearing of approximately 0.87 ha of native vegetation, including 0.78 ha of Cumberland Plain Woodland EEC and 0.08 ha of River-flat Eucalypt Forest EEC. ◗ Removal of one hollow-bearing tree.	◗ Adoption of Prepared CEMP and application of appropriate measures to mitigate impacts on resident fauna within construction footprints, surface water, soil and air quality. ◗ Use of an M-lock bridge, or equivalent, for the proposed crossing of Hinchinbrook Creek in order to maintain the integrity of the existing channel and minimise impacts on the ecological values of the watercourse and its riparian corridor. ◗ A proposed biodiversity offset strategy to offset residual impacts on native biota, preferably aligned with the offset strategy for other development lands at the former Hoxton Park Airport site (GHD 2007b) to create an integrated conservation area associated with the Hinchinbrook Creek riparian corridor.	Development of an offsets strategy in consultation with DECCW and DoP, including the following: ◗ An offset site containing native vegetation habitat resources including: – Cumberland Plain Woodland EEC; – River-flat Eucalypt Forest EEC; – Hollow-bearing trees; and – Continuity with existing conservation land. ◗ Management of the site for biodiversity conservation. ◗ Conservation of the offset site under secure tenure, in perpetuity, either in the NPWS Estate or under a VCA, or equivalent.

Whether or not the proposal is likely to reduce the long-term viability of a local population of any threatened species, population or ecological community.

Assessments of significance have been performed for threatened biota known or likely to occur at the site and to be affected by the Proposal. The outcome of these assessments is that the proposed development is not likely to have a significant impact on any local populations of threatened biota.

The project is unlikely to impose a significant adverse impact on any other threatened biota or their habitats based on the following considerations:

- There are no specific habitat features or resources at the site that suggest any permanent local populations of any other threatened biota are present;
- There is no evidence of important breeding, roosting or sheltering habitat for any other threatened species at the site;
- Based on NPWS mapping, the area of habitat to remove represents less than 0.05% of similar available habitat in the area and is therefore unlikely to contain an ecologically significant proportion of the local populations of any threatened biota;
- The extent of native vegetation would be reduced through the removal of a single strip approximately 20 metres wide. It is likely that sufficient numbers of mature trees and representative species would be retained in the remainder of the corridor to maintain the local occurrence of ecological communities and to provide for fauna movement. Ecological functions such as pollination, seed fall, seedling recruitment and fauna movement are likely to occur across the gap created by the access road and so the riparian corridor is likely to continue to function as a single, viable patch. Therefore this minor reduction in the extent of the riparian corridor is not likely to comprise a significant reduction in the extent of a threatened ecological community or habitat for any local populations of any native species;
- The proposed M-lock bridge design for the crossing of Hinchinbrook Creek should maintain the integrity of the existing channel and minimise impacts on the ecological values of the watercourse and its riparian corridor; and
- The proposed offset strategy would ensure the conservation and management of alternative habitat in perpetuity, including populations and important habitat resources for threatened biota that will be affected by the proposed development.

Whether or not the proposal is likely to accelerate the extinction of any species, population or ecological community or place it at risk of extinction.

As stated above, assessments of significance have been performed for threatened biota potentially affected by the Proposal and the outcome of these assessments is that the proposed development is not likely to have a significant impact on any local populations of threatened biota.

The project is highly unlikely to accelerate the extinction of any other threatened biota, or place them at risk of extinction, based on the following considerations:

- There are no specific habitat features or resources at the site that are likely to be important for maintaining local populations of any threatened biota;

- Considering the limited area of habitat within the development footprint and the extent of alternative habitat in the locality, these areas are unlikely to contain an ecologically significant proportion of the local populations of any threatened biota; and
- The proposed management of the offset site would ensure the conservation of alternative habitat in perpetuity, including populations and important habitat resources for threatened biota that will be affected by the proposed development.

Whether or not the proposal will adversely affect critical habitat.

No listed critical habitat will be removed or adversely affected as a result of this proposal.

10.1.1 Federal EPBC Act Assessment

Assessments pursuant to the DEH (2006) guidelines were performed for MNES potentially affected by the Proposal. On the basis of the assessments undertaken, it is concluded that the Proposal is unlikely to impose “a significant effect” on any Matters of National Environmental Significance and hence is unlikely to constitute a controlled action as defined under the EPBC Act.

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Appendix A

Species Lists Recorded on the Site

Table A.1 Flora species recorded within the study area

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor
Acanthaceae							
	Brunoniella australis	Blue Trumpet	U				x
	Pseuderanthemum variabile	Pastel Flower	U				x
Adiantaceae							
	Adiantum aethiopicum	Common Maidenhair	P13		x		x
	Cheilanthes sieberi	Rock Fern	U		x	x	x
	*Pellaea viridus**	Green Cliff Brake	U		x		
Amaranthaceae							
	Alternanthera denticulata	Lesser Joyweed	U		x	x	
Amygdalaceae							
	*Prunus spp.**		U			x	
Anthericaceae							
	Tricoryne simplex		U		x	x	
Apiaceae							
	Centella asiatica	Indian Pennywort	U		x	x	
	Daucus glochidiatus	Native Carrot	U			x	
Apocynaceae							
	*Araujia sericifera**	Moth Vine	U		x	x	x
	*Gomphocarpus fruticosus**	Narrow-leaved Cotton Bush	U		x		
	Parsonsia straminea	Common Silkpod	U				x
Asparagaceae							
	*Asparagus asparagoides**	Bridal Creeper	U			x	
Asteraceae							
	*Ageratina adenophora**	Crofton Weed	U		x		

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor
	*Aster subulatus**	Wild aster, Bushy starwort	U			x	
	*Bidens pilosa**	Cobbler's Pegs	U				x
	Cassinia aculeata	Dolly Bush	U				x
	*Cirsium vulgare**	Spear Thistle	U		x	x	x
	*Conyza bonariensis**	Flaxleaf Fleabane	U		x	x	x
	Euchiton gymnocephalus	Creeping Cudweed	U			x	
	Euchiton nitidulus	Shining Cudweed	V				x
	Euchiton sphaericus	Star Cudweed	U			x	
	*Gamochaeta americana**	Cudweed	U		x		
	Gnaphalium sphaericum					x	
	*Leontodon taraxacoides**	Lesser Hawkbit/hairy Hawkbit	U			x	
	*Senecio madagascariensis**	Fireweed	U		x	x	x
	Senecio quadridentatus	Cotton Fireweed	U			x	
	*Sonchus oleraceus**	Common Sowthistle	U		x		x
	*Taraxacum officinale**	Dandelion	U		x	x	x
Cactaceae							
	*Opuntia stricta**	Common Prickly Pear, Smooth Pest Pear	U		x	x	x
Campanulaceae							
	Wahlenbergia gracilis	Sprawling Bluebell	U			x	
	Wahlenbergia littoricola		U			x	

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor
Caryophyllaceae							
	*Stellaria media**	Common Chickweed	U		x	x	
	*Spergularia levis**		U			x	
Casuarinaceae							
	Casuarina glauca	Swamp Oak	U			x	x
Chenopodiaceae							
	Einadia hastata	Berry Saltbush	U		x		x
	Einadia nutans	Climbing Saltbush	U		x	x	
	Einadia trigonos	Fishweed	U		x		
Clusiaceae							
	Hypericum gramineum	Small St John's Wort	U			x	x
	*Hypericum perforatum**	St. Johns Wort	U			x	
Commelinaceae							
	Commelina cyanea	Native Wandering Jew	U				x
	*Tradescantia fluminensis**	Wandering Jew	U		x		x
Convolvulaceae							
	Dichondra repens	Kidney Weed	U		x	x	x
Cyperaceae							
	Bolboschoenus caldwellii		U		x	x	
	Carex appressa	Tall Sedge	U		x	x	
	Carex spp.		U		x		
	*Cyperus brevifolius**		U			x	
	*Cyperus eragrostis**	Umbrella Sedge	U		x	x	x

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor
	Cyperus gracilis	Slender Flat-sedge	U			x	
	Cyperus polystachyos		U			x	
	*Cyperus rotundus**	nutgrass	U		x		
	Cyperus spp.		U			x	
	Eleocharis cylindrostachys		U			x	
	Fimbristylis dichotoma	Common Fringe-sedge	U			x	
	*Isolepis prolifera**		U			x	
Ericaceae							
	Astroloma humifusum	Native Cranberry	U			x	
	Leucopogon juniperinus	Prickly Beard-heath	U		x	x	
Fabaceae (Faboideae)							
	Daviesia genistifolia	Broom Bitter Pea	U		x	x	x
	Daviesia ulicifolia	Gorse Bitter Pea	U		x	x	
	Dillwynia acicularis		U		x		
	Dillwynia sieberi		U			x	x
	Glycine microphylla	Small-leaf Glycine	U			x	x
	Glycine tabacina	Variable Glycine	U		x		x
	Hardenbergia violacea	False Sarsaparilla	U			x	
	Pultenaea villosa	Hairy Bush-pea	U			x	
	*Trifolium arvense**	Haresfoot Clover	U				x
Fabaceae (Mimosoideae)							
	Acacia parramattensis	Parramatta Wattle	U		x	x	x

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor
	Acacia longifolia		U			x	x
	Acacia falciformis	Broad-leaved Hickory	U			x	
	Acacia fimbriata	Fringed Wattle	U		x		
	Acacia floribunda	White Sally	U			x	
	Acacia parvipinnula	Silver-stemmed Wattle	U			x	
	Acacia ulicifolia	Prickly Moses	U				x
Gentianaceae							
	*Centaurium tenuiflorum**		U		x		
Geraniaceae							
	Geranium homeanum		U				x
Goodeniaceae							
	Goodenia hederacea	Ivy Goodenia	U			x	
Haloragaceae							
	Haloragis heterophylla	Variable Raspwort	U		x		
	*Myriophyllum aquaticum**	Parrots Feather	U				x
	Myriophyllum variifolium		U			x	
Hydrocharitaceae							
	Ottelia ovalifolia subsp. ovalifolia	Swamp Lily	U				x
Juncaceae							
	*Juncus acuminatus**		U				
	*Juncus acutus subsp. acutus**	Sharp Rush	U		x	x	
	Juncus continuus		U			x	
	Juncus usitatus		U		x	x	
Lamiaceae							

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor
	Clerodendrum tomentosum	Hairy Clerodendrum	U			x	
Lemnaceae							
	Lemna disperma		U				x
Lobeliaceae							
	Pratia purpurascens	Whiteroot	U				x
Loganiaceae							
Lomandraceae							
	Lomandra filiformis subsp. filiformis		U				x
	Lomandra longifolia	Spiny-headed Mat-rush	U		x	x	
	Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush	U		x		x
Luzuriagaceae							
	Geitonoplesium cymosum	Scrambling Lily	U				x
Malaceae							
	*Pyracantha angustifolia**	Orange Firethorn	U				x
Malvaceae							
	Lagunaria patersonia	Norfolk Island Hibiscus	U		x		
	*Sida rhombifolia**	Paddy's Lucerne	U		x	x	x
Myrsinaceae							
	*Anagallis arvensis**	Scarlet Pimpernel	U		x		
Myrtaceae							
	Angophora subvelutina	Broad-leaved Apple	U		x	x	x
	Angophora floribunda	Rough-barked Apple	U				x
	Corymbia maculata	Spotted Gum	U		x	x	x

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor
	Eucalyptus amplifolia	Cabbage Gum					x
	Eucalyptus eugenioides	Thin-leaved Stringybark	U			x	
	Eucalyptus maculata	Grey Gum					x
	Eucalyptus moluccana	Grey Box	U		x	x	x
	Eucalyptus tereticornis	Forest Red Gum	U		x	x	x
	Melaleuca decora		U		x	x	
	Melaleuca linariifolia	Flax-leaved Paperbark	U			x	
	Melaleuca styphelioides	Prickly-leaved Tea Tree	U		x	x	
Oleaceae							
	*Ligustrum sinense**	Small-leaved Privet	U		x		
	Notelaea longifolia	Large Mock-olive	U		x		x
	*Olea europaea subsp. cuspidata**	African Olive	U		x		x
Oxalidaceae							
	*Oxalis corniculata**	Creeping Oxalis	U			x	
Phormiaceae							
	Dianella longifolia	A Blue Flax Lily	U		x		x
	Dianella revoluta	Blueberry Lily, Blue Flax-Lily	U			x	x
Phyllanthaceae							
	Breynia oblongifolia	Coffee Bush	U		x	x	
	Phyllanthus virgatus	Wiry Spurge	U		x	x	
Phytolaccaceae							
	*Phytolacca octandra**	Inkweed	U		x		
Pittosporaceae							
	Bursaria spinosa	Native Blackthorn	U		x	x	x

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor
	Pittosporum revolutum	Rough Fruit Pittosporum	U				x
Plantaginaceae							
	*Plantago lanceolata**	Lamb's Tongues	U		x	x	x
Poaceae							
	Aristida ramosa	Purple Wiregrass	U		x	x	x
	Austrodanthonia caespitosa	Ringed Wallaby Grass	U				x
	Austrodanthonia spp.	A Wallaby Grass	U		x	x	
	*Avena fatua**	Wild Oats	U			x	
	*Avena spp.**	Oats	U		x		
	Axonopus fissifolius	Narrow-leaved Carpet Grass	U			x	
	Bothriochloa macra	Red Grass	U			x	
	*Briza maxima**	Quaking Grass	U			x	
	*Briza minor**	Shivery Grass	U		x	x	x
	*Briza subaristata**		U			x	
	*Bromus diandrus**	Great Brome	U			x	
	*Chloris gayana**	Rhodes Grass	U		x	x	
	Chloris truncata	Windmill Grass	U			x	
	Cymbopogon refractus	Barbed Wire Grass	U			x	x
	Cynodon dactylon	Common Couch	U		x	x	x
	Echinopogon caespitosus	Bushy Hedgehog-grass	U		x		
	*Ehrharta erecta**	Panic Veldtgrass	U			x	x
	*Eleusine tristachya**	Goose Grass	U			x	
	Elymus scaber		U			x	
	Entolasia marginata	Bordered Panic	U			x	
	Entolasia stricta	Wiry Panic	U				x

