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Mirvac

Former Hoxton Park Airport Development

Ecological Impact Assessment for Proposed Northern Detention Basin 6

October 2010

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 a detention basin, spillway and outlet ("the northern basin") adjacent to the development at the former Hoxton Park Airport, in Hoxton Park, NSW ('the Project'). The basin will be situated immediately northwest of the former Hoxton Park Airport development site. The spillway will run eastwards from the basin and link up with an existing open channel which discharges to Hinchinbrook Creek.

The northern basin is part of Liverpool City Council's (LCC) detention strategy for Hinchinbrook Creek. This strategy requires the development to have a permanent detention basin to capture and release the water entering the site from the western side of the M7 at the former Hoxton Park Airport site. It will be a regional scale stormwater detention basin designed to significantly attenuate peak storm inflows and thereby reduce flooding in the Cabramatta Creek system downstream to the Georges River.

The northern basin will follow stormwater best management practices (BMPs) by providing general flood protection (such as a 100-year storm event) and protect downstream erosion by storing water for a limited period of a time and slowly releasing it into Hinchinbrook Creek via an existing open channel. The lag time from input to output will eliminate or minimise the effects of excess runoff generated by the newly-constructed impervious surfaces for the development, including roads, driveways, parking lots and rooftops.

Development of 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.

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.

1.1.1 Relationship to Previous Assessments

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.

A separate Section 75W Modification has already been prepared under the existing Development Consents discussed above (DC 10_0007 and 10_0008) for a bridge and access road across Hinchinbrook Creek as described in the GHD (2010b) *Report for the former Hoxton Park Airport Development: Ecological Impact Assessment for Proposed Access Road and Bridge*. This modification is currently under consideration by the NSW Department of Planning.

1.2 Definitions

The Proposal	the development which is to be assessed, comprising the construction of a detention basin, spillway and outlet
The site	the area to be directly affected by the Proposal, incorporating the development footprint for the northern basin (detention basin, spillway and outlet)
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 Proposal 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

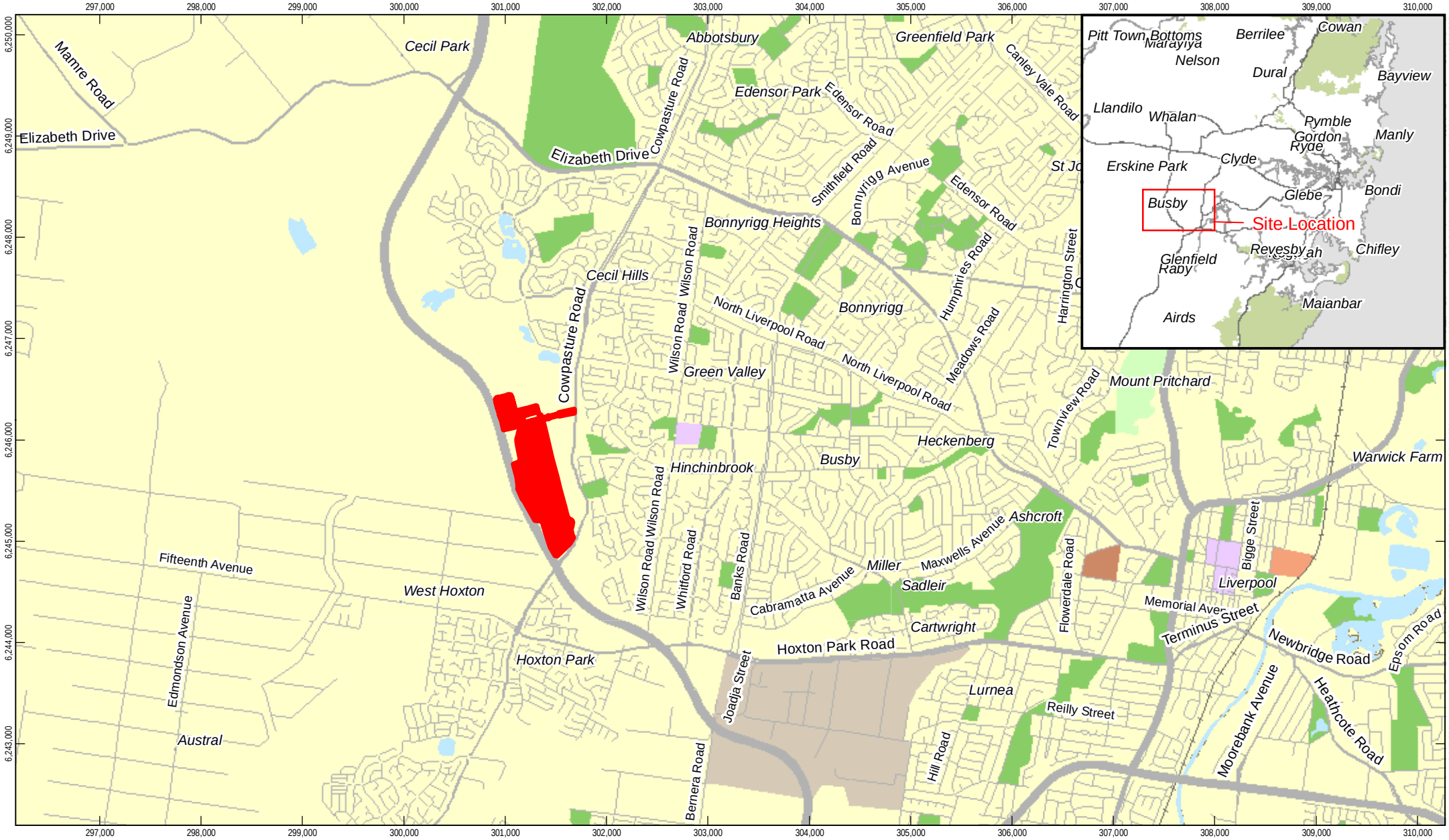
The project is a modification to an existing Major Project Approval and accordingly is subject to the development and assessment processes and requirements of Part 3A of the EP&A Act, with the Minister for Planning as the consent authority. The purpose of this EIA is to assist the Minister to assess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

N

LEGEND

Study Area

GHD

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Mirvac Group Pty Ltd
Hoxton Park Airport Development - EIA for Proposed Northern Basin and Spillway

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

6,245,000

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

M7 Motorway

Hinchinbrook Creek

Cowpasture Road

Image from Google Earth

Legend

- Study Area
- Cadastral Boundaries
- Cleared under previous approvals (Biosis 2006)
- Proposed Northern Basin 6
- Employment Zone Development

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 Northern Basin 6

Job Number 22 - 14911
Revision C
Date 26 OCT 2010

Site Layout

Figure 2

G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z002_Site_Layout1.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

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
- 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
- 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.

This assessment has been prepared with reference to the DEC and DPI (2005) guidelines for development applications assessed under Part 3A of the EP&A Act. These guidelines have been addressed in the current assessment through:

- Desktop and field assessments to determine whether any threatened species, populations or ecological communities listed under the TSC or FM Acts could occur in the study area or be affected by the development
- Assessments of Significance undertaken in accordance with these guidelines for threatened biota which may be directly or indirectly affected by the Proposal, presented in full in Appendix C and summarised in Section 8.3.1 of this report.
- The development of an impact mitigation and offset strategy according to the hierarchy of 'avoid, mitigate and then offset', presented in Section 8
- A discussion of the 4 key threshholds laid out in the guidelines, presented in Section 10

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
- 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
- Assessment of potential impacts on threatened species including Assessments of Significance pursuant to the DEC/DPI (2005) *Guidelines for Threatened Species Assessment* 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
- 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)

As the project is a major project subject to Part 3A of the EP and A Act, State Environmental Planning Policies do not technically apply. Notwithstanding, the general principles of relevant SEPPs have been considered in this assessment.

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”.

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 site for the proposal is located within the Hoxton Park Industrial redevelopment at the former Hoxton Park Airport, in the southwest of Sydney, NSW. The site 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 site 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 site is shown on Figure 2. For the purposes of this report 'the site' refers to the footprint of the proposed basin, spillway and outlet, located to the north and northwest of the employment zone development.

The majority of the site for the 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. The spillway will discharge to an existing open channel in the east of the site and then eastwards to Hinchinbrook Creek via this existing channel. The channel is concrete lined at its upstream (western) end within the former airport and earth-lined through the Hinchinbrook Creek corridor. The channel is vegetated with native wetland plants and environmental weeds. Its immediate banks support regrowth of Swamp Oak (*Casuarina glauca*) adjoining intact native woodland and forest.

To the east of the site is Cowpasture Road and the suburb of Hinchinbrook which predominantly contains low density residential development. A future commercial/retail uses development is located adjoining the basin with a future 200 (approximately) dwellings which are planned for construction further north of the basin. Farther north is the Cecil Hills High School and beyond that the Cecil Hills residential sub-division.

The M7 adjoins the western boundary of the site. 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 site 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 site. Beyond Cowpasture Road is vacant land which is zoned RU1 – Primary Production.

3.2 Geology, Soils and Topography

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

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, which forms part of the wider Georges River catchment further east.

An unnamed drainage line runs through the central portion of the 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 108.5 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 18.1^{o}C in summer down to 5.1^{o}C in winter (Bureau of Meteorology 2010).

4. Methods

4.1 Literature Review

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

- GHD (2010a) *Report for the former Hoxton Park Airport Development: Ecology Assessment*, February 2010
- GHD (2010b) *Report for the former Hoxton Park Airport Development: Ecological Impact Assessment for Proposed Access Road and Bridge,* September 2010
- 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
- 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 within 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
- 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 were conducted for this ecological assessment:

- An initial two-day, one-night survey on 16th-17th December 2009 sampling the proposed locations for the northern basin and access road

- A supplementary three-day, two-night survey on 19th-21st January 2010 sampling the development footprint for an adjoining proposal

With the permission of both proponents the results of both field surveys were combined to describe the study area for the current assessment. Field survey techniques and conditions are described below.

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.

Only one habitat tree suitable for stag-watching was identified within the disturbance footprint. This tree was observed for ½ hour before dusk and one hour after dusk on one night.

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 study area 4 random meander surveys
Threatened flora and incidental flora	Random meander searches	Throughout the entire study area
Riparian Assessments	General assessment of riparian vegetation condition	Along identified watercourses and around dams
Arboreal Birds and Mammals	Habitat tree mapping	Throughout the study area
	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 study area and around identified habitat trees
	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

Target	Survey Technique	Survey Effort
	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 study area 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 study area

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 is 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

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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
- Cadastral Boundaries
- Cleared under previous approvals (Biosis 2006)
- Proposed Northern Basin 6
- Employment Zone Development

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 Northern Basin 6

Job Number	22-14911
Revision	B
Date	26 OCT 2010

Survey Effort

Figure 3

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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

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.

A list of plant species recorded during the field survey 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 at the site is shown on Figure 4.