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor
	Eragrostis brownii	Brown's Lovegrass	U			x	
	*Eragrostis curvula**	African Lovegrass	U		x	x	
	Eriochloa pseudoacrotricha	Early Spring Grass	U			x	
	Imperata cylindrica var. major	Blady Grass	U		x		
	Microlaena stipoides	Weeping Grass	U		x	x	x
	Oplismenus aemulus		U		x	x	x
	Panicum simile	Two-colour Panic	U		x		
	*Paspalum dilatatum**	Paspalum	U		x	x	x
	*Pennisetum clandestinum**	Kikuyu Grass	U			x	
	*Phalaris aquatica**	Phalaris	U		x		
	Phragmites australis	Common Reed	U		x		x
	Poa spp.		U		x		
	Setaria spp.		U		x		
	*Setaria parviflora**		U			x	
	Setaria viridus		U			x	
	*Sporobolus africanus**	Parramatta Grass	U			x	
	Themeda australis	Kangaroo Grass	U		x	x	x
Polygonaceae							
	Persicaria decipiens	Slender Knotweed	U			x	
	Persicaria spp.	Knotweed	U			x	
	*Rumex crispus**	Curled Dock	U			x	x
Proteaceae							
	Grevillea robusta	Silky Oak	U			x	
Ranunculaceae							
	Clematis aristata	Old Man's Beard	U		x		x

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor
Rosaceae							
	*Rubus fruticosus sp. agg.**	Blackberry complex	U		x	x	x
Scrophulariaceae							
	Gratiola pedunculata		U			x	
Solanaceae							
	*Cestrum parqui**	Green Cestrum	U		x	x	
	*Lycium ferocissimum**	African Boxthorn	U		x		
	Solanum campanulatum		U		x		
	*Solanum nigrum**	Black-berry Nightshade	U			x	x
	*Solanum pseudocapsicum**	Madeira Winter Cherry	U		x		
Stackhousiaceae							
	Stackhousia sp.		U		x	x	
Typhaceae							
	Typha orientalis	Broad-leaved Cumbungi	U		x	x	
Verbenaceae							
	*Lantana camara**	Lantana	U			x	x
	*Lantana montevidensis**	Creeping Lantana	U				
	*Verbena bonariensis**	Purpletop	U		x	x	x
	*Verbena hispida**	Rough Verbena	U			x	
Vitaceae							
	Cayratia clematidea	Slender Grape	U				x

x – species recorded
* - Exotic

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Northern basin footprint	Former airport	Hinchinbrook creek corridor

P – Protected under the NPWS Act

U – Unprotected under the NPWS Act

Table A.2 Fauna species recorded within the study site

Scientific Name	Common Name	NSW Status	Federal Status	Observation Type
BIRDS				
Cactua sanguinea	Little Corella	P		Heard
Cormobates leucophaea	White-throated Treecreeper	P		Heard
Eudynamys orientalis	Pacific Koel	P		Heard
Gerygone albogularis	White-throated Gerygone	P		Heard
Grallina cyanoleuca	Australian Magpie-lark	P		Heard
Myzomela sanguinolenta	Scarlet Honeyeater	P		Heard
Psephotus haematonotus	Red-rumped Parrot	P		Heard
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	P		Seen
Acanthiza lineata	Striated Thornbill	P		Seen
Acanthiza nana	Yellow Thornbill	P		Seen
Acanthiza pusilla	Brown Thornbill	P		Seen
Acanthiza reguloides	Buff-rumped Thornbill	P		Seen
Accipiter fasciatus	Brown Goshawk	P		Seen
Acrocephalus australis	Australian Reed Warbler	P		Seen
Anthochaera carunculata	Red Wattlebird	P		Seen
Ardea novaehollandiae	White-faced Heron	P		Seen
Cacatua galerita	Sulphur-crested Cockatoo	P		Seen
Cacatua roseicapilla	Galah	P		Seen
Chenonetta jubata	Wood Duck	P		Seen
Cisticola exilis	Golden-headed Cisticola	P		Seen
Cocomantis flabelliforms	Fan-tailed Cuckoo	P		Seen
*Columba livia**	Rock Dove	U		Seen
Coracina novaehollandiae	Black-faced Cuckoo-shrike	P		Seen
Corvus coronoides	Australian Raven	P		Seen
Corvus mellori	Little Raven	P		Seen
Coturnix sp.	Unidentified Quail	P		Seen
Cracticus nigrogularis	Pied Butcherbird	P		Seen
Cracticus tibicen	Australian Magpie	P		Seen
Cracticus torquatus	Grey Butcherbird	P		Seen
Dacelo novaeguineae	Laughing Kookaburra	P		Seen
Dicaeum hirundinaceum	Mistletoebird	P		Seen
Elanus axillaris	Black-shouldered Kite	P		Seen
Eopsaltria australis	Eastern Yellow Robin	P		Seen

Scientific Name	Common Name	NSW Status	Federal Status	Observation Type
Eurystomus orientalis	Dollarbird	P		Seen
Falco cenchroides	Australian Kestrel	P		Seen
Hirundo neoxena	Welcome Swallow	P		Seen
Malurus cyaneus	Superb Fairy-wren	P		Seen
Manorina melanocephala	Noisy Miner	P		Seen
Neochima temporalis	Red-browed Finch	P		Seen
Ocyphaps lophotes	Crested Pigeon	P		Seen
Oriolus sagittatus	Olive-backed Oriole	P		Seen
Pachycephala rufiventris	Rufous Whistler	P		Seen
Pardalotus punctatus	Spotted Pardalote	P		Seen
Pardalotus striatus	Striated Pardalote	P		Seen
Phalacrocorax melanoleucos	Little Pied Cormorant	P		Seen
Platycercus eximius	Eastern Rosella	P		Seen
*Pycnonotus jocosus**	Red-whiskered Bulbul	U		Seen
Rhipidura fuliginosa	Grey Fantail	P		Seen
Rhipidura leucophrys	Willy Wagtail	P		Seen
Scythrops novaehollandiae	Channel-billed Cuckoo	P		Seen
Sericornis frontalis	White-browed Scrubwren	P		Seen
Smicrornis brevirostris	Weebill	P		Seen
Strepera graculina	Pied Currawong	P		Seen
*Sturnus tristis**	Common Myna	U		Seen
Threskiornis Aethiopica	Australian White Ibis	P		Seen
Todiramphus sanctus	Sacred Kingfisher	P		Seen
Trichoglossus haematodus	Rainbow Lorikeet	P		Seen
Vanellus miles	Masked Lapwing	P		Seen
Zosterops lateralis	Silvereye	P		Seen
MAMMALS				
Terrestrial mammals				
**Bos taurus*	Domestic Cow	U		Scat (old)
**Canis vulpes*	Red Fox	U		Scat, Seen
**Canis familiaris*	Domestic Dog	U		Scat, skull
**Felis catus*	Domestic Cat	U		Seen
**Oryctolagus cuniculus*	European Rabbit	U		Seen
Macropus giganteus	Eastern Grey Kangaroo	P		Seen
Petaurus breviceps	Sugar Glider	P		Seen

Scientific Name	Common Name	NSW Status	Federal Status	Observation Type
Microbats				
Chalinolobus gouldi	Gould's Wattled Bat	P		Anabat (confident)
Chalinolobus morio	Chocolate Wattled Bat	P		Anabat (probable)
Chalinolobus picatus	Little Pied Bat	V		
Falsistrellus tasmaniensis	Eastern Falsistrelle#	P		Anabat (Possible)
Miniopterus schreibersii oceanensis	Eastern Bentwing Bat#	P		Anabat (probable)
Mormopterus species 2	Unidentified Mormopterus 2	P		Anabat (confident)
Mormopterus species 3	Unidentified Mormopterus 3	P		
Mormopterus species 4	Unidentified Mormopterus 4	P		
Myotis macropus	Southern Myotis#	V		Anabat (probable)
Nyctophilus geoffroyi	Lesser Longeared Bat	P		
Nyctophilus gouldi	Gould's Longeared Bat	P		
Nyctophilus sp.	Unidentified Longeared Bat	P		Anabat (confident)
Scoteanax ruepelli	Greater Broad-nosed Bat#	P		Anabat (probable)
Scotorepens orion	Eastern Broad-nosed Bat	P		Anabat (probable)
Scoterepens greyii	Little Broad-nosed Bat	P		
Scotorepens balstoni	Inland Broad-nosed Bat	P		
Tadarida australis	White-striped Freetail Bat	P		Anabat (confident)
Vespadelus darlingtoni	Large Forest Bat	P		
Vespadelus regulus	Southern Forest Bat	P		
Vespadelus vulturnus	Little Forest Bat	P		Anabat (confident)
Vespadelus sp.	Unidentified Forest Bat	P		Anabat (probable)
Flying-Fox				
Pteropus poliocephalus	Grey-headed Flying-fox	V		Heard
FROGS				
Limnodynastes tasmaniensis	Spotted Marsh Frog	P		Heard
Crinia signifera	Common Eastern Froglet	P		Heard, seen
Litoria fallax	Eastern Dwarf Tree Frog	P		Heard
Litoria peronii	Peron's Tree Frog	P		Heard
REPTILES				
Chelodina longicollis	Eastern Long-necked Tortoise	P		Seen
Eulamprus quoyii	Eastern Water-skink	P		Seen
Lampropholis delicata	Dark-flecked Garden Sunskink	P		Seen
Lampropholis guichenotti	Pale-flecked Garden Sun-skink	P		Seen
Pseudechis porphyriacus	Red-bellied Black Snake	P		Seen

Scientific Name	Common Name	NSW Status	Federal Status	Observation Type
Fish				
Gambusia holbrookii	Plague minnow			Seen
Cyprinus carpio	Common carp			Seen
Anguilla reinhardtii	Long-finned eel			Seen

* - Exotic

V – Vulnerable under the TSC Act

P – Protected under the NPW Act

U – Unprotected under the NPW Act

Appendix B

Threatened Biota Assessment

Table B.1 Threatened biota known or predicted from the locality, habitat association and likelihood of occurring at the site

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
EECs						
Blue Gum High Forest (EC of the Cumberland Plain)	Blue Gum High Forest (EC of the Cumberland Plain)	EEC	CE	Blue Gum High Forest is a moist, tall open forest community characterised by the canopy species Sydney Blue Gum (*Eucalyptus saligna*) and Blackbutt (*E. pilularis*). Forest Oak (*Allocasuarina torulosa*) and Sydney Red Gum (*Angophora costata*) also often occur. Moisture preferring species such as Lilly pilly (*Acmena smithii*), Sandpaper Fig (*Ficus coronata*), Soft Bracken (*Calochleana dubia*) and Maiden Hair (*Adiantum aethiopicum*) may also occur. Historically restricted to the ridgelines in Sydney's north from Crows Nest to Hornsby, extending west along the ridges between Castle Hill and Eastwood, remaining remnant patches mainly occur in the Hornsby, Ku-ring-gai, and Baulkham Hills LGA's and represent only 4.5% of the original extent of this community (DEC 2007).	Nil. No suitable ridgeline habitat at the site.	Nil.
Cumberland Plain Woodland (EC of the Cumberland Plain) / Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest'	Cumberland Plain Woodland (CPW)	EEC	CEEC	Characterised by canopy species Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*E. tereticornis*), with Narrow-leaved Ironbark (*E. crebra*), Spotted Gum (*Corymbia maculata*) and Thin-leaved Stringybark (*E. eugenoides*) occurring less frequently. The shrub layer is dominated by Blackthorn (*Bursaria spinosa*), and grasses such as Kangaroo Grass (*Themeda australis*) and Weeping Meadow Grass (*Microlaena stipoides var stipoides*). Occurs as remnants scattered widely across the Cumberland Plain (DECCW, 2010b).	**Present.**	Certain. Proposed development will clear portions of this EEC at the site.
Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and	Freshwater wetlands on coastal floodplains	EEC		Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes	Low. Wetlands at the site are artificial features. Suitable	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
South East Corner bioregions				but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Generally occur below 20 m elevation on level areas. They are dominated by herbaceous plants and have very few woody species. The structure and composition of the community varies both spatially and temporally depending on the water regime.	habitat is extensively modified and/or supports other native vegetation types.	
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	River-Flat Eucalypt Forest on Coastal Floodplains	EEC		Occurs on the flats, drainage lines and river terraces of coastal floodplains where flooding is periodic and where soils are generally rich in silt, lack deep humic layers and have little or no saline (salt) influence. It occurs south from Port Stephens in the NSW North Coast, Sydney Basin and South East Corner bioregions.	**Present.**	Certain. Proposed development will clear portions of this EEC at the site.
Shale/Sandstone Transition Forest in the Sydney Basin Bioregion	Shale/Sandstone Transition Forest	EEC	EEC	Shale/Sandstone Transitional forest occurs on the edges of the Cumberland Plain Western Sydney NSW, where clay soils from the shale rock intergrade with soils from sandstone, or where shale caps overlay sandstone. The boundaries are indistinct, with species composition variable depending on the soil influences. Dominant tree species include Forest Red Gum (*Eucalyptus tereticornis)*, Grey Gum (*E. punctata)*, stringybarks (*E. globoidea*, *E. eugenioides*) and ironbarks (*E. fibrosa* and *E. crebra*). Areas with a low sandstone influence have an understorey that is closer to Cumberland Plain Woodland. 9,950 ha of this community remain intact with the majority occurring in the Hawkesbury, Baulkham Hills, Liverpool, Parramatta, Penrith, Campbelltown and Wollondilly LGA's.	Low. No suitable habitat within the site.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	Swamp oak floodplain forest	EEC		This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which Casuarina glauca (swamp oak) is the dominant species northwards from Bermagui. Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees.	Low. Suitable habitat is extensively modified and/or supports other native vegetation types.	Nil.
Sydney Turpentine-Ironbark Forest (EC of the Cumberland Plain)	Sydney Turpentine-Ironbark Forest (EC of the Cumberland Plain)	E	CE	Sydney Turpentine - Ironbark Forest is an open forest occurring on the Cumberland Plain in Western Sydney NSW. Characteristic canopy trees include Turpentine (*Syncarpia glomulifera*), Grey Gum (*Eucalyptus punctata*), Grey Ironbark (*Eucalyptus paniculata*) and Thin-leaved Stringybark (*E. eugenoides*). In areas of high rainfall (over 1050 mm per annum) Sydney Blue Gum (*E. saligna*) is more dominant. The shrub stratum is sparse, containing species such as Sweet Pittosporum (*Pittosporum undulatum*) and Elderberry (*Panax Polyscias sambucifolia*). Remnants mostly occur in the Baulkham Hills, Hawkesbury, Hornsby, Ku-ring-gai, Parramatta, Ryde, Sutherland and Wollondilly LGA's (DEC 2007).	Nil. No suitable ridgeline or sideslope habitat at the site.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Flora						
Acacia bynoeana	Bynoe's Wattle	E	V	This species is endemic to central eastern NSW, and is currently known from only 34 locations, many of which are only 1-5 plants. This species occurs mainly in heath and dry sclerophyll forest on sandy soils, seeming to prefer open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches. This species flowers from September to March, and fruit matures in November (DECCW, 2010b)	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Acacia pubescens	Downy Wattle	V	V	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. Occurs in open woodland and forest, in communities including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland. Flowers from August to October (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Allocasuarina glareicola		E	E	Occurs primarily in Castlereagh woodland in the Richmond area of the Cumberland Plain region of western Sydney, on lateritic soil. It grows in open woodland commonly in association with Eucalyptus parramattensis, E. fibrosa, Angophora bakeri, E. sclerophylla and Melaleuca decora, M. nodosa, Hakea dactyloides, Hakea sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownei, Themeda australis and Xanthorrhoea minor (DECCW 2010).	Low. The species preferred soils and geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Apatophyllum constablei	*Apatophyllum constablei*		E	This species of shrub grows to 0.4 m and occurs in dry sclerophyll forest on sandy and skeletal soils on slopes with a north to north-westerly aspect near cliff bases or just above. It grows in association with *Eucalyptus piperita, E. punctata, E. sparsifolia, Banksia serrata, Acacia linifolia, Cleistochloa rigida,* and *Lomandra obliqua*. This species is only known from four sites, three within Wollemi National Park near Gospers Mountain and Coorongooba Creek, and the other about 2 km from Glen Davis. Flowering occurs from August to January (DECC 2007).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Caladenia tessellata	Thick Lip Spider Orchid or Tessellated Spider Orchid	E	V	Inhabits grassy sclerophyll woodland on clay loam or sandy soils, and low woodland with stony soil. Flowering generally occurs between September and November, however late flowering in September or early October has been recorded in southern populations. This species is known from Sydney (historic records), Wyong, Ulladulla and Braidwood regions in NSW. Kiama and Queanbeyan populations are presumed extinct. Records from the 1930's occur within the Huskisson area (DEC 2010).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Callistemon linearifolius	Netted Bottle Brush	V	-	This species of shrub grows in dry sclerophyll forest on the coast and adjacent ranges of NSW and flowers in spring and summer (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Cynanchum elegans	White-flowering Wax Plant	E	E	This species is a climber or twiner with a highly variable form. It usually occurs on the edge of dry rainforest or littoral rainforest, but also occurs in Coastal Banksia Scrub, open forest and woodland, and Melaleuca scrub (DECCW, 2010b).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Dillwynia tenuifolia		V	V	This species of shrub occurs within scrubby/dry heath areas of Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays, and associated transitional communities including Castlereagh Scribbly Gum Woodland within the western regions of Sydney, predominately the Cumberland Plain as well as the Lower Blue Mountains and north to Yengo. Flowering occurs from August to March, responding to environmental conditions. (DECCW 2010).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Diuris aequalis	Buttercup Doubletail	E	V	Has been recorded in forest, low open woodland with grassy understorey and secondary grasslands on the higher parts of the central and southern tablelands (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Eucalyptus benthamii	Camden White Gum	V	V	This species of tree grows to 40 m and occurs in open forest with deep alluvial sands and a flooding regime that permits seedling establishment on the alluvial flats of the Nepean River and its tributaries including in the Kedumba Valley in the Blue Mountains National Park and Bents Basin State Recreation Area in NSW. It grows in association with *E. crebra, Eucalyptus elata, E. bauerina, E. amplifolia, E. punctata, E. deanei, Angophora subvelutina, Bursaria spinosa, Leptospermum flavescens, Acacia filicifolia* and *Pteridium esculentum* (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V		Occurs only within Western Sydney of NSW in an area bounded by Blacktown, Erskine Park, Londonderry and Windsor. Outlier populations also occur at Kemps Creek and Pitt Town. This species is found growing on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium, typically containing lateritic gravels in association with Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forests. Flowering occurs between July and October, however may occur at other times throughout the year. Birds and bees are thought to pollinate this species. It regenerates solely from seed, and responds well to soils that have been mechanically disturbed (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	The habitat for this species are broad, and are known to occur in areas supporting heath, shrubby woodland and forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks. It has been known to flower over two periods throughout the year, July to December and April to May (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Gyrostemon thesioides		E		Within NSW, has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. The species has not been recorded from the Nepean and Georges Rivers for 90 and 30 years respectively, despite searches. Grows on hillsides and riverbanks and may be restricted to fine sandy soils (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Leucopogon exolasius	Woronora Beard-heath	V	V	Woronora Beard-heath is found along the upper Georges River area and in Heathcote National Park. The plant occurs in woodland on sandstone. Flowering occurs in August and September (DECCW 2010).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Marsdenia viridiflora subsp. viridiflora		EP		A climber with stems to 4m high that grows in vine thickets and open shale woodland. Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Melaleuca biconvexa	Biconvex Paperbark	V	V	This species occurs in damps areas often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. The flowering period for this species is short with flowering taking place over a 3 - 4 week period during September and October. This species is conspicuous and could be easily identified outside the flowering period. M. biconvexa populations are threatened by land clearing, too frequent fire, alteration to drainage hydrology, increased pollution, and disturbance by stock (DEC 2007).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Melaleuca deanei	Deane's Paperbark	V	V	This species occurs in two distinct areas, in the Ku-ring-gai / Berowra and Holsworthy/Wedderburn areas. There are also more isolated occurrences at Springwood in the Blue Mountains, Wollemi National Park, Yalwal (west of Nowra), and Central Coast (Hawkesbury River) areas. It grows on sandstone and flowers in summer (DECCW, 2010b).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Persoonia bargoensis	Bargo Geebung	E	V	This species of shrub occurs in woodland and dry sclerophyll forest on sandstone and well drained, loamy, gravely soils in the south-west of Sydney. It seems to prefer disturbance areas such as roadsides where more light is available (DECC 2008).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Persoonia hirsuta	Hairy Geebung	E	E	This species is found on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone in the Blue Mountains, Southern Highlands, and Sydney Coastal regions of NSW (DECCW, 2010b).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Persoonia nutans	Nodding Geebung	E	E	Occurs only on aeolian and alluvial sediments in sclerophyll forest and woodland vegetation communities. It is restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south with the largest populations occur in Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland. Flowering occurs Decenber to January, though may flower at any time of the year (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Pimelea curviflora var. curviflora	Pimelea curviflora var. curviflora	V	V	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots. Flowers October to May. Seedlings have been observed following fire (DECC 2008).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Pimelea spicata	Spiked Rice Flower	E	E	This species occurs within undulating substrates derived from Wianamatta Shale on well-structured clay soils, within the Cumberland Plain and Illawarra regions. It is associated with Grey Box (*Eucalyptus moluccana*) and Ironbark (*E. crebra, E. fibrosa*) within the Cumberland Plain, and in Coast Banksia open woodland within the Illawarra regions (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Pomaderris brunnea	Rufous Pomaderris / Brown Pomaderris	V	V	This species of shrub grows in moist woodland and forest communities on clay and alluvial soils of flood plains and creek lines. It occurs in a restricted area near the Nepean and Hawkesbury Rivers in NSW, Walcha on the New England tablelands and in far eastern Gippsland in Victoria. Flowering occurs from September to October (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Pterostylis nigricans	Dark Greenhood	V		Occurs in north-east NSW north from Evans Head. Its preferred habitat is on coastal heathland with *Banksia ericifolia*, and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils (DECC 2008).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Pterostylis saxicola	Sydney Plains Greenhood	E	E	This species of terrestrial orchid occurs in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines within sclerophyll forest or woodland on shale or shale/sandstone transition soils in small isolated pockets from Freemans Reach to Picton in Western Sydney (DECCW, 2010b).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Pultenaea parviflora		E	V	Endemic to the Cumberland Plain, with the core distribution from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. *Eucalyptus fibrosa* is usually the dominant canopy species. *Eucalyptus globoidea*, *E. longifolia, E. parramattensis, E. sclerophylla and E. sideroxylon* may also be present or co-dominant, with Melaleuca decora frequently forming a secondary canopy layer. Associated species may include *Allocasuarina littoralis, Angophora bakeri, Aristida spp. Banksia spinulosa, Cryptandra spp., Daviesia ulicifolia, Entolasia stricta, Hakea sericea, Lissanthe strigosa, Melaleuca nodosa, Ozothamnus diosmifolius* and *Themeda australis*.	Low. The species preferred soils and geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
				The species is often found in association with other threatened species such as *Dillwynia tenuifolia, Dodonaea falcata, Grevillea juniperina, Micromyrtus minutiflora, Persoonia nutans* and *Styphelia laeta*. Pollinators are unknown, and flowering may occur between August and November depending on environmental conditions (DECCW 2010).		
Pultenaea pedunculata	Matted Pea Bush	E	-	This species of prostrate shrub is found on clay or sandy clay soils on Wianamatta Shale, close to localised patches of tertiary alluvium, or on the shale / sandstone interface. In NSW it is represented by three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn (where it is locally abundant). The species occurs in a range of habitats including woodland vegetation, road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Syzygium paniculatum	Magenta Lilly Pilly	V	V	This species is a small to medium rainforest tree, found only in NSW in a narrow linear coast strip from Bulahdelah to Conjola State Forest (DECCW, 2010b).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Thesium australe	Austral Toadflax	V	V	This species is a small straggling herb found in very small populations scattered across eastern NSW. It occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass (*Themeda australis*) (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
FAUNA						
Birds						
Burhinus grallarius	Bush Stone-curlew	E	-	This species inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights, it feed on insects and small vertebrates, such as frogs, lizards and snakes. Nests are on the ground in a scrape or small bare patch (DECCW, 2010b).	Low. Potentially suitable habitat at the site but probably limited by feral predators.	Low.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	This species is nomadic, spending summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests and winter at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.
Glossopsitta pusilla	Little Lorikeet	V		Distributed in dry, open eucalypt forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. They feed primarily on nectar and pollen of profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands White Box Eucalyptus albens and Yellow Box E. meliodora are particularly important food sources for pollen and nectar respectively. Nest hollows have small openings (approximately 3cm diameter) and are mostly found in living, smooth-barked eucalypts, especially Manna Gum Eucalyptus viminalis, Blakely's Red Gum E. blakelyi	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
				and Tumbledown Gum E. dealbata (DECCW 2010).		
Lathamus discolor	Swift Parrot	E	E	This species is migratory, travelling to the mainland from March to October to forage on winter flowering eucalypts and lerps. While on the mainland, it mostly occurs in the southeast, with records of the species spread approximately between Adelaide and Brisbane. Breeding takes place in Tasmania from September to January (DECCW, 2010b)	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.
Ninox connivens	Barking Owl	V		Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or in dense clumps of canopy leaves in large eucalypts. The Barking owl feeds on a variety of prey, with invertebrates predominant for most pf the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits important during breeding. This species lives alone or in a pair with territories ranging from 30 to 200 hectares. Nests are built in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camandulensis*), White Box (*Eucalyptus albens*), Red Box (*Eucalyptus polyanthemos*), and Blakely's Red Gum (*Eucalyptus blakelyi*)(DECCW 2010).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Ninox strenua	Powerful Owl	V		This species is a nocturnal, solitary and sedentary species. They occur in a number of vegetation types ranging from woodland and open sclerophyll forest to tall open wet forest and rainforest. However, this species does prefer large tracts of vegetation. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old with breeding taking place from late summer to late autumn. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400 - 1,450 ha. It forages within open and closed woodlands as well as open areas (DECCW, 2010b). This Owl has a variety of vocal calls and is known to 'dawn call' when returning from its night hunting activities to mark the position of its daytime roost (Parks Victoria 2003).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.
Lophoictinia isura	Square-tailed Kite	V		Although this species shows a preference for timbered watercourses, they have been found in a variety of habitats including woodlands and open forests. It appears to occupy large hunting grounds and breeds from July - February with nests generally located along of near watercourses. It is a solitary bird, and a specialised predator, taking small passerines, especially honeyeaters and their eggs and nestlings as well as large insects in the tree canopy. It generally hunts low over open forest, woodlands and mallee communities, heaths, and other low scrubby habitats that are rich in passerines. This species prefers a structurally diverse landscape with a broad range of habitats and appears to utilise a large range greater than 100 km2 (DECCW 2010).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Melithreptus gularis gularis)	Black-chinned Honeyeater	V		Occupies mostly upper levels of drier open forest or woodlands dominated by Box and Ironbark eucalypts, as well as open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. This species usually occurs in pairs or is nomadic. It forages along twigs, branches, and trunks probing for insects. Nectar is taken from flowers and honeydew is gleaned from foliage. The Black-chinned Honeyeater nests high in the crown of a tree in the uppermost lateral branches (DECCW 2010).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.
Pyrrholaemus saggitatus	Speckled Warbler	V		Occurs in a range of Eucalyptus dominated communities that have a grassy understorey with a sparse shrub layer and open canopy, often in gullies or on rocky ridges. The species requires large, relatively undisturbed remnants in order to persist in an area. Its diet consists mainly of seeds and insects (DECCW 2010).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.
Rostratula benghalensis	Painted Snipe (was Australian Painted Snipe)	E	V, M	This bird is a wetland species with a scattered distribution in Australia. It occurs primarily along the east coast from north QLD to the Eyre Peninsular in SA excluding the majority of Victoria and NSW. This species is normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. This cryptic species nests on the ground amongst tall reed-like vegetation near water. It emerges from the dense growth at dusk to feed on mudflats and the water's edge taking insects, worm and seeds (DECCW, 2010b). This species prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Low. Wetlands in the study area are probably too small and degraded to support the species.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Tyto novaehollandiae	Masked Owl	V		This species occurs in dry eucalypt woodlands at altitudes from sea level to 1100 m and roosts and breeds in hollows and sometime caves in moist eucalypt forested gullies. It hunts along the edges of forests and roadsides and has a home range covering between 500 ha and 1000 ha. Prey for this species are principally terrestrial mammals but arboreal species may also be taken. Masked Owls are sparsely distributed from southern QLD to SA and WA. It has also been recorded on the Nullarbor plain. The southern subspecies occupies a home range of 5 to 10 square km (DEC 2007).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.
Xanthomyza phrygia	Regent Honeyeater	E	E	This species is a semi-nomadic species that inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak where there are significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Fish						
Macquaria australasica	Macquarie Perch	V	E	This species of freshwater fish inhabits river and lake habitats, especially the upper reaches of rivers and their tributaries. Spawning occurs in spring and summer in shallow upland streams or flowing sections of river systems. This species is found in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas. Threats include the reduction in water quality through agricultural and forestry practises (siltation), changes to river flows and temperatures due to damming and in-stream modifications, cold water release from dams affecting spawning, predation and competition by introduced fish species, over-fishing, and disease (DECCW, 2010b).	Low. Not known from the Georges River catchment (Biosis, 2006).	Nil.
Prototroctes mairaena	Australian Grayling	-	V, M	This species of migratory fish inhabits estuarine waters and coastal seas as larvae/juveniles, and freshwater rivers and streams as adults. It occurs in coastal rivers and streams in South East New South Wales into Victoria and Tasmania. Most of their lives is spent in freshwater rivers and streams in cool, clear waters with a gravel substrate and alternating pool and riffle zones, however can also occur in turbid water. The species can penetrate well inland, being recorded over 100 km inland from the sea. Larvae and juveniles inhabit estuaries and coastal seas, with an apparent obligatory marine stage. Threats include in-stream modifications such as dams and weirs, changes to river flows, reduction of water quality from agricultural and industrial activities, and predation and competition with introduced fish species (DSE 2007).	Low. Aquatic habitat at the site is clay substrate.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Frogs						
Heleioporus australiacus	Giant Burrowing Frog	V	V	This species of frog ranges from south-eastern NSW through to Victoria and appears to exist as two distinct populations: The Northern population occurs on sandy soils supporting heath, woodland or open forest and has a marked preference for sandstone ridge top habitats and broader upland valleys along slow flowing to intermittent creek lines. It requires creeks and watercourses for breeding but spends drier months buried under deep leaf litter or sandy loose soil within vegetated areas. This species has been found occurring at considerable distance from suitable riparian breeding or other moist habitats, indicating an ability to move about freely. This species calls mainly in spring and autumn with calling bouts after rains in late summer (Anstis 2002), although may be sampled at any time of the year providing it is raining (Recsei 1996). Breeding takes place from August to march. It feeds on ground-dwelling invertebrates such as beetles, ants, and spiders (DECCW, 2010b).	Low. The species' preferred soils and geomorphic settings are not present.	Nil.
Litoria littlejohni	Littlejohns Treefrog	V	V	Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops, hunting either in shrubs or on the ground. Breeding is triggered by heavy rain and can occur from late winter to autumn, but is most likely to occur in spring when conditions are favourable. Males call from low vegetation close to slow flowing pools and eggs are laid in loose gelatinous masses attached to small submerged twigs. Eggs and tadpoles are mostly found in slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools (DECCW,	Low. The species' preferred soils and geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
				2010b).		
Litoria aurea	Green and Golden Bell Frog	E	V	This species inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. It prefers sites containing cumbungi (Typha spp.) or spike rushes (Eleocharis spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. They are active by day and breed during the summer months (DECCW, 2010b). Plague Minnow (Gambusia holbrooki) is a key threatening process as they feed on green and Golden Bell Frog eggs and tadpoles.	Low-medium. Suitable habitat for the species at the site, however the species is known from a limited number of populations in the Sydney region.	Low.
Mixophyes balbus	Stuttering Barred Frog	E	V	Occurs along the east coast of Australia. They are found in rainforest and wet, tall, open forest. When not breeding, adults live in deep leaf litter and thick understorey vegetation on the forest floor. This species feeds on insects and smaller frogs, breeding in streams during summer after heavy rain (DEC 2007).	Low. The species' preferred vegetation types and geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Mixophyes iteratus	Giant Barred Frog	E	E	This species occurs on the coast and ranges from southeastern QLD to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. They forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. They breed in shallow, flowing rocky streams from late spring to summer, and feed primarily on large insects and spiders (DEC 2007).	Low. The species' preferred vegetation types and geomorphic settings are not present.	Nil.
Mammals						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	This species is distributed between south-eastern QLD to NSW from the coast to the western slopes of the divide. This species roosts in caves and mines and has been most commonly recorded from dry sclerophyll forests and woodlands. C. dwyeri is an insectivorous species that flies relatively slowly over the canopy or along creek beds (Churchill 1998) (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	This species of carnivorous marsupial is largely nocturnal but opportunistically hunts prey during the day. It inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are found in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		This species of bat inhabits moist forest generally with trees larger than 20 m and roosts in eucalypt hollows, underneath bark or in buildings. Diet consists of moths, beetles and other insects, which it collects within or just below the tree canopy. This species hibernates during winter and breeding takes place in late spring (DECCW, 2010b).	Medium. 'Possible' Anabat recording.	Low. Limited areas of suitable habitat within construction footprint
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		This species has dark reddish-brown to dark brown fur and is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998, DECCW, 2010b). In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within 6 m of the ground. Moths form the major component of their diet and breeding takes place from October to April (Churchill 1998).	**High.** 'Probable' Anabat recording.	Low. Limited areas of suitable habitat within construction footprint.
Mormopterus norfolkensis	Eastern Freetail-bat	V		This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range and roosts primarily in tree hollows but also in man-made structures or under bark. This species is solitary and probably insectivorous (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Myotis adversus	Large-footed Myotis	V		Primarily a coastal species that forages over streams and watercourses feeding on fish and insects, it will occur inland along large river systems. Breeding takes place during November or December, roosting in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage (DECC 2007).	**High.** 'Probable' Anabat recording.	Low. Limited areas of suitable habitat within construction footprint.
Petaurus norfolcensis	Squirrel Glider	V		This species of glider is widely though sparsely distributed throughout eastern Australia. In NSW it inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. This species prefers a diversity of food supplies including acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein, and requires an abundant supply of tree-hollows for nesting and shelter (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.
Phascolarctos cinereus	Koala	V		The Koala is protected under SEPP 44, which aims to conserve habitat within its current distribution. The Koala has a fragmented distribution throughout eastern Australia. It is limited to areas of preferred feed trees in eucalypt woodlands and forests. Along the coastal fringe these areas are becoming more fragmented and isolated due to urbanisation. Koalas are generally inactive for 20 hours a day, with activity peaking just after sunset when they begin to forage (Martin and Handasyde 1995). The size of their home range varies depending on the quality of habitat, ranging from less than 2 ha to several hundred hectares in size. Females breed at two years of age and produce one young per year (DEC 2005).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	This species roosts in camps generally located within 20 km of a regular food source and are commonly found in gullies, close to water and in vegetation with a dense canopy. This species is known to forage in areas supporting subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps on the nectar and pollen of native trees, in particular eucalypts, melaleucas and banksias. Grey-headed Flying-fox show a regular pattern of seasonal movement with much of the population moving to northern NSW and QLD during May and June where they exploit the winter flowering trees such as Swamp Mahogany, Forest red gum and Paperbark (NSW Scientific Committee 2004). This species will also forage in urban gardens and cultivated fruit crops (DECCW, 2010b).	Present. Recorded in Hinchinbrook Creek riparian corridor.	Low. Woodland patches in the disturbance footprint would have little value for the species.
Petrogale pencillata	Brush-tailed Rock-wallaby	E	V	This species of small wallaby occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. In NSW they occur along the whole Eastern section of the State (DECC 2008).	Low. The species' preferred geomorphic settings are not present.	Nil.
Potorous tridactylus	Long-Nosed Potoroo	V	V	This species of small mammal is generally restricted to areas with high annual rainfall, inhabiting coastal heath and dry and wet sclerophyll forests. Its major habitat requirement is relatively thick ground cover with occasional open areas and may consist of grass trees, sedges, ferns or heath, or low shrubs of tea-trees and Melaleucas where soil is light and sandy. It feeds on the fruiting bodies of underground-fruiting fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil. Breeding occurs biannually in late winter / early spring and in late summer, with one young being reared (Johnston 1995). In NSW it is generally restricted to coastal heaths and forests east of the Great	Low. The species' preferred soils, vegetation types and geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
				Dividing Range, with annual rainfall exceeding 760 mm (DECCW, 2010b).		
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	This species is a large and robust bat that feed on slow-flying prey such as large moths and beetles. It hunts from above rows of trees lining creeks and the edges of woodland in otherwise cleared paddocks, roosting in hollow tree trunks and branches as well as the roofs of old buildings (Churchill 1998). It inhabits a variety of habitats ranging from moist and dry eucalypt forest and rainforest to tall wet forest, however tends to prefers moist gullies in mature coastal forest or rainforest from the Atherton Tablelands in north QLD, along the coastal regions to southern NSW. The species is only found at low altitudes (below 500 m) (Churchill 1998; DECCW, 2010b). Reproduction takes place in January at maternal roosting sites (DEC 2005).	**High.** 'Probable' Anabat recording.	Low. Limited areas of suitable habitat within construction footprint
Invertebrates						
Meridolum corneovirens	Cumberland Land Snail	E	-	This species of snail has a 25 - 30 mm diameter shell which may be any shade of brown, is always uniform in colour, and is more flattened and very thin and fragile than the common exotic garden snail. It is found primarily under litter of bark, leaves and logs, or in loose soil around grass clumps within Cumberland Plain Woodland - a grassy, open woodland with occasional dense patches of shrubs. I has also been found under rubbish. It occurs within a small area on the Cumberland Plain, from Richmond and Windsor to Picton and from Liverpool to the Hawkesbury and Nepean Rivers. It feeds on fungus, and does not eat green plants. During periods of drought this species can burrow into the soil to	**High.** Suitable habitat in Shale Plains Woodland in the site.	Low-medium.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
				escape the dry conditions (DECCW, 2010b)		
Reptiles						
Hoplocephalus bungaroides	Broad-Headed Snake	E	V	This species is generally black above with yellow spots forming narrow, irregular cross-bands. The average length is around 60 cm, with a maximum of 150 cm. The Broad-headed snake is nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter, and spring, moving to shelters in hollows of large trees within 200m of escarpments in summer. It feeds mostly on geckos and small skinks, as well as occasionally on frogs and small mammals (DECCW, 2010b).	Low. The species' preferred vegetation types and geomorphic settings are not present.	Nil.