Areas of intact Shale Plains Woodland are consistent with the definition of the Critically Endangered Ecological Community (CEEC) 'Cumberland Plain Woodland – Endangered Community of the Cumberland Plain' (CPW), which is listed under the NSW TSC Act. The Derived Tussock Grassland comprises low condition CEEC within the TSC Act definition.

Areas of intact Shale Plains Woodland are also consistent with the definition of the CEEC 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' which is listed under the EPBC Act. Under the EPBC Act the CEEC appears to meet the criteria for Category C as defined by the Threatened Species Scientific Committee (DEWHA, 2010b): patch size is greater than 0.5 ha, greater than 30% of the understorey vegetation is native, and the patch is contiguous (i.e. is within 100 m) with a patch to the west that is greater than 5 ha and is likely to be dominated by native species in each structural layer. The patch is separated by greater than 100 m from the CEEC associated with Hinchinbrook Creek to the east. The Derived Tussock Grassland does not meet the DEWHA condition criteria for the CEEC listed under the Commonwealth EPBC Act (DEWHA, 2010b).

The proposed spillway contains areas of highly degraded Exotic Grassland vegetation dominated by introduced plant species. The current management of the site includes periodic mowing and so the capacity for the regeneration of native vegetation is very low. This area would have historically supported CEECs but would not qualify as CEEC in its present condition.

Shale Plains Woodland

Shale Plains Woodland occurs 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.

Freshwater Wetlands

Drains, sediment detention ponds and depressions throughout the site 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.

Derived Tussock Grassland

There are areas of Derived Tussock Grassland at the site 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).

Dominant species included a dense groundcover of tussock grasses such as Kangaroo Grass (*Themeda australis*), Shorthair Plumegrass (*Dichelachne micrantha*) and Plains Grass (*Austrostipa aristiglumis*) interspersed with Common Couch (*Cynodon dactylon*). Herbaceous environmental weeds are sub-dominant and include Dandelion (*Taraxacum officinalis*) and Fireweed (*Senecio madagascariensis*).

This community contains some trees, including juvenile Swamp Oak, however these only occur as isolated patches and do not contribute to the vegetation structure of the community (hence its classification as grassland).

Native vegetation within this community is in good condition, with evidence of moderate grazing pressure and relatively minor weed invasion. The Derived Tussock Grassland did not appear to have been grazed by cattle nor mown for a number of years prior to the field survey (in contrast to areas mapped as Exotic Grassland and described below). It is likely that the Derived Tussock Grassland would regenerate into Shale Plains Woodland if the current conditions at the site continued.

Exotic Grassland

The majority of the grassland within the spillway 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.

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
Green Cestrum	*Cestrum parqui*	3
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
Bridal Creeper	*Asparagus asparagoides*	5

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'. For Category 5 weeds, 'the requirements in the *NW Act* for a notifiable weed must be complied with' and for Category 3 weeds, 'the plant must be fully and continuously suppressed and destroyed'.

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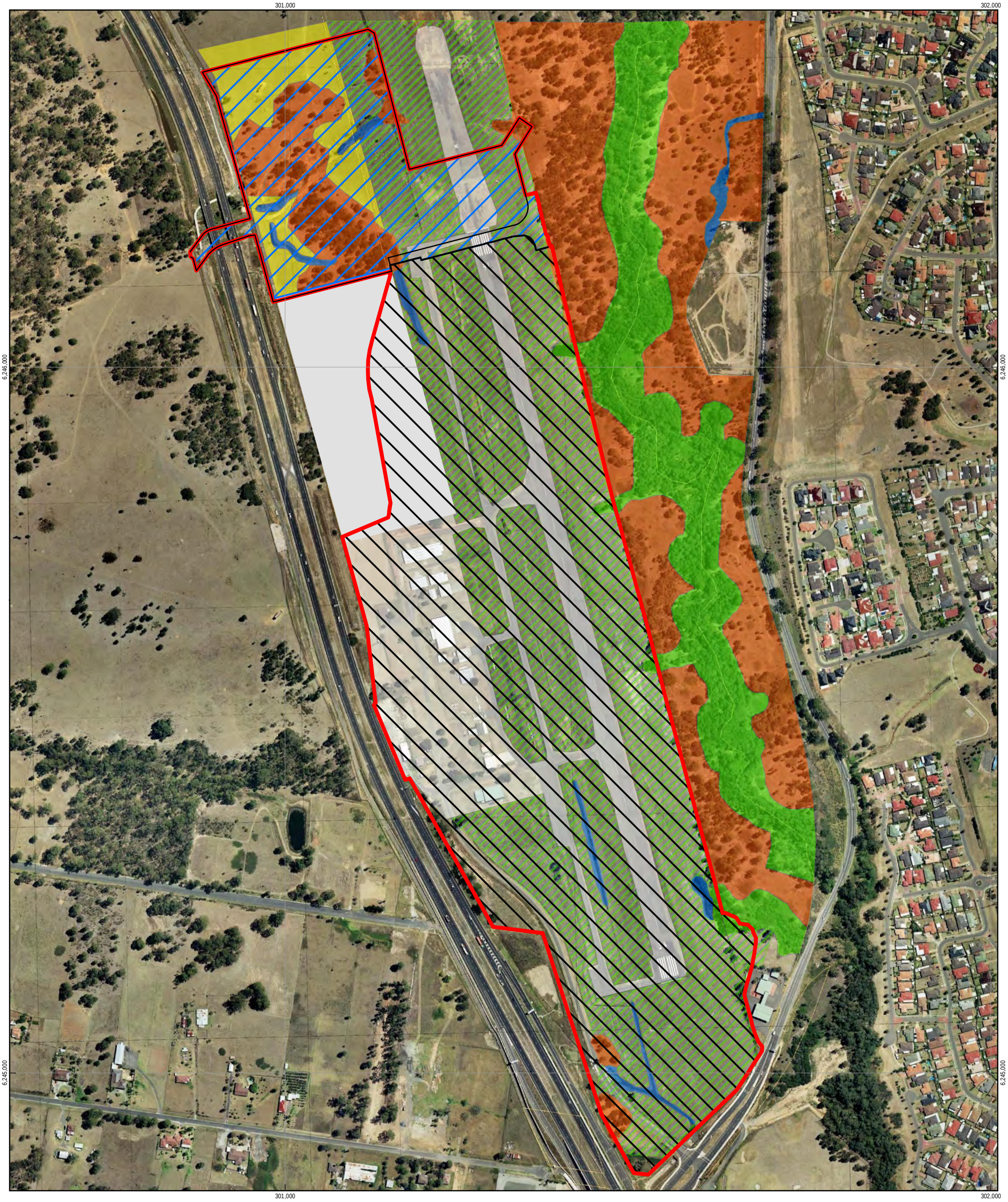

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Legend

- Study Area
- Cleared under previous approvals (Biosis 2006)
- Employment Zone Development
- Proposed Northern Basin 6
- 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 Northern Basin 6

Job Number	22 - 14911
Revision	C
Date	20 OCT 2010

Vegetation

Figure 4

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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 at the site, 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.

The remnant patch of Shale Plains Woodland within the footprint of the proposed northern basin features healthy and diverse native vegetation with an intact canopy and diverse vegetation structure but supported a limited suite of native birds. Only large generalist species such as the Crested Pigeon (*Ocyphaps lophotes*), Australian Raven (*Corvus coronoides*) and Noisy Miners

were observed in this patch of vegetation. It is likely that the small patch size, isolation and dominance of these aggressive native species have limited the habitat value of this patch for other native bird species.

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 within the study area. 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. 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 within the study area 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 guichenotti*) 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 from the study area, 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 across 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, despite targeted searches through potentially suitable habitat within the study area. 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.

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’ within the Hinchinbrook Creek Corridor 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.

The habitat assessment identified the following main habitat types:

Native Woodland and Forest

The patch of woodland within the basin footprint is relatively small and is 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. This patch is 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 this patch, which is probably attributable to fragmentation and edge effects. The patch is 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*), which may be able to persist in vegetation in the Hinchinbrook Corridor.

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. This vegetation 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*).The patch of woodland within the northern basin footprint is identified as 'Other native vegetation' by the same assessment. The GHD field surveys and habitat connectivity assessments support these definitions.

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.

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).

There are five habitat trees within the footprint of the proposed northern basin, including large, hollow-bearing Spotted Gum and stags. One hollow-bearing Spotted Gum featured conspicuous scratches suggesting that it was occupied. Despite stag-watching the species of resident fauna was not identified. Woodland patches within the northern basin footprint would have little value for threatened arboreal mammals and forest owls as they are small and surrounded by disturbed, cleared land. Habitat trees within the northern basin are more likely to be occupied by more aggressive and/or generalist native fauna such as Common Brushtail Possums, Sulfur-crested Cockatoos or Galahs.

The site 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 present survey. Hollow bearing trees at the site may contain roost sites for the tree-roosting Greater Broad-nosed Bat, and may also support the threatened Large-footed Myotis since they are 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 micorbats are less dependant upon large, mature hollow-bearing trees than arboreal mammals and forest owls (Gibbons and Lindenmayer, 2002). The site 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 broader study area and these species may utilise the site 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 at the site and within the remainder of 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). These canopy species are also present in good numbers within the Hinchinbrook Creek corridor, which has better connectivity and habitat values for native fauna, and it is likely that foraging native animals would use habitats within the basin footprint on an opportunistic basis or as an adjunct to core habitats within the Hinchinbrook Creek Corridor.

Woodland and forest at the site 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 at the site would comprise suitable habitat for the species and may support local populations not detected during the current survey.

The site 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 at the site (DECCW, 2010b; Ehman, 1997).

Derived Grassland

Derived native grasslands at the site would provide habitat for open country bird species and a limited suite of native reptiles and mammals. Dust, altered hydrology and increased nutrient loading associated with past livestock grazing are likely to reduce the value of these areas for many native fauna.

Native grasses at the site would provide foraging habitat for many native bird species, particularly finches and parrots. Patches of native, perennial tussock grasses are an important food resource for species such as the Diamond Firetail (*Stagonopleura guttata*). The derived grassland adjoins intact woodland and would provide potential foraging habitat for woodland birds. The value of this habitat in the former airport runway area is reduced by current land uses, which include periodic mowing and slashing. Derived grasslands within the northern basin area are fenced and excluded from mowing and have not been intensely grazed in recent years. This area contains better condition native vegetation and consequently has greater habitat value. Given the history of disturbance at the site and the fragmented nature of woodland and

native grassland patches the site is unlikely to be important habitat for any local populations of threatened woodland birds.

Woody debris was completely absent from cleared areas and so these areas would be unlikely to support small, shelter dependant animals such as the Cumberland Land Snail or native reptiles.