Appendix C

Bridge and Access Road Design Drawings

Appendix D

Assessments of Significance

11.1 7-part Tests

Relevant sections of the EP&A Act lists the seven factors that must be taken into account in the determination of the significance of potential impacts of a proposed development on "threatened species, populations or ecological communities or their habitats" (threatened biota) listed under the TSC Act. The so-called 7-part test is used to determine whether a proposed development is likely to impose a significant effect on threatened biota and thus whether a Species Impact Statement (SIS) is required to accompany the DA. Should the 7-part test conclude that there is likely to be a significant effect on a listed species, population or ecological community, an SIS must be prepared.

7-part tests for threatened biota potentially affected by the development are presented below.

11.1.1 Threatened Ecological Communities

Cumberland Plain Woodland ***Critically Endangered Ecological Community***

Criteria	Cumberland Plain Woodland
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Not applicable to this CEEC.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	Not applicable to this CEEC.
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	The Proposal will reduce the extent of this community by removing or modifying a total of approximately 0.79 ha of native vegetation. The removal of the CPW CEEC includes: an isolated patch of 0.04 ha of Shale Plains Woodland near the edge of the northern basin footprint, and a further 0.75 ha of Shale Plains Woodland within the footprint of the bridge and access road within the Hinchinbrook Creek corridor. The distribution of the CEEC within the immediate study area includes: an extensive area within the Hinchinbrook Creek riparian corridor; large, but disjunct patches to the west of the M7; and small fragmented patches within the former Hoxton Park Airport redevelopment area. There is an estimated 1069 ha of Shale Plains Woodland within the locality (radius of 10 km) based on NPWS (2002) mapping. The Proposal would remove approximately 0.07 % of the extent of this vegetation type in the locality. Further, over 550 ha of Shale Hills Woodland and additional areas of modified vegetation would also qualify as part of the local occurrence of the CEEC (NPWS, 2002). The access road footprint comprises a very minor proportion of the extent of CPW within the Hinchinbrook Creek riparian corridor. The extent of CPW would be reduced through the removal of a single strip approximately 20 metres wide. It is likely that sufficient numbers of mature trees and representative species would be retained in the remainder of the corridor to maintain the local occurrence of the CEEC. Ecological functions such as pollination, seed fall, seedling recruitment

Criteria	Cumberland Plain Woodland
	and fauna movement are likely to occur across the gap created by the access road and so the riparian corridor is likely to continue to function as a single, viable patch. The viability of the Hinchinbrook Corridor would be supported by the proposed offset strategy, which would provide for its conservation and management. Therefore the extent of removal of CPW associated with the Proposal would not place the local population at risk of extinction.
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	The Proposal would modify the composition of the CEEC by removing species within the development footprint. It is also likely to modify the composition of retained and regenerating vegetation due to edge effects. Extra light, wind and resultant temperature changes may favour the growth of weeds and or hardier native species along disturbed edges of retained vegetation. The 0.79 ha of vegetation to be removed or modified is highly unlikely to contain an ecologically significant proportion of the local population of any species within the CEEC. No threatened species of plants or less-mobile threatened fauna were recorded in the development footprint. Therefore no species would be expected to become locally extinct and the biodiversity of the CEEC is not expected to be reduced. Overall this would comprise a minor modification and a minor reduction in the overall number of plant species and individuals that contribute to the composition of the CEEC in the locality. Intact vegetation and habitat would be maintained in the immediate vicinity of the access road disturbance footprint and in an extensive riparian corridor. Ecological functions such as pollination, seed fall, seedling recruitment and fauna movement are likely to occur across the gap created by the access road and so the riparian corridor is likely to continue to function as a single, viable patch with species composition more or less equivalent to the current situation. Edge effects are unlikely to significantly change the species composition of the remaining CEEC within the Hinchinbrook Creek corrdidor given the existing levels of disturbance. The proposed offset strategy would support the conservation of retained CPW and would help maintain its species composition through weed management and supplementary planting. Therefore the development is not likely to modify the composition of the EEC such that the local occurrence is likely to be placed at risk of extinction.
d) In relation to the habitat of a threatened species, population or ecological community:	
(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and	The development will remove approximately 0.79 ha of habitat that currently supports vegetation consistent with the CEEC. The remainder of the development footprint contains unsuitable geomorphology or exotic grassland or disturbed cleared land that does not comprise habitat for the CEEC. Removal of habitat includes 0.79 ha of Shale Plains Woodland within the footprint of the access road, including vegetation that is contiguous with a large area of habitat in the Hinchinbrook Creek corridor. The Proposal will remove habitat resources associated with this native vegetation, including mature trees, woody debris, topsoil and leaf litter. Provided recommended impact mitigation measures are adopted the Proposal is highly unlikely to significantly modify any habitat for the CEEC outside of construction footprints.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	The removal of a small strip of vegetation through the Hinchinbrook Creek corridor for construction of the access road will create a gap of not more than 20m. Ecological functions such as pollination, seed fall, seedling recruitment and fauna movement are likely to occur across the gap created by the access road. The access road would also provide for movement of many fauna species including vectors for plant propagules. Therefore the riparian corridor is likely to continue to function as a single, viable patch. Habitat for many species representative of the CEEC would also be maintained under the proposed bridge through adjoining

Criteria	Cumberland Plain Woodland
	areas of Alluvial Woodland. Shale Plains Woodland and Alluvial Woodland share many common species (NPWS, 2002) and so no area of habitat would be completely isolated. The overall reduction in habitat connectivity is unlikely to compromise significant fragmentation of habitat for CPW within the Hinchinbrook Creek corridor.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	The 0.79 ha of Shale Plains Woodland within the Hinchinbrook Creek corridor is contiguous with a large area of habitat. This corridor would have considerable value for local populations given the overall patch size and habitat connectivity. A 0.79 ha reduction in the extent of habitat available within the Hinchinbrook Creek corridor is unlikely to significantly affect the long-term survival of the CPW CEEC in the locality. Overall the Proposal would remove approximately 0.07 % of the extent of Shale Plains Woodland mapped by NPWS (2002) in the locality. Further, over 1000 ha of Shale Hills Woodland and areas of modified vegetation would also qualify as part of the local occurrence of the CEEC (NPWS, 2002).
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	There is no recommended or declared critical habitat of relevance to this assessment (DECCW, 2009e, DPI, 2009b).
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.	There is no specific recovery plan for CPW. The CEEC is included in the DECCW (2009) *Draft Recovery Plan for the Cumberland Plain*. The Draft Plan outlines four specific recovery objectives. These recovery objectives, and their application to the proposal area as follows (DECCW, 2009): 1. *To build a protected area network, comprising public and private lands, focused on the identified priority conservation lands* – The Proposal is consistent with this objective in terms of the Proposal design and offsets strategy, which conserves the majority of land in the Hinchinbrook Creek riparian corridor. The majority of vegetation removal arising from the Proposal is within areas mapped as 'other native vegetation' by NPWS (2002) and is located outside of identified priority conservation lands. 2. *To deliver best practice management to remnant bushland across the Cumberland Plain on priority conservation lands and public lands where the primary management objectives are compatible with biodiversity conservation* - The Proposal is consistent with this objective in terms of the Proposal design and offsets strategy. 3. *To develop an understanding and enhanced awareness in the community of the Cumberland Plain's threatened biodiversity, the best practice standards for its management, and the proposed recovery program* - The Proposal is consistent with this objective in terms of the Proposal design and offsets strategy and with the environmental assessment and consideration of threatened biota of the Cumberland Plain presented in this report. 4. *To increase knowledge of the threats to the survival of the Cumberland Plain's threatened biodiversity, and thereby improve capacity to manage these in a strategic and effective manner* - The Proposal is consistent with this objective in terms of the Proposal design and offsets strategy and with the environmental assessment and consideration of threatened biota of the Cumberland Plain presented in this report.
g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The Proposal would contribute to the operation of the following Key Threatening Processes (KTPs) of relevance to CPW: ◗ Clearing of native vegetation; and ◗ Removal of dead wood and dead trees.

Criteria	Cumberland Plain Woodland
	The proposed pre clearing surveys and salvage of woody debris would partially mitigate against the operation of these KTPS. The following KTPs may also be of relevance to the Proposal: ◗ Invasion of native plant communities by exotic perennial grasses; and ◗ Invasion and establishment of exotic vines and scramblers. Protocols for the management of soil and surface water shall be included in the CEMP for the proposed construction and would mitigate against the operation of these KTPs.
Conclusion of Assessment of Significance	The Proposal will remove or modify a total of approximately 0.79 ha of Shale Plains Woodland within the footprint of the bridge and access road. This is a minor proportion of the local population of the CEEC, which includes: an extensive area within the Hinchinbrook Creek riparian corridor; large, but disjunct patches to the west of the M7; and small fragmented patches within the former Hoxton Park Airport redevelopment area. The access road footprint would affect a viable patch of CPW within the Hinchinbrook Creek riparian corridor, but would remove a very minor portion of its overall extent. Ecological functions such as pollination, seed fall, seedling recruitment and fauna movement are likely to occur across the gap created by the access road and so the riparian corridor is likely to continue to function as a single, viable patch. The viability of the Hinchinbrook Creek Corridor would be supported through the proposed offset strategy, which would provide for its conservation and management. Therefore the Proposal is not likely to have a significant negative effect on the local population of CPW.

River Flat Eucalypt Forest

Criteria	River Flat Eucalypt Forest
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Not applicable to this EEC.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	Not applicable to this EEC.

Criteria	River Flat Eucalypt Forest
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	The Proposal will reduce the extent of this community by removing or modifying approximately 0.79 ha within the footprint for the proposed bridge and access road. Based on NPWS (2002) vegetation mapping this is approximately 0.008 % of the extent of this vegetation community in the locality. The local population occupies an extensive area within the Hinchinbrook Creek riparian corridor. The access road footprint comprises a very minor proportion of this extent that would not place the local occurrence of the community at risk of extinction.
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	The Proposal would modify the composition of the EEC by removing species within the development footprint. It is also likely to modify the composition of retained and regenerating vegetation in close proximity to the access road due to edge effects. Extra light, wind and resultant temperature changes may favour the growth of weeds and or hardier native species along newly created edges. A thin riparian strip would be retained beneath the proposed bridge that would contain a proportion of the species within the disturbance footprint. This area would be permanently modified through the removal of mature trees and through increased shading and rainfall interception which may modify the species composition of this habitat. Vegetation in this area is closed forest and so understorey species are adapted to low light levels and to competition for moisture with mature trees. A proportion of indigenous understorey plant species would readily persist in the environment beneath the bridge. The majority of native fauna species within the EEC are also likely to persist in this shaded environment. Intact vegetation and habitat would be maintained in the immediate vicinity of the disturbance footprint and in an extensive riparian corridor. Overall the clearing, shading and edge effects would comprise a minor modification and a minor reduction in the overall number of plant species and individuals that contribute to the composition of the EEC in the locality. The 0.79 ha of vegetation to be removed or modified is highly unlikely to contain an ecologically significant proportion of the local population of any species within the EEC such that the species composition of the EEC as a whole would change. Therefore the development is not likely to modify the composition of the EEC such that the local occurrence is likely to be placed at risk of extinction.
d) In relation to the habitat of a threatened species, population or ecological community:	
(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and	The development will permanently remove or modify 0.79 ha of habitat for the EEC in existing patches of Alluvial Woodland within the footprint for the proposed access road and bridge. The majority of this area would be permanently removed and replaced with infrastructure. The creek channel and banks beneath the bridge would be retained. This area would be permanently modified through the removal of mature trees and through increased shading and rainfall interception. As stated in *Part c)* this is likely to comprise a minor modification to the species composition of the EEC. Standard environmental management measures are likely to avoid any substantial impacts on the EEC outside the immediate construction footprint.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	The proposed access road would have an impact on the integrity of habitat for the EEC by removing an area of habitat and by creating a direct obstacle to movement of some less mobile or larger (eg macropods) fauna species. The magnitude of such impacts would not completely compromise existing connectivity of habitat for the EEC. The access road would be a standard two-lane single carriageway and native woody vegetation would be maintained adjacent to the road corridor. The gap thus created would be under 20 m wide. Ecological processes of plant populations, such as pollination, seed dispersal and recruitment, would be maintained across this gap. The proposed bridge design should ensure that fauna passage is not interrupted within the immediate riparian zone. The majority of fauna species would readily traverse the access road via aerial habitat or the creek line beneath the bridge.

Criteria	River Flat Eucalypt Forest
	Therefore the proposed access road would create a partial barrier to fauna movement through the Hinchinbrook Creek riparian corridor but would not fragment or isolate any areas of habitat.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	The habitat to be removed or modified is very limited in extent (0.79 ha, approximately 0.008 % of the extent of this vegetation community in the locality, with a maximum width less than 20 m) and would have relatively minor value to populations of species within the EEC. An extensive continuous patch of the EEC would be retained along Hinchinbrook Creek. Overall these effects on habitat for the EEC are relatively minor and unlikely to cause the community to decline.
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	There is no recommended or declared critical habitat of relevance to this assessment (DECCW, 2009e, DPI, 2009b).
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.	The DECCW has not prepared a recovery plan for River Flat Eucalypt Forest or a threat abatement plan for KTP's of particular relevance to this community. The EEC is included in the DECCW (2009) *Draft Recovery Plan for the Cumberland Plain*. The Draft Plan outlines four specific recovery objectives. These recovery objectives and their application to the Proposal are assessed above in the 7-part test for CPW. The outcome of this assessment is that the broader Proposal, incorporating design and the offsets strategy, is consistent with these strategies. The DECCW has identified a number of recovery strategies for the EEC which are primarily concerned with research, habitat assessment, stakeholder communication and awareness and management of weeds and fire. The construction phase of the Proposal is inconsistent with these strategies since it involves direct removal and modifiifcation of a portion of the EEC. The proposed offset strategy, including the conservation of a vegetated riparian corridor and management of environmental weeds is generally consistent with the objectives of these recovery strategies.
g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The development would contribute to the operation of the following Key Threatening Processes (KTPs) of relevance to River Flat Eucalypt Forest: ◗ Clearing of native vegetation; and ◗ Removal of dead wood and dead trees. The proposed pre clearing surveys and salvage of woody debris would partially mitigate against the operation of these KTPS. The following KTPs may also be of relevance to the Proposal: ◗ Invasion of native plant communities by exotic perennial grasses; and ◗ Invasion and establishment of exotic vines and scramblers. ◗ Protocols for the management of soil and surface water will be included in the CEMP for the proposed construction and would mitigate against the operation of these KTPs.
Conclusion of Assessment of Significance	The Proposal would remove or modify a very small proportion of the local occurrence of the EEC (0.79 ha, with a maximum disturbance footprint width of less than 20 m comprising approximately 0.008% of its extent in the locality). The habitat directly affected would have relatively minor value to populations of species within the EEC. Standard environmental management measures are likely to avoid any impacts on the EEC outside the immediate construction footpint. An extensive continuous patch of the EEC would be retained along Hinchinbrook Creek. This area of retained habitat is likely to be sufficient to maintain local populations of the vegetation community and species that comprise the EEC. The Proposal would not significantly affect the continuity of the EEC, disrupt any ecological processes or isolate any areas of habitat. Therefore the Proposal is not likely to have a significant impact on the local occurrence of River Flat Eucalypt Forest.

11.1.2Fauna

Threatened Microbats

Criteria	Eastern Bent-wing Bat	Large Footed Myotis	Greater Broad-nosed Bat
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Critical features in the life cycle of microbats include: maintenance of viable local population sizes; availability of diurnal roost sites, maternity roost sites and hibernation sites; availability of foraging resources; and connectivity of suitable habitat resources. The development would have an impact on this species through removal of potential roosting and foraging habitat within the development footprint. The proposed habitat removal would have a minor effect on the availability of resources for the species in the locality and would not significantly affect connectivity of habitat (see part d). The proposed development may also disturb some individuals through increased light, noise and traffic. However these impacts are likely to be minor in the context of existing disturbance at the site, including the adjacent M7 motorway. Based on the above considerations the development is unlikely to have an adverse effect on the life cycle of the Eastern Bent-wing Bat such that a viable local population of the species is likely to be placed at risk of extinction.	Critical features in the life cycle of microbats include: maintenance of viable local population sizes; availability of diurnal roost sites, maternity roost sites and hibernation sites; availability of foraging resources; and connectivity of suitable habitat resources. The Project is unlikely to impact on foraging resources for this species, however the clearance of native vegetation may have a minor impact on the availability of roosting habitat for this species (part d). The construction of the bridge spanning Hinchinbrook creek may provide additional roosting habitat in the longer term. The proposed development may also disturb some individuals through increased light, noise and traffic. However these impacts are likely to be minor in the context of existing disturbance at the site, including the adjacent M7 motorway. Based on the above considerations the development is unlikely to have an adverse effect on the life cycle of the Large Footed Myotis such that a viable local population of the species is likely to be placed at risk of extinction.	Critical features in the life cycle of microbats include: maintenance of viable local population sizes; availability of diurnal roost sites, maternity roost sites and hibernation sites; availability of foraging resources; and connectivity of suitable habitat resources. The clearance of native vegetation would remove potential roosting and foraging habitat for this species. This habitat removal would have a minor effect on the availability of resources for the species in the locality and would not significantly affect connectivity of habitat (see part d). The proposed development may also disturb some individuals through increased light, noise and traffic. However these impacts are likely to be minor in the context of existing disturbance at the site, including the adjacent M7 motorway. Based on the above considerations the development is unlikely to have an adverse effect on the life cycle of the Greater Broad-nosed Bat such that a viable local population of the species is likely to be placed at risk of extinction.