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

An unnamed drainage line runs through the central portion of the northern basin area, from the M7 underpass in the west to a culvert and drain beneath the former airport and then eastwards to Hinchinbrook Creek. This major drainage line appears to be man-made and supports very little intact riparian vegetation. The main channel of the creek was classified by Biosis (2006) as in poor condition, with most of the native bank vegetation cleared and impacted by erosion and grazing. The Liverpool City Council Biodiversity Strategy (LCC & EcoLogical, 2003), cited by Biosis (2006) identifies this drainage line as a "Riparian Corridor" through the M7 underpass. This corridor has some potential to provide a habitat link from the woodlands along Hinchinbrook Creek to the Spotted Gum Forest west of the M7 Motorway. However, Biosis (2006) note that this is currently a potential, rather than functional, corridor since the drainage line is piped under the airport runway and would require extensive rehabilitation and revegetation to be effective as a habitat corridor for most species.

Since the Biosis (2006) site survey the drainage line through the M7 underpass has been rehabilitated and planted with native wetland and riparian plants. The underpass would provide connectivity for some aquatic invertebrates and wetland fauna. There is currently a > 2 m change in relief between the drainage line through the site and the underpass and they are also separated by a stretch of grass functioning as an access track. Therefore this drainage line is limited by barriers to fish movement to the east and west of the northern basin footprint. The drainage line through the site would qualify as 'Class 3 - Minimal fish habitat' i.e. an unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (NSW Fisheries, 1999).

Despite its limited value for fish populations this drainage line features healthy stands of Cumbungi, Water Skinks, Eastern Snake-necked Turtles, frogs and invertebrates which were observed during field surveys. The *Typha orientalis* would provide refuge and foraging habitat for wetland birds including the Australian White Ibis (*Threskiornis aethiopica*) and White-faced Heron (*Ardea novaehollandiae*) observed during field surveys. This area may also provide foraging habitat for shelter-dependant wetland birds such as the Australian Painted Snipe (*Rostratula australis*) and Australasian Bittern (*Botaurus poiciloptilus*) though the surrounding disturbed areas, traffic and other human activities would limit their value for these species. Dams and ponds at the site are highly unlikely to support the open water species Blue-billed Duck (*Oxyura australis*) and Freckled Duck (*Stictonetta naevosa*) as they prefer large, permanent wetlands with dense fringing vegetation (DECCW, 2010b).

The drainage line would provide foraging habitat for microbats, including the three threatened species recorded at the site, particularly the Large-footed Myotis. The Large-footed Myotis is a specialist feeder from water and was recorded by Anabat immediately above the drainage line.

There is another, smaller drainage line through the basin footprint which is in near-original condition and supports intact riparian vegetation. The channel morphology and in stream and riparian vegetation is in good condition. It appears to have been isolated by earthworks and construction of the major channel and would now only carry local runoff after rainfall. Therefore it comprises Class 4 - Unlikely fish habitat: an unnamed waterway with intermittent flow following rain events only in a dry gully with no permanent aquatic flora present (NSW Fisheries, 1999).

There are an additional two artificial ephemeral drainage lines and freshwater wetlands within the footprint for the northern basin. These have previously been subject to cattle grazing and are in poor to moderate condition. They are completely isolated from aquatic habitats outside the site and would not function as fish habitat. They contain good growth of native and exotic herbs and sedges and would support native invertebrates, reptiles and frogs.

The site 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.

Hinchinbrook Creek, which occurs to the west of the site 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 site 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).

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).

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, drainage lines and wetlands 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 desktop assessments, 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 at the site 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 desktop 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 of the site 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 at the site. 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 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 as adult plants in the footprint for the proposed development. 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.

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 desktop 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 proposal footprint.	Certain. Proposed development will clear portions of this CEEC at the site.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Present. Recorded in Hinchinbrook Creek riparian corridor.	Potential foraging habitat in woodland across the entire study area. No camps noted within the study area.	High. Removal of foraging habitat for the species in woodland within the disturbance footprint.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	High likelihood. 'Probable' Anabat recording.	Potential foraging habitat in woodland across the entire 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 entire study area. Potential diurnal roosting habitat within footprint.	High. Removal of habitat in woodland within the disturbance footprint, including potential roost trees.

Scientific Name	Common Name	TSC Act	EPBC Act	Record Type	Habitat within Proposal Footprint	Likelihood of Impacts
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	High likelihood. 'Probable' Anabat recording.	Potential foraging habitat across the entire study area. Suitable roosting habitat within basin 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 desktop literature review indicates thirteen threatened ecological communities listed under the TSC/EPBC Acts which are known from the region surrounding the site. 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 Cumberland Plain Woodland at the site (refer Section 7), but will not affect any areas of River-flat Eucalypt Forest.

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 of the site. DECCW (2010a) Wildlife Atlas threatened species records from the locality of the site 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 at the site.

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, 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 throughout the study area contains foraging habitat for the species in the form of flowering eucalypts. No roost camps for the species are present at the site. The closest known roost camp is approximately 5km to the east of the site 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 study area 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 study area 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 at the site.

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 site 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; and
- *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 (<6 ha) 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 6
- 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

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Mirvac Group Pty Ltd
Hoxton Park Airport Development-
EIA for Proposed Northern Basin 6

Job Number	22-14911
Revision	B
Date	26 OCT 2010

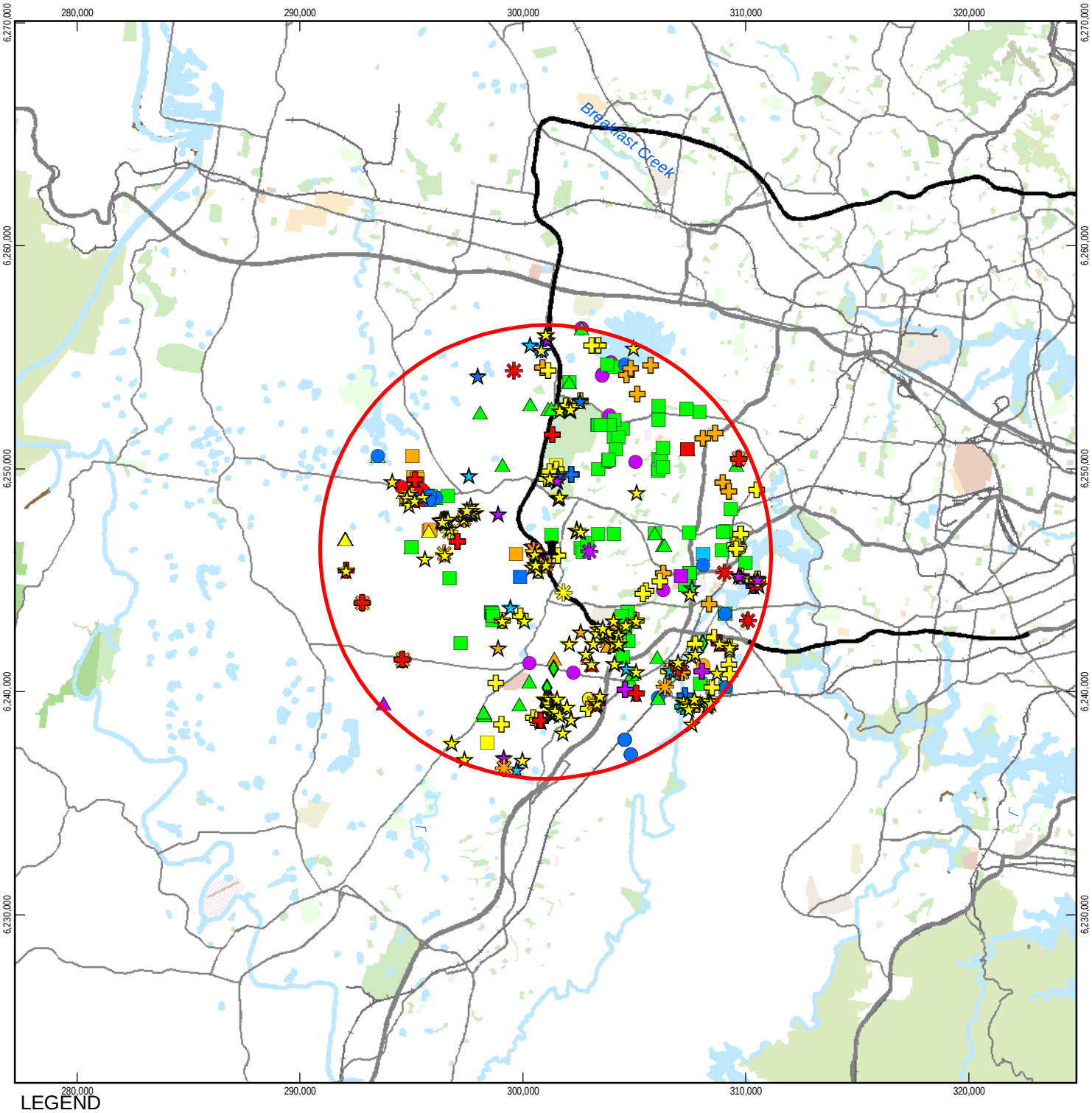
Threatened Biota and Habitat Resources

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-
EIA for Proposed Northern Basin and Spillway

Job Number 21-14911
Revision A
Date 04 FEB 2010

DECCW threatened species recorded in the locality

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, rphamer

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 site. 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 at the site: '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 at the site qualify as the CEEC listed under the EPBC Act. The Proposal would involve the clearing of CPW at 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 at the site.

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

- *Lathamus discolor* Swift Parrot;
- *Xanthomyza phrygia* Regent Honeyeater;
- *Chalinolobus dwyeri* Large-eared Pied Bat; and
- *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 of the site (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 site and is separated by the expanse of Botany Bay. Therefore the Proposal is highly unlikely to affect the Ramsar Wetland.

7. Impact Assessment

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

7.1 Vegetation Clearing and Construction Impacts

7.1.1 Vegetation Communities

Construction of the Proposed infrastructure would require the clearing or permanent modification of native vegetation within the development footprint for the northern basin and the spillway. It is assumed that no additional vegetation clearing would be required for the operation of the existing channel or 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 3.09 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. The development footprint also contains a further 2.10 ha of Derived Tussock Grassland that is consistent with a form of CEEC in low condition in accordance with the TSC Act definition. The proposal will remove valuable fauna habitat in 0.20 ha of Freshwater Wetlands associated with existing open drains.

The remainder of the development footprint 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 approximately 0.02 % of the overall extent of equivalent woodland and forest vegetation communities in the locality. The Proposal would remove wetland habitats equivalent to 2.60 % of the mapped extent in the locality, however this figure would not account for small, non-natural wetlands of the type to be disturbed. The wetlands within the site disturbance footprint would have little value in comparison to the 7.8 ha of large, natural wetlands mapped in the locality by NPWS (2002) as well as aquatic habitats in Hinchinbrook Creek.

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	3.09	1059.7	0.02
Derived Tussock Grassland	CEEC (low condition)		2.1	-	-
Freshwater Wetlands			0.20	7.8	2.60
Exotic Grassland			NA	-	-
Total			**5.39**		

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 have a high likelihood of occurring (refer Appendix B).