Criteria	Eastern Bent-wing Bat	Large Footed Myotis	Greater Broad-nosed Bat
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.		Not applicable to these threatened fauna species.	
d) In relation to the habitat of a threatened species, population or ecological community:			
(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and	The Eastern Bentwing Bat is essentially a cave-roosting bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other similar structures. It forages for flying insects above the tree canopy of well-timbered areas (DECCW 2010b). The project will remove foraging habitat for this species by removing 0.87 ha of native woodland vegetation. The loss or modification of habitat would force local populations to modify their foraging behaviour to exploit alternative resources. This may increase energy costs of foraging for some individuals. Based on available NPWS (2002) mapping the Proposal would remove less than 0.05 % of the overall extent of equivalent native woodland and forest vegetation communities in the locality. The remainder of the development footprint is derived grassland or disturbed cleared land. Microbats may forage in aerial habitat above cleared land, particularly where it adjoins native	The Large-footed Myotis generally roosts in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges or even dense foliage in the tropical part of its range (Strahan 1995). It forages over streams and pools, catching insects and small fish by raking its feet across the water surface (DECCW 2010b). The Proposal will remove potential roosting habitat for this species in 0.87ha of native woodland, containing one hollow-bearing tree. Based on available NPWS (2002) mapping the Proposal would remove less than 0.05 % of the overall extent of equivalent native woodland and forest vegetation communities in the locality. The construction of the bridge spanning Hinchinbrook creek may provide additional roosting habitat in the longer term. Provided recommended impact mitigation measures are adopted the Proposal is highly	The Greater Broadnosed bat feeds on slow-flying prey such as large moths and beetles. It hunts from above rows of trees lining creeks and the edges of woodland in otherwise cleared paddocks, roosting in hollow tree trunks and branches as well as the roofs of old buildings (Churchill 1998). The project will remove roosting and foraging habitat for this species by removing 0.87 ha of native woodland vegetation, containing 2 hollow bearing trees. The loss or modification of habitat would force local populations to modify their foraging behaviour to exploit alternative resources. This may increase energy costs of foraging for some individuals. Based on available NPWS (2002) mapping the Proposal would remove less than 0.05 % of the overall extent of equivalent native woodland and forest vegetation communities in the locality. The remainder of the development footprint is

Criteria	Eastern Bent-wing Bat	Large Footed Myotis	Greater Broad-nosed Bat
	vegetation. The post-development footprint would contain equivalent aerial foraging habitat to the current situation. The project will also remove or modify a small number of man-made structures such as drain culverts, which represent potential roosting habitat for this species. Provided recommended impact mitigation measures are adopted the Proposal is highly unlikely to significantly modify any habitat for the species outside of construction footprints.	unlikely to significantly modify any habitat for the species outside of construction footprints.	exotic grassland or disturbed cleared land. Microbats may forage in aerial habitat above cleared land, particularly where it adjoins native vegetation. The post-development footprint would contain equivalent aerial foraging habitat to the current situation. Provided recommended impact mitigation measures are adopted the Proposal is highly unlikely to significantly modify any habitat for the species outside of construction footprints.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	The proposed action is unlikely to significantly increase habitat fragmentation or isolation in the area. The removal of small strips of vegetation through the Hinchinbrook Creek corridor for construction of the access road and spillway will create gaps of not more than 20m, which would be readily traversed by these highly mobile species.		
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	The home ranges of micro-bats vary with species, habitat type, age, sex and season. Some species will traverse tens of kilometres in a night or hundreds of kilometres to form seasonal breeding aggregations (Churchill, 1998; DECCW, 2009b). A detailed assessment of these factors is beyond the scope of this EIA, however it is possible to conclude that the removal of 0.87 ha of native vegetation is unlikely to represent a significant loss of habitat resources for the Eastern Bent-wing Bat in the locality. Retained native vegetation in the Hinchinbrook creek corridor and elsewhere in the locality is likely to provide sufficient alternative foraging resources to maintain the viability of local populations of the species. Potential roosting habitat for the species in man-made structures	The home ranges of micro-bats vary with species, habitat type, age, sex and season. Some species will traverse tens of kilometres in a night or hundreds of kilometres to form seasonal breeding aggregations (Churchill, 1998; DECCW, 2009b). A detailed assessment of these factors is beyond the scope of this EIA, however it is possible to conclude that the removal of 0.87 ha of native vegetation is unlikely to represent a significant loss of habitat resources for mobile fauna such as micro-bats. There are extensive areas of equivalent habitat in the locality including within the Hinchinbrook Creek riparian corridor that is likely to provide sufficient alternative habitat resources within the home ranges of the majority of both individuals and species. The proposed bridge may also provide suitable alternative roosting habitat for these species.	

Criteria	Eastern Bent-wing Bat	Large Footed Myotis	Greater Broad-nosed Bat
	such as drain culverts would have relatively minor importance as similar structures are common throughout the rest of the former Hoxton Park Airport site and in the immediate surrounds. Notably, culverts, bridges and overpasses associated with the M7 and Cowpasture Road provide alternative resources. The proposed bridge may also provide suitable alternative roosting habitat for the species.		
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	There is no recommended or declared critical habitat of relevance to this assessment (DECCW, 2009e, DPI, 2009b).		
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.	No recovery plan has been prepared for this species. The DECCW has identified a number of recovery strategies for the Eastern Bent-wing Bat which are primarily concerned with research, stakeholder awareness and the identification and protection of important habitat resources, particularly maternity roost caves. The construction phase of the Proposal is inconsistent with these strategies since it involves the removal of native vegetation which represents foraging habitat for this species. The proposed offset strategy, including the conservation of a vegetated riparian corridor is generally consistent with the objectives of these recovery strategies.	No recovery plans have been prepared for these species. The DECCW has identified a number of recovery strategies for these microbats which are primarily concerned with research and the identification, protection and promotion of important habitat resources such as hollow bearing trees and water bodies. The construction phase of the Proposal is inconsistent with these strategies since it involves the removal of native vegetation which may include both roosting and foraging habitat for these species. The proposed offset strategy, including the conservation of a vegetated riparian corridor is generally consistent with the objectives of these recovery strategies.	

Criteria	Eastern Bent-wing Bat	Large Footed Myotis	Greater Broad-nosed Bat
g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	Relevant key threatening processes listed by the NSW Scientific Committee under Schedule 3 of the TSC Act for this species include 'Clearing of native vegetation'. The development will contribute to the operation of this KTP through the removal of approximately 0.87 ha of native woodland vegetation. This is likely to have a relatively minor effect on local populations (see section d). On the basis of the above, the proposed development is unlikely to greatly increase the operation of KTPs on the Eastern Bentwing-bat at this locality. Other threats to the Eastern Bentwing-bat include damage to or disturbance of roosting and maternity caves; loss of foraging habitat; application of pesticides in or adjacent to foraging areas; and predation by feral cats and foxes (DECCW 2010b). The Proposal would not affect any maternity roost sites or otherwise affect the operation of these additional threats.	Relevant key threatening processes listed by the NSW Scientific Committee under Schedule 3 of the TSC Act for this species include 'Loss of hollow-bearing trees' and 'Clearing of native vegetation'. The development will contribute to the operation of this KTP through the removal of approximately 0.87 ha of native woodland vegetation containing one hollow-bearing tree. This is likely to have a relatively minor effect on local populations (see section d). On the basis of the above, the proposed development is unlikely to greatly increase the operation of KTPs on the Large-footed Myotis at this locality. Current threats to the Large Footed Myotis include the reduction in stream water quality affecting food resources; loss or disturbance of roosting sites; clearing adjacent to foraging areas; and application of pesticides in or adjacent to foraging areas (DECCW 2010b). The Proposal would, in general, help to maintain water quality in the locality through detention and attenuation of stormwater flows. The proposed bridge design and standard CEMP measures should mitigate against surface water impacts in the construction phase of the Proposal.	Current threats to the Greater Broad-nosed Bat include disturbance to roosting and summer breeding sites; clearing of foraging habitats; loss of hollow-bearing trees; application of pesticides in or adjacent to foraging areas and waterways; and changes to water regimes (DECCW 2010b). Relevant key threatening processes listed by the NSW Scientific Committee under Schedule 3 of the TSC Act for this species include 'Loss of hollow-bearing trees' and 'Clearing of native vegetation'. The development will contribute to the operation of this KTP through the removal of approximately 0.87 ha of native woodland vegetation containing one hollow-bearing tree. This is likely to have a relatively minor effect on local populations (see section d). On the basis of the above, the proposed development is unlikely to greatly increase the operation of KTPs on the Greater Broad-nosed Bat at this locality.
Conclusion of Assessment of Significance	The development would have an impact on these species through removal of potential roosting and foraging habitat within the development footprint. The proposed habitat removal would have a minor effect on the availability of habitat resources and would not isolate any habitat within the likely home ranges of these highly mobile species. The proposed development may also disturb some individuals through increased light, noise and traffic. However these impacts are likely to be minor in the context of existing disturbance at the site, including the adjacent M7 motorway. Based on the above considerations the development is not likely to have a significant negative effect on local populations of the Eastern Bent-wing Bat, Large-footed Myotis or Greater Broad-nosed Bat.		

11.1.3Grey-headed Flying Fox

Criteria	Grey-headed Flying Fox
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	The Grey-headed Flying Fox occupies roosting camps of up to tens of thousands of animals, which are used for mating, birth and the rearing of young. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Site fidelity to camps is high with some camps being used for over a century (DECCW, 2009b). The most important factors in the life cycle of the Grey-headed Flying Fox are a viable population size, the presence of viable roosting camps, availability of foraging habitat and connectivity between roost camps and foraging habitat. No roost camps were recorded at the site and none are known from the locality. The development would be very unlikely to result in injury or mortality of any flying foxes since vegetation clearing would occur in daylight hours. The development would have an impact on the species through removal of foraging habitat in native vegetation within the development footprint. The proposed vegetation removal would have a minor effect on the availability of foraging resources for the species in the locality and would not significantly affect connectivity of habitat (refer part d). Based on the above considerations the development is unlikely to have an adverse effect on the life cycle of the Grey-headed Flying-fox such that a viable local population of the species is likely to be placed at risk of extinction.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	There are no endangered Grey-headed Flying-fox populations listed under the TSC Act.
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed…	Not applicable to this threatened species.
d) In relation to the habitat of a threatened species, population or ecological community:	
(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and	The development will remove approximately 0.87 ha of native woodland and forest, comprising foraging habitat and resting habitat for the species. The remainder of the development footprint is derived grassland or disturbed cleared land that would have negligible value to local populations of the species. The loss or modification of habitat would force local populations to modify their foraging behaviour to exploit alternative resources. This may increase energy costs of foraging for some individuals; however this is likely to be a minor impact, given the mobility of the species and the proximity of a large area of alternative foraging habitat along the Hinchinbrook Creek corridor. Based on available NPWS (2002) mapping the Proposal would remove less than 0.05 % of the overall extent of equivalent native woodland and forest vegetation communities in the locality.

Criteria	Grey-headed Flying Fox
	Provide recommended impact mitigation measures are adopted the Proposal is highly unlikely to significantly modify any habitat for the species outside of construction footprints.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	The removal of small strips of vegetation through the Hinchinbrook Creek corridor for construction of the access road will create gaps of not more than 20m width. This would not compromise significant fragmentation of habitat as the gap thus created would be readily traversed by this highly mobile species.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	Female Grey-headed Flying-foxes are thought to occupy home ranges of up to 30 hectares and males a significantly larger area (Churchill, 1998). The removal of 0.87 ha of foraging habitat within ranges of this size is unlikely to represent a significant loss of habitat resources for any single individual or for local populations as a whole. Based on available NPWS (2002) mapping the Proposal would remove less than 0.05 % of the overall extent of equivalent native woodland and forest vegetation communities in the locality. The habitat resources to be removed or modified are likely to a have a relatively minor value for local populations given the extent and close proximity of the retained habitat along Hinchinbrook Creek and alternative habitat in the locality.
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	There is no recommended or declared critical habitat of relevance to this assessment (DECCW, 2009e, DPI, 2009b).
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.	DECC has prepared a recovery plan (DECC 2008) for Grey-headed Flying-fox which lists 7 objectives for the recovery of this species. The Proposal conflicts with one of these recovery objectives, “To conserve Grey-headed Flying-fox in its existing habitat”, through the removal of foraging habitat for the species. As described in Part d) above, this loss of habitat would have relatively minor effect. The proposed offset strategy is consistent with the objective: “To rehabilitate and restore Grey-headed Flying-fox habitat and populations”. The remainder of the objectives are related to study and education and are not directly related to the Proposal.
g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	A threatening process is defined under the TSC Act as “a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities”. Current threats to the Grey-headed Flying-fox include habitat loss and fragmentation, habitat degradation, road kills, dog attack, fire, logging, Chlamydia disease, severe weather conditions and over-browsing (DECCW, 2009b). Relevant key threatening processes listed by the NSW Scientific Committee under Schedule 3 of the TSC Act for this species include ‘Clearing of native vegetation’. The development will contribute to the operation of this KTP through the removal of approximately 3.71 ha of native woodland vegetation. This is likely to have a relatively minor effect on local populations (see section d). On the basis of the above, the proposed development is unlikely to greatly increase the operation of KTPs on the Grey-headed Flying-fox at this locality.

Criteria	Grey-headed Flying Fox
Conclusion of Assessment of Significance	The development would have an impact on the Grey-headed Flying Fox through removal of foraging habitat potential roosting within the development footprint. The proposed habitat removal would have a minor effect on the availability of habitat within the likely home ranges of the local population of this highly mobile species and would not isolate any areas of habitat or affect any roost camps. The proposed development may also disturb some individuals through increased light, noise and traffic. However these impacts are likely to be minor in the context of existing disturbance at the site, including the adjacent M7 motorway. Based on the above considerations the development is not likely to have a significant negative effect on local populations of the Grey-headed Flying Fox

11.1.4Cumberland Land Snail

Criteria	Cumberland Land Snail
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	DECCW (2010f) provides the following information about the biology and life history of the Cumberland Land Snail. It is hermaphroditic and lays clutches of eggs in moist and dark areas such as under logs. The species probably reproduces year round, where conditions are suitable. It is a fungal feeder and is generally active at night. Nothing is currently known about rates of fecundity, length of life span, dispersal patterns and over what distances individuals can move. Based on the above, potentially significant risks to the life cycle of the species include removal, modification or fragmentation of important areas of habitat or removal of suitable shelter sites. Impacts on habitat are addressed in factor d), and are unlikely to result in any significant effects. The 0.87 ha of woodland and forest within the footprint of the access road includes vegetation which is contiguous with a large area of habitat in the Hinchinbrook Creek corridor. No individuals of the species were recorded in the proposed construction footprint and there are only small amounts of suitable woody debris shelter sites. Cumberland Land Snails may be present, buried in loose soil or leaf litter. The Proposal is unlikely to remove a significant proportion of either individuals or habitat resources due to the limited area directly affected. The remainder of the Hinchinbrook Creek corridor is likely to contain sufficient amounts of both individuals and habitat resources to maintain local populations. The proposed construction would include a pre-clearing survey including salvage of any snails or woody debris in construction footprints and placement in adjacent areas of retained vegetation. This would partially mitigate impacts on local populations. Therefore the proposed action is unlikely to have adverse effect on the life cycle of local population of the species (if any are present).
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	Not applicable to this threatened species.
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed…	Not applicable to this threatened species.
d) In relation to the habitat of a threatened species, population or ecological community:	
(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and	The development will remove approximately 0.87 ha of native woodland and forest that would comprise potentially suitable shelter and foraging habitat for the species. The remainder of the development footprint is derived grassland or disturbed cleared land that does not comprise habitat for local populations of the

Criteria	Cumberland Land Snail
	species. The proposed construction would disturb some important shelter resources associated with woody debris in the disturbance footprint. There is relatively little woody debris in the broader study area and so any to be removed is likely to have considerable value for local populations of the species if they occur. The proposed pre-clearing surveys and retention of woody debris and placement in adjacent areas of intact habitat is likely to mitigate against the removal of these habitat resources. Retained woody debris and mulch generated by clearing are also likely to have habitat value for the species after construction has ceased. Provided recommended impact mitigation measures are adopted the Proposal is highly unlikely to significantly modify any habitat for the species outside of construction footprints.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	The removal of a small strip of vegetation through the Hinchinbrook Creek corridor for construction of the access road will create gaps of not more than 20m. Snails could traverse the road at night, during wet weather, but would experience increased risk of predation or traffic-injury as a result. Habitat for the Cumberland Land-snail would also be maintained under the proposed bridge and so no area of habitat would be completely isolated. The overall reduction in habitat connectivity is unlikely to compromise significant fragmentation of habitat for the species within the Hinchinbrook Creek corridor.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	The 0.87 ha of woodland and forest within the footprint of the access road includes vegetation which is contiguous with a large area of habitat in the Hinchinbrook Creek corridor. This vegetation would have considerable value for local populations given the overall patch size and habitat connectivity. A 0.87 ha reduction in the extent of habitat available within the Hinchinbrook Creek corridor is unlikely to significantly affect the viability of the local population the species.
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	There is no recommended or declared critical habitat of relevance to this assessment (DECCW, 2009e, DPI, 2009b).
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.	There is no recovery plan for the Cumberland Land Snail. The Cumberland Land Snail is included in the DECCW (2009) *Draft Recovery Plan for the Cumberland Plain*. The Draft Plan outlines four specific recovery objectives. These recovery objectives and their application to the Proposal are assessed above in the 7-part test for CPW. The outcome of this assessment is that the broader Proposal, incorporating design and the offsets strategy, is consistent with these strategies. DECCW (2009b) identifies a total of 8 strategies and associated priority actions to help recover this threatened species. These strategies involve community consultation, research and habitat management. Other than through the removal of habitat addressed in factor d) above, the Proposal, including provision of offset habitat is broadly consistent with these strategies or else unrelated.