7.1.3 Fauna

The Proposal would remove habitat resources for native fauna within the 5.39 ha of native vegetation and wetland habitats to be removed.

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 disturbance footprints 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 individuals 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 3.09 ha of native woodland containing 5 habitat trees. Based on available NPWS (2002) mapping the Proposal would remove less than 0.01 % 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 likely to comprise a minor proportion and potential roost sites and other habitat resources available in the locality and so 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 any local populations of any fauna species.

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

There is 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 habitat resources for native flora and fauna. This clearing will have additional negative effects on the quality of habitats in the broader locality through fragmentation of habitat and the disruption of fauna habitat corridors.

The Proposal would remove five habitat trees within the footprint of the proposed northern basin, including large, hollow-bearing *Corymbia maculata* and stags. These trees may provide roost sites for some species of native bird and microbats, potentially including the threatened Large-footed Myotis or Greater Broad-nosed Bat. These habitat trees are unlikely to support threatened arboreal fauna or forest owls as they are situated in a relatively small and isolated patch of vegetation. One hollow-bearing *C. maculata* featured conspicuous scratches suggesting that it was occupied but the species of resident fauna was not identified. Pre-clearing surveys should include additional stag-watching to try and identify the species of resident fauna. It is most likely to support a Common Brushtail Possum and so the construction planning and techniques outlined in Section 8.2.1 are likely to be sufficient.

Construction of the northern basin will contribute to a barrier to movement of fauna in the locality by creating additional obstacles between the Hinchinbrook Creek riparian corridor and woodland to the west of the M7. The vegetation to be directly removed for the northern basin would have limited value as a fauna movement corridor as the habitat to be removed is a ‘dead end’ for many fauna species as fauna movement to the west is already limited by the M7 and to the south by industrial development. Movement of the majority of non-flying mammals, reptiles and frogs and many species of birds would be limited by existing vegetation clearing and/or the M7.

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 to birds or bats in the context of existing land uses in the locality.

The modified site area may have an affect on regional movements of migratory fauna species such as native birds and bats by increasing the area of non-viable habitat that they need to traverse. Migratory species often rely on ‘stepping stones’ of suitable foraging and roosting habitat during migrations. By removing a patch of habitat the proposed construction would increase the distance between suitable patches. In a regional context this would probably comprise a minor effect on these more mobile species.

The northern basin and spillway would be vegetated with native wetland species. Once this vegetation has become established it would restore a degree of habitat connectivity through the site. The final landform would create a partially vegetated habitat corridor through the centre of the site, connecting Hinchinbrook Creek with the northern basin. Many native fauna, including microbats, invertebrates, frogs, reptiles and wetland birds are likely to benefit from a vegetated

habitat corridor surrounding the drainage line and associated aquatic habitats. 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. With the exception of wetland birds, the majority of these species would readily use the underpass and so the Proposal may result in some overall benefits to habitat connectivity in the long term. Modified habitats created by the proposal would have little value for forest and woodland birds and terrestrial mammals. The vegetated strip adjoining the basin would be narrow and would have little value as shelter and travelling habitat for these species.

The project will not isolate any vegetation or wildlife corridors outside the immediate surface disturbance area.

Based on available NPWS (2002) mapping the Proposal would remove less than 0.01 % of the overall extent of native woodland and forest vegetation communities in the locality. Therefore the impacts described are only likely to affect a minor proportion of the habitat resources available in the locality.

7.1.5 Aquatic Habitat

Aquatic habitats within the northern basin development footprint are all artificial drainage features and have little conservation value. They are unlikely to support any threatened biota or be important to the maintenance of any local populations of aquatic biota.

The operational northern basin will be revegetated and will include aquatic habitats with habitat value for wetland and aquatic species. The basin and spillway will include designed habitat features such as woody debris and fringing habitat for wetland plants. The adjoining batters and corridor would be revegetated with species representative of adjoining intact native vegetation and appropriate to the modified geomorphology of the site.

Within the study area Hinchinbrook Creek provides greater habitat value, including good habitat resources for aquatic species, but will not be directly affected by the current Proposal. Provided standard environmental management practices are adopted through the construction process the proposal is unlikely to result in significant indirect impacts on aquatic habitat in the area as described below.

7.2 Indirect Impacts

7.2.1 Sediments, Dust and Runoff

Potential indirect impacts to terrestrial flora and fauna within the corridor 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. The local topography of the northern basin footprint has been extensively modified by drainage diversion and works, and the construction footprint could be effectively isolated from sensitive receptors with relatively minor additional sediment control works. 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.

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 result in some positive long term impacts within the study area through the approved offset strategy (refer to Section 8.3).

7.4 Key Threatening Processes

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

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

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

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 Proposal will remove approximately 5 habitat trees. A comprehensive census of habitat trees outside the construction areas was not obtained during field surveys, however given the limited extent of clearing this is expected to be a minor proportion of the hollow bearing tree resource in the locality.

Construction will require alterations to the hydrology of the drainage lines through the northern basin footprint and associated moist grasslands and wetlands on adjoining alluvial flats. The hydrology of this area is already substantially modified by previous disturbance, including grazing and stock trampling, contour banking and installation of drains and culverts. The proposed construction would have a short term effect on extensively degraded aquatic and

wetland habitats. In the long term, the proposed reconstruction and vegetation of the northern basin is likely to result in comparable aquatic habitat resources to those currently present at the site.

The design and operation of the northern basin should ensure that discharges to Hinchinbrook Creek are consistent with the natural flow regime.

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 Proposal has been presented according to the hierarchy of avoidance; mitigation and offsetting of impacts.

8.1 Avoidance of Impacts

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.

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.

8.2 Mitigation of Impacts

8.2.1 Construction Planning

It is recommended that the Construction Environmental Management Plan (CEMP) be developed for the Proposal and include, as a minimum, the impact mitigation measures and principals outlined below.

Construction Staging

The vegetation to be removed for the proposed basin is a small isolated patch and so there is little opportunity for shelter-dependant fauna to seek refuge. It should be noted that only mobile, generalist species were recorded in this patch.

Aquatic habitat at the site should be progressively drained in such a way that opportunities are provided for fish, turtles and other aquatic fauna to vacate the site and move into areas of 'secure' habitat to evade injury. Construction of the basin should be staged so that at least some aquatic habitat is maintained on site as refuge for aquatic fauna throughout the construction period.

Soil and surface water management

The CEMP will 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
- 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
- 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
- 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
- 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
- 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). The northern basin would be designed and revegetated to provide suitable wetland habitat, indicative of the local area. The northern basin will, in the longer term, provide habitat resources for native biota, and potentially improve habitat connectivity.

Final detailed design of the northern basin would incorporate inputs from a civil and environmental engineer and relevant government departments to ensure that the final design appropriately performs the functions of a wetland habitat in this context. The final plan of the northern basin would include designed habitat features such as woody debris and fringing habitat for wetland plants. The adjoining batters and corridor would be revegetated with species representative of adjoining intact native vegetation and appropriate to the modified geomorphology of the site. This is likely to consist of species from the Alluvial Woodland and Shale Plains Woodland. The overall design should include provision of substrate for native wetland plants that would be allowed to regenerate into heavily vegetated freshwater wetlands to compensate for the removal of the freshwater wetlands within the construction footprint.

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 Proposed Impacts

8.3.1 Need for offsetting

The project would result in residual impacts on native flora and fauna, including removal of approximately 5.39 ha of native vegetation and freshwater wetlands, including 3.09 ha of a critically endangered ecological community under the TSC and EPBC Acts and a further 2.10 ha of low condition CEEC under the TSC Act. 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.

A more detailed offsets strategy will be provided as a separate report. 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, incorporating approximately 15ha, is located in the eastern portion of the Hinchinbrook Creek riparian corridor, to the northern or 'upstream' end of the site. The vegetation in this area has high regeneration potential, and natural regeneration methods should produce good results in most areas. Revegetation/planting works will be limited to small patches dominated by introduced pasture grasses. It is anticipated this offset would achieve the same objectives and outcomes as the Offset Strategy already prepared for the approved development footprints (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 areas of Shale Plains Woodland
- The presence of threatened ecological communities comprising intact Shale Plains 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 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.

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 will be detailed in a separate 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 proposed 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 approximately 15 ha

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 was performed following the assessment criteria identified in the DEC/DPI (2005) *Guidelines for Threatened Species Assessment* for developments to be assessed under Part 3A of the Ep&A Act.

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 northern basin footprint would reduce the extent of potential habitat at the site by a total of 5.39 ha (the area of Shale Plains Woodland, Derived Tussock Grassland and Freshwater Wetlands) involving the complete removal of a patch of native vegetation. The value of the vegetation and potential habitat to be removed is limited by previous disturbance In this context, the direct removal of a 5.39 ha patch of potential habitat is not likely to comprise a significant reduction in the extent of available habitat for any local populations of threatened plants;
- 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

The Proposal will remove or modify a total of approximately 5.19 ha of native vegetation consistent with the Cumberland Plain Woodland CEEC as defined under the TSC Act, including a patch of 3.09 ha of Shale Plains Woodland and 2.10 ha of Derived Tussock Grassland within the footprint of the northern basin. The full Assessment of Significance pursuant to the DEC/DPI (2005) guidelines is presented in Appendix C.

The value of the vegetation and habitat to be removed is limited by the isolation of this patch of CEEC. This remnant patch would likely make a relatively minor contribution to the viability of the local population of the CEEC, and represents approximately 0.02% of of the overall extent of

equivalent woodland and forest vegetation communities in the locality. 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, GHD 2010b). The offset strategies would provide for the conservation and management of the majority of CPW 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.

Assessments of Significance pursuant to the DEC/DPI (2005) guidelines 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 during construction. 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 resting 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 3.09 ha of foraging habitat (Shale Plains 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 during construction. 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 3.09 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 derived grassland or disturbed cleared land that does not comprise suitable habitat for this species.

The 3.09 ha of Shale Plains Woodland to be removed within the footprint of the northern basin is an isolated patch surrounded by derived grassland and cleared land. Habitat in this area would be completely isolated from the remainder of the population potentially present in the locality and would make a minor contribution to its long term viability.

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 DEC/DPI (2005) *Guidelines for Threatened Species Assessment* have 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 0.01 % of the overall extent of 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 basin footprint would reduce the extent of habitat at the site by a total of 5.39 ha (the area of Shale Plains Woodland and adjoining Derived Tussock Grassland and Freshwater Wetlands within the footprint) involving the complete removal of a patch of native vegetation. The value of the vegetation and habitat to be removed is limited by its isolation. In this

context the direct removal of a 5.39 ha patch of habitat is not likely to comprise a significant reduction in the extent of available habitat for any 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*
- 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 CPSW-SGTF comprises an impact on a matter of NES. The local population of this community is ecologically equivalent to Cumberland Plain

Woodland, 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 CPSW-SGTF (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 CPSW-SGTF at the site was performed. A detailed assessment of the significance of impacts on CPSW-SGTF pursuant to the DEWHA (2009) guidelines is presented in Appendix C.

The Proposal will reduce the extent of this community by removing or modifying a total of approximately 3.09 ha of Shale Plains Woodland within the footprint for the northern basin.This is a minor proportion of the local population of the CEEC, which includes an extensive area within the Hinchinbrook Creek riparian corridor and large, but disjunct patches to the west of the M7.

The basin footprint would reduce the extent of the CEEC by a total of 3.09 ha involving the complete removal of a patch of CPSW-SGTF. The value of the vegetation and habitat to be removed is limited by the isolation of this patch of CEEC. This remnant patch would make a relatively minor contribution to the viability of the local population of the CEEC.

Consideration of the above assessment criteria concludes that the development is considered unlikely to have a significant impact on CPSW-SGTF. However, given that CPSW-SGTF is listed as a 'critically endangered ecological community', it is recommended that the proposed development be Referred to the Commonwealth Minister to confirm the activity is not a controlled action and to provide certainty that no further assessment or approval under the EPBC Act is required.

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. An Assessment of Significance pursuant to the DEC/DPI (2005) guidelines was prepared 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 the DEC/DPI (2005) *Guidelines for Threatened Species Assessment* 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 northern basin is limited in extent and isolated by surrounding cleared land and major roads. Therefore the habitats present are not considered to constitute critical or important habitat for any listed species under the migratory bird provisions of the EPBC Act.

The modified site area would potentially affect regional movements of migratory species by increasing the area of non-viable habitat that they need to traverse. Migratory species often rely on 'stepping stones' of suitable foraging and roosting habitat during migrations. By removing habitat within the northern basin footprint the proposed construction would increase the distance between suitable patches. In a regional context this would probably comprise a minor effect on these more mobile species particularly given the presence of alternative habitat in the Hinchinbrook Creek riparian 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 established basin would create a partially-vegetated habitat corridor through the centre of the site. In the longer term this habitat would be modified through revegetation with wetland plants and a narrow fringing strip of indigenous woodland species. Once established the basin would function as viable habitat for many migratory species, especially wetland birds.

The Proposal is 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

This ecological assessment noted a mix of ecological values at the site, reflecting the extent of previous disturbance. The extent, condition and conservation significance of native vegetation and habitats at the site is equivalent to that described in the Biosis (2006) assessment and subsequent GHD (2007a, GHD 2010a) site surveys. Some relatively intact habitats have high conservation significance including intact patches of the TSC/EPBC Act listed CEEC Cumberland Plain Woodland. Native vegetation at the site is likely to contribute to the habitat available for local populations of six threatened fauna species based on the site surveys, habitat assessments and/or recent observations of the species in the locality.

The Proposal would result in impacts on native biota and their habitats within the 5.39 ha of native woodland, grassland and wetland vegetation to be cleared. This vegetation also includes 5.19 ha of vegetation consistent with the TSC Act listed CEEC Cumberland Plain Woodland, 3.09 ha of which also qualifies as the EPBC Act listed form of this CEEC. Based on available NPWS (2002) mapping the Proposal would remove approximately 0.02% of equivalent woodland communities and 2.6% of freshwater wetlands in the locality. In this context, the direct removal of this vegetation is not likely to comprise a significant reduction in the extent of habitat for any local populations of native species.

Impact mitigation measures would avoid or reduce the potential for adverse impacts on threatened biota and their habitats at the site. Measures recommended in this report include:

- Preparation of a CEMP and application of appropriate measures to mitigate impacts on resident fauna within construction footprints, surface water, soil and air quality
- Design of the proposed basin as an ‘artificial wetland’, including habitat resources such as aquatic and semi-aquatic plants, areas of rocky substrate and a buffer of planted native vegetation
- A proposed biodiversity offset strategy to offset residual impacts on native biota, aligned with the offset strategy for other development lands at the former Hoxton Park Airport site (GHD 2007b, GHD 2010b) to create an integrated conservation area associated with the Hinchinbrook Creek riparian corridor.

10.1 Assessment of Key Threshholds under Part 3A of the EP&A Act

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 study area 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 will be detailed in a separate 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 5.39 ha of native vegetation to be removed and approximately 15 ha being rehabilitated and managed for conservation. This includes a net increase in vegetation cover, through time, of approximately 9.6 ha
- Compensation for this removal by rehabilitating 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
- 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 5.39 ha of native vegetation, including 5.19 ha of the TSC Act listed Cumberland Plain Woodland EEC ◗ Removal of five hollow-bearing trees.	◗ Adoption of Prepared CEMP and application of appropriate measures to mitigate impacts on resident fauna within construction footprints, surface water, soil and air quality. ◗ 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, GHD 2010b) 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 – Hollow-bearing trees – 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
- The proposal will remove approximately 0.02% of the extent of the CEEC Cumberland Plain Woodland in the locality. Given the relative isolation and disturbed nature of the vegetation to be removed it is unlikely that the portion of CEEC to be removed represents an ecologically significant proportion of the local occurrence of the community
- Based on NPWS mapping, the area of habitat to be removed represents less than 0.01% of the total extent of woodland and forest communities, and 2.6% of freshwater wetland habitats within 10km. The habitat value of the vegetation to be removed is also limited by its relative isolation and position within a matrix of disturbed lands. The site is therefore unlikely to contain an ecologically significant proportion of the local populations of any threatened flora or fauna
- 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
- 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.

Conclusion:

Based on the above criteria the Proposal will not have a net negative impact on any threatened biota occurring or with the potential to occur at the site or in adjoining and downstream habitats. Therefore the Proposal is considered to have satisfied the requirement to 'maintain or improve' biodiversity values in the study area.

10.2 Federal EPBC Act Assessment

Assessments of significance pursuant to the DEWHA (2009) 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. However, given that CPSW-SGTF is listed as a 'critically endangered ecological community', it is recommended that the proposed development be Referred to the Commonwealth Minister to confirm the activity is not a controlled action and to provide certainty that no further assessment or approval under the EPBC Act is required.

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Appendix A

Species Lists

Table A.1. Flora Species List

Plants	Scientific Name	Common Name	NSW Status	EPBC Status	Northern basin footprint	Employment Zone development	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			
	*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	
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
	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
	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							
	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
	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
	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
	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
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
P Protected under the NSW NPWS Act
U Unprotected under the NSW NPWS Act

Table A.2 Fauna Species List

Scientific Name	Common Name	NSW Status	EPBC 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

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type
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
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

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type
*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
Bats				
Chalinolobus gouldi	Gould's Wattled Bat	P		Anabat (confident)
Chalinolobus morio	Chocolate Wattled Bat	P		Anabat (probable)
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)
Myotis macropus	Southern Myotis#	V		Anabat (probable)
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)
Tadarida australis	White-striped Freetail Bat	P		Anabat (confident)
Vespadelus vulturnus	Little Forest Bat	P		Anabat (confident)

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type
Vespadelus sp.	Unidentified Forest Bat	P		Anabat (probable)
Pteropus poliocephalus	Grey-headed Flying-fox	V	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
Fish				
**Gambusia holbrookii*	Plague minnow	U		Seen
**Cyprinus carpio*	Common carp	U		Seen
Anguilla reinhardtii	Long-finned eel	U		Seen

* Exotic
V Vulnerable under the TSC/EPBC Act
P Protected under the NSW NPW Act
U Unprotected under the NSW 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 South East Corner bioregions	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 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.	**Low.** Wetlands at the site are artificial features. Suitable habitat is extensively modified and/or supports other native vegetation types.	**Nil.**
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.**

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.**
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.**
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	**Low.** The species preferred soils and geomorphic settings are not present.	**Nil.**

				Huskisson area (DEC 2010).		
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.**
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.**

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.**

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.**

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.**

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**.
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	**Nil.**

					not present.	
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*. 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).	**Low.** The species preferred soils and geomorphic settings are not present.	**Nil.**

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.**
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	**Low**.

					limited by feral predators.	
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 and Tumbledown Gum E. dealbata (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 .
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.
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.
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 at the site are probably too small and degraded to support the species.	**Low**.
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.
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**.
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	**Low**. The species' preferred soils and geomorphic settings are	**Nil**.

				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).	not present.	
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, 2010b).	**Low**. The species' preferred soils and geomorphic settings are not present.	**Nil**.
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	**Low**.

					populations in the Sydney region.	
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**.
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	**Medium**. May occur in suitable woodland and forest habitat	**Low**. Limited areas of suitable habitat within construction footprint.

			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).	at the site on an occasional basis.	
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 (<2 ha) occurring as small, isolated patches
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.

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.

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 and isolated trees 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 Dividing Range, with annual rainfall	**Low**. The species' preferred soils, vegetation types and geomorphic settings are not present.	**Nil**.

				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 (<2 ha) occurring as small, isolated patches
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 escape the dry conditions (DECCW, 2010b)	**High**. Suitable habitat in Shale Plains Woodland in the site.	**Low-medium**.

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

Assessments of Significance

11.1 7-part Tests

Section 5A of the EP&A Act lists 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
i) How is the project likely to affect the lifecycle of a threatened species and/or population?	Not applicable to this CEEC
ii) How is the project likely to affect the habitat of a threatened species, population or ecological community?	
a) disturbs any permanent, semi permanent or ephemeral water bodies;	Not applicable: the Proposal will disturb freshwater wetlands within the footprint of the northern basin but these areas do not comprise habitat for this CEEC.
b) degrades soil quality;	Soil protection measures and techniques would be implemented during and following construction. 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. The local topography of the northern basin footprint has been extensively modified by drainage diversion and works. The construction footprint for the northern basin could be effectively isolated from sensitive receptors with relatively minor additional sediment control works. The entire patch of Shale Plains Woodland (CPW) would be removed for the northern basin, which will no longer represent habitat for this CEEC: as such, soil degradation in the immediate construction footprint will not affect any habitat for this CEEC.
c) clears or modifies native vegetation;	The Proposal will remove a total of approximately 5.19 ha of this community within the footprint of the northern basin, including an isolated patch of 3.09 ha of Shale Plains Woodland and 2.1 ha of surrounding Derived Tussock Grassland. The patch of CEEC is likely to make a minor contribution to the species composition and ecological function of local populations of the CEEC due to its isolation. The Derived Tussock Grassland represents a highly degraded form of this CEEC and contains only a subset of the species representative of the CEEC. The Proposal would modify the composition of the CEEC by removing species within the development footprint. This patch is adjacent to additional areas of Derived Tussock Grassland, and edge effects may also modify the species composition of these retained areas. Extra light, wind and resultant