Criteria	Cumberland Land Snail
g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The development would contribute to the operation of the following Key Threatening Processes (KTPs) of relevance to the Cumberland Land Snail: ◗ Clearing of native vegetation; and ◗ Removal of dead wood and dead trees. The proposed action would directly increase the operation of these KTPs by removing approximately 0.87 ha of native woodland and forest and associated dead wood and trees. The proposed pre-clearing surveys and salvage of woody debris would partially mitigate against the operation of these KTPs.
Conclusion of Assessment of Significance	The development will remove approximately 0.87 ha of native woodland and forest that would comprise potential shelter and foraging habitat for the species. No individuals of the species have been recorded in this habitat, though Cumberland Land Snails may be present, buried in loose soil or leaf litter. The remainder of the development footprint is derived grassland or disturbed cleared land that does not comprise habitat for local populations of the species. The 0.87 ha of woodland and forest within the footprint of the access road includes vegetation which is contiguous with a large area of habitat in the Hinchinbrook Creek corridor. No individuals of the species were recorded in the proposed construction footprint and there are only small amounts of suitable woody debris shelter sites. Cumberland Land Snails may be present, buried in loose soil or leaf litter. The Proposal is unlikely to remove a significant proportion of either individuals or habitat resources due to the limited area directly affected (0.87 ha). The remainder of the Hinchinbrook Creek corridor is likely to contain sufficient amounts of both individuals and habitat resources to maintain local populations. The proposed construction would include a pre-clearing survey including salvage of any snails or woody debris in construction footprints and their placement in adjacent areas of retained vegetation. This would partially mitigate impacts on local populations. Therefore the proposed action is unlikely to have a significant negative effect on the local population of the Cumberland Land Snail.

11.2 EPBC Act Assessment of Significance

11.2.1 Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

Approach

Pursuant to the EPBC Act, an assessment of potential impacts arising from the development on matters of NES must be undertaken. If the assessment concludes that a significant impact is likely then a referral to the Minister of DEWHA must be made. This assessment is provided consistent with *EPBC Act Policy Statement 1.1 - Significant Impact Guidelines Matters of National Environmental Significance* (DEH 2006). The DEH (2006) guidelines require proponents (or their representatives) to perform a 'self-assessment' to decide whether or not the proposed action is likely to have a significant impact on any matters of NES. Where impacts on a matter of NES are likely then an assessment of the significance of those impacts must be performed.

The Proposal would involve the clearing of 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' which is listed as a Critically Endangered Ecological Community under the EPBC Act. The local occurrence of this community is ecologically equivalent to CPW, listed under the TSC Act and so for the purposes of this assessment Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest at the site is also referred to as 'CPW'. However, the criteria for identifying the CEEC differs between the forms listed under the two Acts. Derived Tussock Grassland is consistent with the TSC Act definition of CPW, but does not meet the condition criteria for the EPBC Act definition of CPW (DEWHA, 2010b). Only areas mapped as Shale Plains Woodland at the site qualify as the CEEC listed under the EPBC Act.

The proposed clearing of CPW comprises an impact on a matter of NES. A detailed assessment of the significance of these impacts on CPW is provided below.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

Reduce the extent of an ecological community

The Proposal will reduce the extent of this community by removing or modifying a total of approximately 0.79 ha of Shale Plains Woodland within the footprint of the access road.

The immediate population of the CEEC within the study area includes: an extensive area within the Hinchinbrook Creek riparian corridor; large, but disjunct patches to the west of the M7; and small fragmented patches within the former Hoxton Park Airport redevelopment area. There is an estimated 1060 ha of Shale Plains Woodland within the locality (radius of 10 km) based on NPWS (2002) mapping. The Proposal would remove approximately 0.07 % of the extent of this vegetation type in the locality. Further, over 550 ha of Shale Hills Woodland and a number of shale-sandstone transition vegetation types would also qualify as part of the local occurrence of the CEEC (NPWS, 2002).

The access road footprint comprises a very minor proportion of the extent of CPW within the Hinchinbrook Creek riparian corridor (0.75 ha). The extent of CPW would be reduced through the removal of a single strip approximately 20 metres wide. It is likely that sufficient numbers of mature trees and representative species would be retained in the remainder of the corridor to maintain the local occurrence of the CEEC.

Ecological functions such as pollination, seed fall, seedling recruitment and fauna movement are likely to occur across the gap created by the access road and so the riparian corridor is likely to continue to function as a single, viable patch.

• fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

The removal of a small strip of vegetation through the Hinchinbrook Creek corridor for construction of the access road will create gaps of not more than 20m. Ecological functions such as pollination, seed fall, seedling recruitment and fauna movement are likely to occur across the gap created by the access road and so the riparian corridor is likely to continue to function as a single, viable patch. Habitat for many species representative of the CEEC would also be maintained under the proposed bridge through adjoining areas of Alluvial Woodland. Shale Plains Woodland and Alluvial Woodland share many common species (NPWS, 2002) and so no area of habitat would be completely isolated. The overall reduction in habitat connectivity is unlikely to compromise significant fragmentation of habitat for CPW within the Hinchinbrook Creek corridor.

• adversely affect habitat critical to the survival of an ecological community

The 0.79 ha of Shale Plains Woodland within the Hinchinbrook Creek corridor is contiguous with a large area of habitat. This area does comprise habitat critical to the survival of the CEEC as defined by the DEH (2006) guidelines, both in terms of its condition and integrity and its recognition in Regional biodiversity strategies (EcoLogical, 2003; NPWS, 2002).This corridor vegetation would have considerable value for local populations given the overall patch size and habitat connectivity. A 0.79 ha reduction in the extent of habitat available within the Hinchinbrook Creek corridor is unlikely to significantly affect the long-term survival of the local population of CPW.

• modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

Standard environmental management measures implemented according to the CEMP for the Proposal are likely to mitigate against negative impacts on abiotic factors outside of the immediate surface disturbance footprint.

• • cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

-- assisting invasive species, that are harmful to the listed ecological community, to become established, or

The Proposal would increase the operation of edge effects on remnant native vegetation adjacent to the proposed access road. Construction vehicles and equipment and post-development traffic along the access road may transmit weed propagules into remnant vegetation. Measures recommended in Section 8 should be implemented to minimise the potential for these impacts. The Hinchinbrook Creek riparian corridor is already subject to moderate levels of disturbance and weed infestation and so the magnitude of the increase in weed infestation is likely to be relatively minor.

-- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or

The Proposal does not directly involve production or transport of any fertilisers, herbicides or other chemicals or pollutants. Construction vehicles and equipment would cause a minor localized increase in the risk of hydrocarbon contamination. Standard environmental management measures implemented according to the CEMP for the Proposal are likely to mitigate against negative impacts outside of the immediate surface disturbance footprint.

•--interfere with the recovery of an ecological community.

Based on available NPWS (2002) mapping the Proposal would remove approximately 0.07 % of the extent of this vegetation type in the locality.

The 0.79 ha of Shale Plains Woodland within the footprint of the access road includes vegetation which is contiguous with a large area of habitat in the Hinchinbrook Creek corridor. This vegetation would have considerable value for local populations given the overall patch size and habitat connectivity. A less than 1 ha reduction in the extent of habitat available within the Hinchinbrook Creek corridor is unlikely to significantly affect the long-term survival of the local population of CPW or otherwise interfere with the recovery of the CEEC as a whole.

Conclusion

The Proposal will reduce the extent of this community by removing or modifying a total of approximately 0.79 of Shale Plains Woodland within the footprint of the access road.

This is a minor proportion of the immediate local population of the CEEC in the study area, which includes: an extensive area within the Hinchinbrook Creek riparian corridor; large, but disjunct patches to the west of the M7; and small fragmented patches within the former Hoxton Park Airport redevelopment area. Based on available NPWS (2002) mapping the Proposal would remove approximately 0.07 % of the extent of Shale Plains Woodland in the locality (radius of 10 km), noting that a number of other vegetation types also comprise the local occurrence of the CEEC.

The access road footprint would affect a viable patch of CPW within the Hinchinbrook Creek riparian corridor, but would remove a very minor portion of its overall extent (0.75 ha). Ecological functions such as pollination, seed fall, seedling recruitment and fauna movement are likely to occur across the gap created by the access road and so the riparian corridor is likely to continue to function as a single, viable patch.

Consideration of the above assessment criteria concludes that the development is considered unlikely to have a significant impact on CPW.

Appendix E

Proposed Framework for Vegetation Offsetting

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Mirvac Projects Pty Limited

Proposed Hinchinbrook Creek Link Road / Bridge
Former Hoxton Park Airport Redevelopment

Proposed Framework for Vegetation Offsetting

September 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Background

GHD Pty Ltd (GHD) has been engaged by Mirvac Projects to prepare an offset 'framework' for impacts to vegetation from the proposed access road and bridge to span Hinchinbrook Creek. The Project is within the Liverpool Government Area (LGA). Implementation of the proposed development will impact on 0.87 ha of native woodland communities.

The proposed access road would provide alternate flood free access and egress to the industrial development currently under construction and future proposed residential developments adjoining the site.

The proposed link road/ bridge is to be assessed as a Section 75W Modification to existing Development Consent (DC 10_0007 and 10_0008) obtained under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act). Part 3A provides the assessment and approvals process for major infrastructure projects.

The proposed offset site is located on the eastern side of Hinchinbrook Creek at the northern end of the corridor (as shown in Appendix A). This location will allow this offset to 'build' on the works being undertaken as part of the adjoining industrial development under existing approvals on the western side of Hinchinbrook Creek. Existing approvals include the Vegetation Management Plan (VMP) for the former Hoxton Park Airport Redevelopment (GHD 2007a) and an offsets strategy for employment zoned lands (GHD 2007b). The outcomes of these works will see the western side of the Hinchinbrook Creek corridor restored to 'full functioning' native vegetation.

The previous Offset Strategy prepared by GHD (2007b) did not cover the impacts on native flora and fauna generated by the construction of the access road and bridge across the Hinchinbrook Creek corridor. Therefore, this document provides a summary offset framework for the access road and bridge. This offset framework has been prepared giving due consideration to previous environmental approvals and obligations to ensure integration of the outcomes from all components of the former Hoxton Park Airport redevelopment.

This Summary Offset report will outline the ecological impacts as a consequence of the construction of the access road and bridge and clearly define what biodiversity offsets will be required to mitigate these impacts.

1.2 Site Location

The study area is located within the Hinchinbrook Creek corridor adjoining the former Hoxton Park Airport, in the southwest of Sydney, NSW. The site is located between Hinchinbrook Creek and Cowpasture Road in the northern end of the corridor (see Appendix A).

For the purposes of this report 'the project' refers to the footprint of the proposed access road and bridge, which will run from Cowpasture Road, across Hinchinbrook Creek Corridor to provide access to the development. 'The site' refers to the actual location of the proposed offset site. Refer to Appendix A, Figure 1.

1.3 Objectives

The objectives of the offset framework for the Project are:

- To help mitigate impacts to biodiversity values from the Project.
- To lay the foundations to improve, through time, native vegetation cover in the locality.
- To provide for the future placement of conservation security over retained vegetation and proposed rehabilitated vegetation in the locality.
- Improve connectivity of native vegetation in the locality.
- Invest in improving the condition of retained vegetation.
- Provide the base rehabilitation/revegetation structure that will be implemented as part of this framework.

1.4 Relationship with existing reports

The Summary Offset Strategy has taken into consideration the impacts of the following documentation:

- GHD *Hoxton Park Airport Development Offset Strategy,* October 2007.
- GHD *Hoxton Park Airport Development Vegetation management Plan,* November 2007.
- Biosis Research *Flora and Fauna Assessment of the Stage 1 Subdivision, Hoxton Park Airport*, July 2006.
- GHD *Report for the Hoxton Park Airport Ecology Assessment for Proposed Access Road and Bridge,* September 2010.
- GHD *Vegetation Management Plan for Proposed Access Road and Bridge*, September 2010.

1.5 List of Abbreviations

CEEC	Critically Endangered Ecological Communities
DECCW	NSW Department of Environment, Climate Change and Water
DEWHA	Commonwealth Department of Environment, Water, Heritage and the Arts
DoP	NSW Department of Planning
EEC's	Endangered Ecological Communities
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act, 1999
Ha	Hectares
LCC	Liverpool City Council
LGA	Local Government Area (Liverpool City Council)
TSC Act	NSW Threatened Species Conservation Act, 1995
VMP	Vegetation Management Plan
WMA	Water Management Act 2000

2. Vegetation Offsetting

2.1 Why Offsetting

A history of vegetation clearing throughout NSW has led to the State Government adopting a range of policies and guidelines to help address a decline in biodiversity values and vegetation distribution. Where clearing has occurred, to a level threatening the integrity of entire vegetation communities, or where the landscape is becoming unsustainable due to vegetation decline, a net increase in vegetation cover may be required. Vegetation offsets are an avenue for balancing both economic development and environmental protection.

2.2 Current Framework

The use of offsetting as a mechanism to mitigate impacts of development on natural resources throughout Western Sydney has gained momentum during this decade. In particular, projects such as Second Ponds Creek Residential Development, Erskine Park Release Area and Ropes Crossing have raised the 'benchmark' in terms of determining and implementing suitable offset programs. Traditionally, each was negotiated on a 'case by case' basis between the client, DECCW and relevant local government. DECCW is the lead government agency in negotiating suitable offsets but does not give final approval to such proposals. Approval usually rests with the relevant local government agency through the NSW regulatory planning system administered by the NSW Department of Planning (DoP).

The design and approval of suitable offsets may still be negotiated under the same framework. However, the NSW Government has recognised the need to formalise a process for assessing appropriate offsets and has gazetted the Biobanking (DECC 2006) legislation to guide this process. A framework for the approval and management of Biobanking has been recently established but is a voluntary process. Given the limited area of impact from the proposed access road and bridge, we consider Biobanking scheme is not appropriate for assessing this project.

The Project will be preparing and committing to offset actions that follow the same principals as those previously adopted for the Employment Zone development of the former Hoxton Park area ensuring outcomes are integrated with previous approvals and outcomes.

2.3 Legislation

The following legislation has been considered in determining an appropriate offset framework for the site:

- Threatened Species Conservation Act 1995.
- Water Management Act 2000.
- Environmental Planning and Assessment Act 1979.
- Environment Protection and Biodiversity Conservation Act 1999.
- Offsetting Principles and Guidelines DECC, 2006.
- Biodiversity Banking Scheme DECC, 2006.
- Local Government Act 1993 and Local Government Amendment (Community Land Management) Act 1998.

The above list has been identified as being highly relevant to the offset framework proposed for the Project. However, this list by no means covers all relevant legislation pertaining to the subject site.

3. Proposed Offset Framework

3.1 Summary of Vegetation Impact

The proposed access road passes through the Hinchinbrook Creek riparian corridor. Vegetation within the riparian zone of the creek line is predominately Alluvial Woodland (consistent with the EEC River Flat Eucalypt Forest). These communities grade to Shale Plains Woodland (consistent with the CEEC Cumberland Plain Woodland) outside the riparian zone.

Construction within the development footprints for the access road and bridge requires the clearing or permanent modification of native vegetation as follows.

- Cumberland Plain Woodland - The Proposal will remove or modify approximately 0.79 ha of vegetation consistent with this CEEC as defined under the TSC Act within the footprint of the bridge and access road.
- River Flat Eucalypt Forest - The Proposal would remove or modify a very small proportion of the local population of the RFEF EEC (approximately 0.08 ha, with a maximum disturbance width of less than 20 m).

3.2 Summary Project Offset Framework Actions

The Offset Strategy includes two distinct management actions to mitigate vegetation clearing for the Project, being:

- Rehabilitation of approximately 4.3 ha existing vegetation.
- Revegetation activities as necessary to achieve this target.

Approximate areas of the vegetation impact, offset ratio and offset area to be rehabilitated are outlined in Table 1 below.

Table 1 Former Hoxton Park Airport Proposed Access Road and Bridge Offset Strategy Summary

Vegetation Community	Vegetation Impact	Offset Compensation Ratio	Offset Area
	(ha)	(impact: offset)	(ha)
Shale Plains Woodlands	0.79	1:5	3.9
River Flat Eucalypt Forest	0.08	1:5	0.40
TOTAL	**0.87**		**4.3**

The offset actions have two components, bush regeneration to improve condition of retained remnant vegetation and revegetation to help compensate for vegetation loss and improve connectivity. These activities are proposed to occur in the areas shaded in Appendix A, Figure 1.

The offset site would be located on the eastern side of Hinchinbrook Creek, in the northern or 'upstream' end of the corridor. The approximate size of the area is 4.3 ha. LCC have indicated no additional plantings are to occur in areas indicated as high flood risk (see Appendix A, Figure 2 for flood risk plan of the Hinchinbrook Creek Corridor). This offset will only complete bush regeneration activities in these areas.

The eastern portion of the Hinchinbrook Creek corridor, incorporating the location of the proposed offset site, was surveyed as part of the ecological assessment (GHD 2010b) and previously during the preparation of the Hinchinbrook Creek VMP (GHD 2007a). The corridor is dominated by intact and regenerating native vegetation with 'pockets' of cleared vegetation scattered throughout. The proposed offset site is likely to comprise a suitable biodiversity offset for habitat to be removed within the development footprint, based on the following considerations:

- The presence of appropriate 'like for like' vegetation communities, including Shale Plains Woodland and River Flat Eucalypt Forest.
- The presence of threatened ecological communities comprising intact CPW and RFEF in good condition, with relatively high plant species diversity and minor weed infestation.
- Hollow bearing trees.
- Continuity with existing conservation land to yield a continuous patch of conserved native woodland and riparian forest habitats within a regionally significant habitat corridor.

This land is under the care and control of LCC and access for the purposes of implementing the offset has been granted.

3.2.1 Management

The DECC (2008) offsetting principals require the improvement of condition and biodiversity values at offset sites through ongoing management of the offset area. It is proposed that Mirvac would be responsible for initial establishment and maintenance works for a period of three (3) years. At this time management responsibilities would return to LCC. It is anticipated that funding for on-going management would be included as an agreement between Mirvac & Council.

3.2.2 Titling

The DECC (2008) offsetting principles state that offset areas must be 'enduring' and they must be enforceable; that is, the offset area must be protected in perpetuity by a planning instrument and/or by changes to the title of the property.

In this case the 'offset' will be delivered in open space owned and managed by LCC and zoned for environmental protection.

A detailed works program would be provided to LCC at the appropriate stage.

4. Conclusion

Implementation of the offset actions outlined in this document will help mitigate and offset unavoidable impacts associated with the access road and bridge. The offset framework also considers the outcomes and approach taken in the existing Offset Strategy for the former Hoxton Park Airport Development (GHD 2007b), thereby ensuring the integration of outcomes from this and other environmental approvals (e.g. VMP's).

By targeting the north eastern corner of the corridor, the offset will:

- Effectively mitigate the unavoidable impacts from the proposal.
- Compliment existing works being completed on the western side of Hinchinbrook.
- Increase the size of the contiguous 'patch' of vegetation associated with the Hinchinbrook Creek corridor.
- Follow 'best practice' by starting in the upstream end of the site and utilising rehabilitation and management techniques previously endorsed by DECCW and other industry stakeholders.

The north eastern portion of the Hinchinbrook Creek corridor, incorporating the preferred offset site, was surveyed as part of the ecology assessment via a rapid vegetation and habitat assessment. The area chosen as the preferred offset site is dominated by intact and regenerating native vegetation. The proposed offset site comprises a suitable biodiversity offset for habitat to be removed within the development footprint, based on the following considerations:

- The presence of appropriate 'like for like' vegetation communities, including Shale Plains Woodland and Alluvial Woodland.
- The presence of threatened ecological communities comprising intact Shale Plains Woodland and Alluvial Woodland in good condition, with relatively high plant species diversity and minor weed infestation.
- The ability to improve the condition of aquatic and riparian habitat associated with Hinchinbrook Creek.
- Part of a larger patch size and superior habitat connectivity than the majority of the habitat to be removed within the disturbance footprint.
- Continuity with existing rehabilitation and conservation lands to yield a continuous patch of conserved native woodland and riparian forest habitats within a regionally significant habitat corridor.
- Providing conservation security for the offset site.

Given the above listed considerations, implementation of the proposed offset will achieve, through time, a '*maintain or improve*' outcome for this project. Additionally, this investment will improve the biodiversity values of the immediate area for the local community.

5. References

Biosis Research (2006), *Flora and Fauna Assessment of the Stage 1 Subdivision, Hoxton Park Airport*, July 2006.

Department of Environment, Climate Change and Water (NSW) (2009), *Draft Recovery Plan for the Cumberland Plain*, Sydney.

Department of Environment and Conservation (DEC), *Recovering Bushland - Best Practice Guidelines for Vegetation Restoration on the Cumberland Plain*, 2005.

Department of Environment and Conservation (DEC), *Offsetting Principles Draft Lower Hunter Regional Conservation Plan*, 2006.

Department of Infrastructure Planning and Natural Resources (DIPNR) (2004), *Best Practice Guidelines for Bush Regeneration on the Cumberland Plain*.

GHD (2007a), *Vegetation Management Plan for Hoxton Park Airport*, November 2007;

GHD (2007b), *Offset Strategy Hoxton Park Airport*, October 2007;

GHD (2010a), *Vegetation Management Plan for Proposed Access Road and Bridge*, prepared for Mirvac, September 2010.

GHD (2010b), *Report for the former Hoxton Park Airport Development Ecology Assessment*, prepared for Mirvac, September 2010

Liverpool City Council & EcoLogical (2003), *Liverpool City Council Biodiversity Strategy*.

Appendix A

Maps

Figure 1 Offset Site Location

Figure 2 LCC Flooding Assessment Map

Image from Google Earth

Legend

- Study Area
- Cadastral Boundaries

Vegetation Offset

- Bush Regeneration
- Revegetation

1:2,500 (at A3)

0 10 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

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Mirvac Group Pty Ltd

Former Hoxton Park Airport Development

Job Number 22-14911
Revision A
Date 22 SEP 2010

Vegetation Offset Area

Figure 1

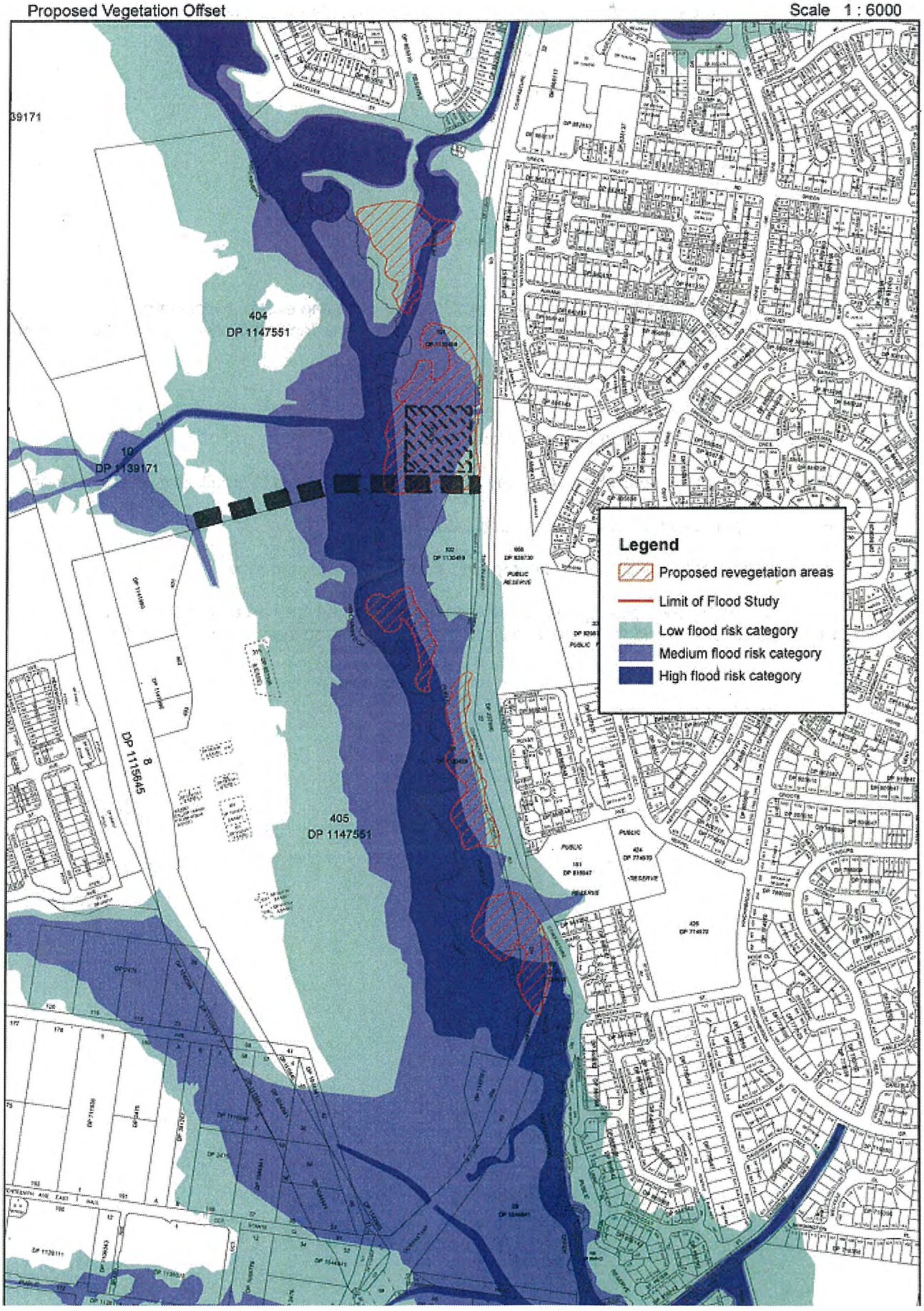
G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z011_Vegetation_Offset_Area.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: DCDB, NSW Dept. of Lands: Cadastre - 19/01/2010; Imagery: Nearmap - 19/01/2010. Created by: qjchung, bahambly, rphamer

Proposed Vegetation Offset

Scale 1 : 6000



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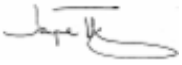
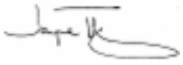
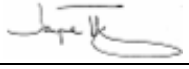
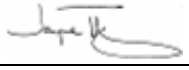
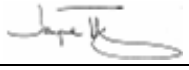
0	B Harrington	J Tipping		J Tipping		29/3/10
1	R Hamer	D Williams	*D Williams*	J Tipping		2/08/10
2	R Hamer	D Williams	*D Williams*	J Tipping		16/09/10
3	R Hamer	D Williams	*D Williams*	J Tipping		22/09/10
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