Criteria	Cumberland Plain Woodland
	temperature changes may favour the growth of weeds and or hardier native species along disturbed edges of retained vegetation. 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 0.02 % 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). Note that it is likely that some of the mapped extent of these communities in the locality is likely to have been cleared in the intervening time by other developments.
d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;	The study area contains six species declared as noxious weeds in Liverpool LGA. The project may increase the incidence of weeds in areas of Derived Tussock Grassland to the north of the basin through edge effects as described above. Standard environmental management measures at the site will aim to reduce the spread of weeds into these areas as far as possible. Impacts of weed invasion on these areasare likely to be minor given the current levels of disturbance and weed invasion operating within the study area. Soil protection measures and techniques would be implemented during and following construction, to prevent the transmission of weed propagules to downstream areas via runoff from disturbed areas, including vegetation clearing areas, construction laydown areas and access roads. There are unlikely to be impacts from runoff on any nearby patches of CPW. The proposal is unlikely to lead to an increase in feral animals in any nearby patches of CPW.
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;	The Proposal will remove habitat resources associated with this native vegetation, including 5 hollow-bearing habitat trees, mature trees, woody debris, topsoil and leaf litter.
f) affects natural revegetation and recolonisation of existing species following disturbance.	Existing species comprising this CEEC will not be able to recolnise the development footprint after construction as the operational basin will be revegetated as a wetland habitat and will not contain areas of suitable habitat or geomorphology for this CEEC.
iii) Does the project affect any threatened species or populations that are at the limit of its known distribution?	Not applicable
iv) How is the project likely to affect current disturbance regimes?	The site for the proposal is located within the old Hoxton Park Airport, in an area containing remnant and regenerating native vegetation. The M7 lies immediately to the west of the area. The site is otherwise surrounded by previously cleared and disturbed land. The vegetation within the site is therefore highly disturbed, and currently subject to edge effects and weeds. Much of the remaining area within the old airport site is

Criteria	Cumberland Plain Woodland
	proposed for development as an employment zone. Disturbances are therefore likely to be similar to what are presently occurring at the site.
a) modifies the intensity and frequency of fires;	Fire is very rare in the area. The proposed development is not likely to alter the intensity or frequency of fires.
b) modifies flooding flows;	The Proposal would substantially alter surface water drainage patterns within the footprint of the proposed northern basin. The area thus affected would only contain disturbed environments and so this modification would not directly affect any remaining areas of CPW in the locality. The Proposal would also modify surface water flows across the broader study area by channelling storm water into the northern basin and then gradual discharge to Hinchinbrook Creek via the return drain. The northern basin is part of Liverpool City Council's detention strategy for Hinchinbrook Creek. The northern basin will follow stormwater best management practices (BMPs) and will eliminate or minimise the effects of excess runoff generated by the newly-constructed impervious surfaces for the development, including roads, driveways, parking lots and rooftops. This would be expected to have net positive impacts on CPW in the locality by mitigating potential negative impacts of other developments in the locality.
v) How is the project likely to affect habitat connectivity?	The value of the vegetation and habitat to be removed is limited by the isolation of this patch of CEEC. Highly mobile species of fauna and plants with widely dispersed pollen and seed, such as grasses, would be able to traverse the gaps in habitat surrounding the patch. However many ecological functions such as pollination, seed fall, seedling recruitment and fauna movement would not occur across gaps in habitat for many species within the CEEC. NPWS (2002) conservation significance mapping classed the patch to be removed as 'other native vegetation' with lesser value for maintaining regional populations of native biota. In this context the direct removal of 5.19 ha of the CPW CEEC is not likely to comprise a significant reduction in the local occurrence of the community.
a) creates a barrier to fauna movement;	The vegetation that comprises the CEEC within the footprint of the northern basin is an isolated patch surrounded by derived grassland and cleared land. Habitat in this area is isolated from the remainder of the local population and would make a minor contribution to fauna movement, other than as a stepping stone for mobile fauna.
b) removes remnant vegetation or wildlife corridors; and	The removal of vegetation for the proposed northern basin will increase the distance between habitat for the CEEC along Hinchinbrook Creek and vegetated areas to the west of the site by up to 150m. The former Hoxton Park airport site and the M7 immediately to the west of the site have fragmented the local occurrence of CPW. In this context the northern basin would not significantly increase the degree of fragmentation of habitat in the locality.

Criteria	Cumberland Plain Woodland
c) modifies remnant vegetation or wildlife corridors.	The Proposal will not modify any remnant vegetation or wildlife corridors.
vi) How is the project likely to affect critical habitat?	There is no recommended or declared critical habitat of relevance to this community.
Conclusion	Based on consideration of the above criteria the Proposal is unlikely to have a significant impact on the local population of Cumberland Plain Woodland.

11.1.2 Threatened Microbats

Criteria	Eastern Bentwing Bat	Large-footed Myotis	Greater Broad-nosed Bat
	The Eastern Bentwing Bat forages in a range of habitat types, including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland and open grasslands. In forested areas the species forages above the canopy, while in more open areas such as grass lands it will forage within a few metres of the ground. Breeding occurs in large maternity colonies in caves, and it roosts in caves, mines and culverts outside the breeding season (Churchill 2008).	The Large-footed Myotis is Australia's only fishing bat. It forages across permanent, slow-flowing waterbodies (such as dams) for small fish and aquatic insects by trailing its large feet through the water surface. It will also hunt insects that fly above the water surface. The species is known to roost near water in caves, tree hollows, among vegetation, and in man-made structures such as culverts, stormwater drains, mines, and tunnels (Churchill 2008).	This species is a large and robust bat that 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. 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. Reproduction takes place in January at maternal roosting sites in suitable trees (Churchill 2008, Hoye and Richards 2006).
i) How is the project likely to affect the lifecycle of a threatened species and/or population?	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.		
a) displaces or disturbs threatened species and/or populations;	The Proposal will remove 5.39 ha of native woodland, grassland and wetland vegetation comprising potential habitat for these species. There are substantial alternative areas of similar habitat in the Hinchinbrook Creek riparian corridor and vegetation to the west of the M7 and the loss of this habitat is unlikely to significantly affect the lifecycle of local populations or individuals of these species. The proposed development may also disturb some individuals through increased light, noise and traffic during construction. However these impacts are likely to be minor in the context of existing disturbance at the site, including the adjacent M7 motorway.		
b) disrupts breeding cycle;	Eastern Bent-wing Bats breed in specific maternity caves. The proposal would not impact any	The clearance of native vegetation may have a minor impact on the availability of breeding habitat for	The clearance of native vegetation may have a minor impact on the availability of breeding habitat for

Criteria	Eastern Bentwing Bat	Large-footed Myotis	Greater Broad-nosed Bat
	breeding habitat.	this species through the removal of 5 hollow-bearing trees. The nearby Hinchinbrook Creek riparian corridor and habitats to the west of the M7 would contain alternative breeding habitat for the species.	this species through the removal of 5 hollow-bearing trees. The nearby Hinchinbrook Creek riparian corridor and habitats to the west of the M7 would contain alternative breeding habitat for the species.
c) disturbs the dormancy period;	This species hibernates in caves through winter. The Proposal will not affect any suitable hibernation habitat for this species.	Not applicable	Not applicable
d) disrupts roosting behaviour;	The development may have a minor impact on this species through removal of potential roosting habitat within the development footprint. The project will remove or modify a small number of man-made structures such as drain culverts, which represent potential roosting habitat for this species. The construction of the bridge spanning Hinchinbrook Creek (GHD 2010b) may provide additional roosting habitat in the longer term.	The clearance of native vegetation will have a minor impact on the availability of roosting habitat for this species. The project will remove or modify a small number of man-made structures such as drain culverts, and 5 hollow-bearing trees which represent potential roosting habitat for this species. The nearby Hinchinbrook Creek riparian corridor and habitats to the west of the M7 would contain alternative roosting habitat for the species.	The clearance of native vegetation may have a minor impact on the availability of roosting habitat for this species through the removal of 5 hollow-bearing trees. The nearby Hinchinbrook Creek riparian corridor and habitats to the west of the M7 would contain alternative roosting habitat for the species.
e) changes foraging behaviour;	The project will remove foraging habitat for this species by removing 3.09 ha of native woodland vegetation comprising potential foraging habitat for 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	The Proposal will remove 0.20 ha of freshwater wetlands, including areas of potential foraging habitat for this species. The proposed habitat removal would have a minor effect on the availability of resources for the species in the locality, as there is extensive alternative wetland foraging habitat in the Hinchinbrook Creek Corridor. Once complete, the northern basin	The project will remove foraging habitat for this species by removing 3.09 ha of native woodland vegetation comprising potential foraging habitat for 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

Criteria	Eastern Bentwing Bat	Large-footed Myotis	Greater Broad-nosed Bat
	for some individuals. Based on available NPWS (2002) mapping the Proposal would remove less than 0.01 % of the overall extent of native woodland and forest vegetation communities in the locality, which include extensive alternative foraging habitat in habitats along the Hinchinbrook Creek Corridor and in vegetation to the west of the M7. The remainder of the development footprint is derived grassland or disturbed cleared land. Eastern Bentwing Bats 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.	will contain additional areas of wetalnd habitat which may provide foraging habitat for this species.	for some individuals. Based on available NPWS (2002) mapping the Proposal would remove less than 0.01 % of the overall extent of native woodland and forest vegetation communities in the locality, which include extensive alternative foraging habitat in habitats along the Hinchinbrook Creek Corridor and in vegetation to the west of the M7. The remainder of the development footprint is derived grassland or disturbed cleared land. Greater Broad-nosed Bats 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.
f) disrupts pollination cycle; g) disturbs seedbanks; or h) disrupts recruitment (i.e. germination and establishment of plants);	Not applicable to any of these threatened fauna species		
i) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).	Not applicable to any of these threatened fauna species		
j) affects migration and dispersal	Clearing of native vegetation would not significantly affect connectivity of habitat for any of these highly mobile species. The Proposal will increase the gap between habitats west of the M7 and along Hinchinbrook Creek by		

Criteria	Eastern Bentwing Bat	Large-footed Myotis	Greater Broad-nosed Bat
ability;	an additional 150m, which may easily be traversed by these highly mobile species. The presence of the brightly lit M7 may already pose a partial barrier to such movements in these species.		
ii) How is the project likely to affect the habitat of a threatened species, population or ecological community?			
a) disturbs any permanent, semi permanent or ephemeral water bodies;	Not applicable	The project will remove approximately 0.20 ha of freshwater wetlands on site. The majority of these areas are unsuitable foraging habitat for this species, being generally well vegetated and lacking open water. These impacts would only be short term as the operational northern basin would provide suitable foraging habitat for the species over the longer-term.	Not applicable
b) degrades soil quality;	Soil protection measures and techniques would be implemented during and following construction. 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. The local topography of the northern basin footprint has been extensively modified by drainage diversion and works. The construction footprint for the northern basin could be effectively isolated from sensitive receptors with relatively minor additional sediment control works.		
c) clears or modifies native vegetation;	The project will remove foraging habitat for this species by removing 3.09 ha of native woodland vegetation. Based on available NPWS (2002) mapping the Proposal would remove less than 0.01 % of the overall extent of native woodland and forest vegetation communities in the locality, which include extensive alternative foraging habitat in habitats along the Hinchinbrook Creek Corridor and in vegetation to the west of the M7.	The project will remove 3.09 ha of native woodland vegetation containing five hollow-bearing trees that may provide roosting habitat for this species, and 0.20 ha of wetland habitat comprising potential foraging habitat for the species. Based on available NPWS (2002) mapping the Proposal would remove less than 0.01 % of the overall extent of native woodland and forest vegetation communities in the locality, which include extensive alternative foraging	The project will remove foraging habitat for this species by removing 3.09 ha of native woodland vegetation. Based on available NPWS (2002) mapping the Proposal would remove less than 0.01 % of the overall extent of native woodland and forest vegetation communities in the locality, which include extensive alternative foraging habitat in habitats along the Hinchinbrook Creek Corridor and in vegetation to the west of the M7.

Criteria	Eastern Bentwing Bat	Large-footed Myotis	Greater Broad-nosed Bat
	The remainder of the development footprint is derived grassland or disturbed cleared land. Eastern Bentwing Bats 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.	habitat in habitats along the Hinchinbrook Creek Corridor and in vegetation to the west of the M7. There is also extensive foraging habitat for this species in the Hinchinbrook Creek corridor, and the operational northern basin would provide suitable foraging habitat for the species over the longer-term.	The remainder of the development footprint is derived grassland or disturbed cleared land. Greater Broad-nosed Bats 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.
d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;	The study area contains six species declared as noxious weeds in Liverpool LGA. The Project may marginally increase the incidence of weeds in adjoining areas of native and exotic grassland through edge effects. Increased weed invasion in these areas is not likely to alter their habitat value for these threatened microbats, which may forage above open grassland areas but are more reliant on the presence of woodland habitats. Soil protection measures and techniques would be implemented during and following construction, to prevent the transmission of weed propagules to downstream areas via runoff from disturbed areas, including vegetation clearing areas, construction laydown areas and access roads. The proposal is unlikely to lead to an increase in feral animals in the study area.		
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;	The Proposal will remove 3.09 ha of native woodland that is foraging habitat for this species, and a small number of man-made structures which may provide roost habitats for this species outside the breeding season. As discussed above, there are extensive areas of suitable alternative habitat in the locality.	The project will remove approximately 0.20 ha of freshwater wetlands on site. The majority of these wetlands are unsuitable foraging habitat for this species, being generally well vegetated and lacking open water. Given the proximity of Hinchinbrook Creek, which has long stretches of suitable foraging habitat for this species, the removal of these resources is unlikely to threaten the persistence of local populations of this species. Further, these impacts would only be short term as the operational northern basin would provide	The Proposal will remove 3.09 ha of native woodland that is potential foraging habitat for this species, and 5 hollow-bearing trees that are potential roost sites. As discussed above, there are extensive areas of suitable alternative habitat in the locality.

Criteria	Eastern Bentwing Bat	Large-footed Myotis	Greater Broad-nosed Bat
		suitable foraging habitat for the species over the longer-term. The Proposal will remove 5 hollow-bearing trees that are potential roost sites. Based on available NPWS (2002) mapping the Proposal would remove less than 0.01 % of the overall extent of native woodland and forest vegetation communities in the locality.	
f) affects natural revegetation and recolonisation of existing species following disturbance.	Construction of the Proposed infrastructure would require the clearing or permanent modification of native vegetation within the development footprints for the northern basin and spillway. Existing vegetation species would not be able to regenerate in these areas, although areas will be revegeted with native wetland species and include designed habitat features such as woody debris, sandstone boulders and fringing habitat for wetland plants. The adjoining batters and corridor would be revegetated with species representative of adjoining intact native vegetation and appropriate to the modified geomorphology of the site. The proposed offset strategy will also involve rehabilitation of areas of native vegetation on the eastern bank of the Hinchinbrook Creek corridor.		
iii) Does the project affect any threatened species or populations that are at the limit of its known distribution?	The project's location is not near the limit of distribution for any of these species.		
iv) How is the project likely to affect current disturbance regimes?	The site for the proposal is located within the old Hoxton Park Airport, in an area containing remnant and regenerating native vegetation. The M7 lies immediately to the west of the area. The site is otherwise surrounded by previously cleared and disturbed land. The vegetation within the site is therefore highly disturbed, and currently subject to edge effects and weeds. Much of the remaining area within the old airport site is proposed for development as an employment zone. Disturbances are therefore likely to be similar to what are presently occurring at the site.		
a) modifies the intensity and frequency of fires;	Fire is very rare in the area. The proposed development is not likely to alter the intensity or frequency of fires.		

Criteria	Eastern Bentwing Bat	Large-footed Myotis	Greater Broad-nosed Bat
b) modifies flooding flows;	The Proposal would substantially alter surface water drainage patterns within the footprint of the proposed northern basin. The area thus affected would only contain disturbed environments and so this modification would not directly affect any remaining areas of habitat for these threatened microbats. The Proposal would also modify surface water flows across the broader study area by channelling storm water into the northern basin and then gradual discharge to Hinchinbrook Creek via the return drain. The northern basin is part of Liverpool City Council's detention strategy for Hinchinbrook Creek. The northern basin will follow stormwater best management practices (BMPs) and will eliminate or minimise the effects of excess runoff generated by the newly-constructed impervious surfaces for the development, including roads, driveways, parking lots and rooftops. This would be expected to have net positive impacts on microbat habitat in native vegetation in the locality by mitigating potential negative impacts of other developments in the locality.		
v) How is the project likely to affect habitat connectivity?			
a) creates a barrier to fauna movement;	Microbats are highly mobile. The Eastern Bent-wing Bat forages in a range of habitat types, including forests and open grasslands. The proposed development will not create a barrier to movement for this species.	Microbats are highly mobile. The Large-footed Myotis moves between forested areas for roosting and wetland areas for hunting. The proposed development will not create a barrier to movement for this species.	Microbats are highly mobile. The Greater Broad-nosed Bat forages in a range of habitat types, including forests and open grasslands. The proposed development will not create a barrier to movement for this species.
b) removes remnant vegetation or wildlife corridors; and	The proposed action is unlikely to significantly increase habitat fragmentation or isolation in the area. The removal of vegetation for the proposed northern basin will increase the degree of separation between areas of intact habitat in the locality. Woodland within the northern basin footprint currently comprises a 'stepping stone' area of habitat between Hinchinbrook Creek and vegetated areas to the west of the site. The proposed action would increase the gap between woodland vegetation by up to 150m. The presence of the M7 immediately to the west of the site is likely to represent a far more significant barrier to microbat movement between these habitats than the increased distance resulting from this development. In this context the removal of habitat within the northern basin would comprise a relatively minor increase in the degree of habitat fragmentation in the locality.		
c) modifies remnant vegetation or wildlife corridors.	The Proposal will not involve the modification of any remnant native vegetation or wildlife corridors.		
vi) How is the project likely to affect critical habitat?	There is no recommended or declared critical habitat of relevance to any of these species.		

Criteria	Eastern Bentwing Bat	Large-footed Myotis	Greater Broad-nosed Bat
Conclusion	Based on consideration of the above criteria the Proposal is unlikely to have a significant effect on local populations of these threatened microbat species.		

11.1.3 Grey-headed Flying Fox

Criteria	Grey-headed Flying-fox
	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). Grey-headed Flying-foxes travel up to 50 km a night to forage. They feed on fruit, flowers, pollen and nectar. Preferred foraging trees are predominately from the Myrtaceae family, and they also forage from native figs and cultivated fruit trees (Churchill, 2008).
i) How is the project likely to affect the lifecycle of a threatened species and/or population?	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.
a) displaces or disturbs threatened species and/or populations;	The study area does not contain any roost camps of this species, and direct impacts will be limited to the removal of 3.09 ha of potential foraging habitat (see criteria e below). Therefore the Proposal will not displace or disturb any resident individuals of this species. The proposed development may disturb some foraging ndividuals through increased light, noise and traffic during construction. However these impacts are likely to be minor in the context of existing disturbance at the site, including the adjacent M7 motorway.
b) disrupts breeding cycle;	No roost camps were recorded at the site and none are known from the locality. The closest known roost camp is approximately 5km to the east of the site in the Cabramatta Creek riparian corridor, Cabramatta (pers. obs.). The breeding cycle of this species is therefore unlikely to be affected by the Proposal.
c) disturbs the dormancy period;	Not applicable to this species.
d) disrupts roosting behaviour;	No roost camps were recorded at the site and none are known from the locality. The closest known roost camp is approximately 5km to the east of the site in the Cabramatta Creek riparian corridor, Cabramatta (pers. obs.). The roosting behaviour of the species is therefore unlikely to be affected by the Proposal.
e) changes foraging behaviour;	The development would have an impact on the species through removal of 3.09 ha 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 for this

Criteria	Grey-headed Flying-fox
	highly mobile species, which may travel up to 50km to forage.
f) disrupts pollination cycle; g) disturbs seedbanks; or h) disrupts recruitment (i.e. germination and establishment of plants);	Not applicable
i) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).	Not applicable
j) affects migration and dispersal ability;	Clearing of native vegetation would not significantly affect connectivity of habitat for this highly mobile species.
ii) How is the project likely to affect the habitat of a threatened species, population or ecological community?	
a) disturbs any permanent, semi permanent or ephemeral water bodies;	The Proposal will remove 0.20 ha of freshwater wetland habitats, however these are small, isolated and would have very little habitat value for this species.
b) degrades soil quality;	Soil protection measures and techniques would be implemented during and following construction. 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. The local topography of the northern basin footprint has been extensively modified by drainage diversion and works. The construction footprint for the northern basin could be effectively isolated from sensitive receptors with relatively minor additional sediment control works. Habitat for the Grey-headed Flying-fox within the construction footprint will be permanently removed, so any decrease in soil quality in this area will not be relevant to this species.
c) clears or modifies native vegetation;	The development will remove approximately 3.09 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 0.01 % of the overall extent of native woodland and forest communities in the locality.
d) introduces weeds, vermin or	The study area contains six species declared as noxious

Criteria	Grey-headed Flying-fox
feral species or provides conditions for them to increase and/or spread;	weeds in Liverpool LGA. The Project will not increase weed invasion in any areas of potential habitat for this species as there are no areas of adjoining woodland vegetation likely to be affected by activities withi nthe footprint for the northern basin. Soil protection measures and techniques would be implemented during and following construction, to prevent the transmission of weed propagules to downstream areas via runoff from disturbed areas, including vegetation clearing areas, construction laydown areas and access roads. The proposal is unlikely to lead to an increase in feral animals in the study area.
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;	The Proposal will remove 3.09 ha of native woodland that is potential foraging habitat for this species. Based on available NPWS (2002) mapping the Proposal would remove less than 0.01 % of the overall extent of native woodland and forest communities within a 10km radius of the site.
f) affects natural revegetation and recolonisation of existing species following disturbance.	Existing species comprising foraging habitat for the Grey-headed Flying-fox will not be able to recolonise the northern basin footprint following construction. The proposed offset plan for the Proposal will involve the rehabiliation of areas of native vegetation within the Hinchinbrook Creek corridor, potentially imporving the habitat value of this area for the Grey-headed Flying-fox.
iii) Does the project affect any threatened species or populations that are at the limit of its known distribution?	The project's location is not near the limit of distribution for this species.
iv) How is the project likely to affect current disturbance regimes?	The site for the proposal is located within the old Hoxton Park Airport, in an area containing remnant and regenerating native vegetation. The M7 lies immediately to the west of the area. The site is otherwise surrounded by previously cleared and disturbed land. The vegetation within the site is therefore highly disturbed, and currently subject to edge effects and weeds. Much of the remaining area within the old airport site is proposed for development as an employment zone. Disturbances are therefore likely to be similar to what are presently occurring at the site.
a) modifies the intensity and frequency of fires;	Fire is very rare in the area. The proposed development is not likely to alter the intensity or frequency of fires.
b) modifies flooding flows;	The Proposal would substantially alter surface water drainage patterns within the footprint of the proposed northern basin. The area thus affected would only contain disturbed environments and so this modification would not directly affect any remaining areas of habitat for this species. The Proposal would also modify surface water flows across the broader study area by channelling storm water into the northern basin and then gradual discharge to Hinchinbrook

Criteria	Grey-headed Flying-fox
	Creek via the return drain. The northern basin is part of Liverpool City Council's detention strategy for Hinchinbrook Creek. The northern basin will follow stormwater best management practices (BMPs) and will eliminate or minimise the effects of excess runoff generated by the newly-constructed impervious surfaces for the development, including roads, driveways, parking lots and rooftops. This would be expected to have net positive impacts on Grey-headed Flying-fox habitat in native vegetation in the locality by mitigating potential negative impacts of other developments in the locality.
v) How is the project likely to effect habitat connectivity?	
a) creates a barrier to fauna movement;	The Grey-headed Flying-fox travels large distances over urban areas each night when foraging. The proposed development will not create a barrier to movement for this species.
b) removes remnant vegetation or wildlife corridors; and	The proposed action is unlikely to significantly increase habitat fragmentation or isolation in the area. The removal of vegetation for the proposed northern basin will increase the degree of separation between areas of intact habitat in the locality. Woodland within the northern basin footprint currently comprises a 'stepping stone' area of habitat between Hinchinbrook Creek and vegetated areas to the west of the site. The proposed action would increase the gap between woodland vegetation by up to 150m. The presence of the M7 immediately to the west of the site is likely to represent a far more significant barrier to Grey-headed Flying-fox movement between these habitats than the increased distance resulting from this development. In this context the removal of habitat within the northern basin would comprise a relatively minor increase in the degree of habitat fragmentation in the locality.
c) modifies remnant vegetation or wildlife corridors.	The Proposal will not modify any remnant vegetation or wildlife corridors.
vi) How is the project likely to affect critical habitat?	There is no recommended or declared critical habitat of relevance to this species.
Conclusion	Based on consideration of the above criteria, the Proposal is unlikely to have a significant impact on the Grey-headed Flying-fox.

11.1.4 Cumberland Land Snail

Criteria	Cumberland Land Snail
	The Cumberland Land Snail 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,

Criteria	Cumberland Land Snail
	length of life span, dispersal patterns and over what distances individuals can move (DECCW 2010f).
i) How is the project likely to affect the lifecycle of a threatened species and/or population?	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.
a) displaces or disturbs threatened species and/or populations;	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 alternative areas of intact habitat within the study area 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.
b) disrupts breeding cycle;	The 3.09 ha of Shale Plains Woodland to be removed within the footprint of the northern basin is an isolated patch surrounded by derived grassland and cleared land. 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. Any individuals in this area would be completely isolated from the remainder of the local population and would make a minor contribution to its long term viability.
c) disturbs the dormancy period;	Not applicable
d) disrupts roosting behaviour;	Not applicable
e) changes foraging behaviour;	The development would have an impact on the species through removal of foraging habitat in native vegetation within the development footprint. Given the isolation of the patch of vegetation to be removed, this removal is unlikely to affect the foraging behaviour of any individuals outside the immediate disturbance area.
f) disrupts pollination cycle; g) disturbs seedbanks; or h) disrupts recruitment (i.e. germination and establishment of plants);	Not applicable
i) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).	Not applicable
j) affects migration and dispersal ability;	The 3.09 ha of Shale Plains Woodland to be removed within the footprint of the northern basin is an isolated patch surrounded by derived grassland and cleared land. Habitat in this area is already completely isolated from the remainder of

Criteria	Cumberland Land Snail
	the local occurrence in respect to snail movement.
ii) How is the project likely to affect the habitat of a threatened species, population or ecological community?	
a) disturbs any permanent, semi permanent or ephemeral water bodies;	Not applicable
b) degrades soil quality;	Habitat for this species within the northern basin will be permanently removed, and any decrease in soil quality in this area will therefore not affect any areas of remaining habitat for the species. Soil protection measures and techniques would be implemented during and following construction. 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. The local topography of the northern basin footprint has been extensively modified by drainage diversion and works. The construction footprint for the northern basin could be effectively isolated from sensitive receptors with relatively minor additional sediment control works.
c) clears or modifies native vegetation;	Removal of potential habitat includes a relatively isolated patch of 3.09 ha of Shale Plains Woodland within the footprint of the northern basin.
d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;	The study area contains six species declared as noxious weeds in Liverpool LGA. The Project will not increase weed invasion in any areas of potential habitat for this species as there are no areas of adjoining woodland vegetation likely to be affected by activities within the footprint for the northern basin. Soil protection measures and techniques would be implemented during and following construction, to prevent the transmission of weed propagules to downstream areas via runoff from disturbed areas, including vegetation clearing areas, construction laydown areas and access roads. The proposal is unlikely to lead to an increase in feral animals in the study area.
e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;	The Proposal will remove 3.09 ha of native woodland that comprises potential foraging and sheltering habitat for this species.
f) affects natural revegetation and recolonisation of existing species following disturbance.	Construction of the Proposed infrastructure would require the clearing of native vegetation within the development footprints for the northern basin and spillway. Exisitng species comprising habitat for this species will not be able to recolonise the disturbance footprint after construction. The proposed offset plan for the Proposal will involve the rehabilitation and revegetation of areas of native vegetation

Criteria	Cumberland Land Snail
	within the Hinchinbrook Creek corridor, which will potentially increase the habitat value of this area for the Cumberland land Snail.
iii) Does the project affect any threatened species or populations that are at the limit of its known distribution?	The project's location is not near the limit of distribution for this species.
iv) How is the project likely to affect current disturbance regimes?	The site for the proposal is located within the old Hoxton Park Airport, in an area containing remnant and regenerating native vegetation. The M7 lies immediately to the west of the area. The site is otherwise surrounded by previously cleared and disturbed land. The vegetation within the site is therefore highly disturbed, and currently subject to edge effects and weeds. Much of the remaining area within the old airport site is proposed for development as an employment zone. Disturbances are therefore likely to be similar to what are presently occurring at the site.
a) modifies the intensity and frequency of fires;	Fire is very rare in the area. The proposed development is not likely to alter the intensity or frequency of fires.
b) modifies flooding flows;	The Proposal would substantially alter surface water drainage patterns within the footprint of the proposed northern basin. The area thus affected would only contain disturbed environments and so this modification would not directly affect any remaining areas of habitat for this species. The Proposal would also modify surface water flows across the broader study area by channelling storm water into the northern basin and then gradual discharge to Hinchinbrook Creek via the return drain. The northern basin is part of Liverpool City Council's detention strategy for Hinchinbrook Creek. The northern basin will follow stormwater best management practices (BMPs) and will eliminate or minimise the effects of excess runoff generated by the newly-constructed impervious surfaces for the development, including roads, driveways, parking lots and rooftops. This would be expected to have net positive impacts on Cumberland Land Snail habitat in native vegetation in the locality by mitigating potential negative impacts of other developments in the locality.
v) How is the project likely to affect habitat connectivity?	
a) creates a barrier to fauna movement;	The 3.09 ha of Shale Plains Woodland to be removed within the footprint of the northern basin is an isolated patch surrounded by derived grassland and cleared land. Habitat in this area is already completely isolated from the remainder of the local occurrence in respect to snail movement.
b) removes remnant vegetation or wildlife corridors; and	The removal of vegetation for the proposed northern basin will increase the degree of separation between areas of intact habitat in the locality. These areas of habitat are already fragmented with respect to the limited mobility of the

Criteria	Cumberland Land Snail
	Cumberland Land Snail. The M7 and the cleared land within the former airport site already comprise significant barriers for movement of the species. In this context the proposed northern basin would not significantly increase the degree of fragmentation of habitat in the locality.
c) modifies remnant vegetation or wildlife corridors.	The Proposal will not modify areas of remnant native vegetation or wildlife corridors.
vi) How is the project likely to affect critical habitat?	There is no recommended or declared critical habitat of relevance to this species.
Conclusion	Based on consideration of the above criteria, the Proposal is unlikely to have a significant impact on 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 an isolated 3.09 ha patch of Shale Plains Woodland within the footprint of the northern basin. The value of the vegetation and habitat to be removed is limited by the isolation of this patch of CEEC. Highly mobile species of fauna and plants with widely dispersed pollen and seed, such as grasses, would be able to traverse the gaps in habitat surrounding the patch. However many ecological functions such as pollination, seed fall, seedling recruitment and fauna movement would not occur across gaps in habitat for many species within the CEEC. NPWS (2002) conservation significance mapping classed the patch to be removed as 'other native vegetation' with lesser value for maintaining regional populations of native biota.

The immediate population of the CEEC within the vicinity of the norhtern basin includes an extensive area within the Hinchinbrook Creek riparian corridor and large, but disjunct patches to the west of the M7. 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 0.02 % 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). In this context the direct removal of 3.09 ha of Shale Plains Woodland is not likely to comprise a significant reduction in the extent of the community.

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

The proposal will remove a relatively isolated patch of the CEEC. This patch is fragmented from the CEEC to the west by the M7 but is within 100 m (and is connected by an underpass) and is therefore contiguous with it according to the Threatened Species Scientific Committee definition (DEWHA 2010b). The patch is already separated by over 100m from the CEEC present within the Hinchinbrook Creek riparian corridor to the east.

The removal of vegetation for the proposed northern basin will increase the distance between habitat for the CEEC along Hinchinbrook Creek and vegetated areas to the west of the site by up to 150m. The former Hoxton park airport site and the M7 immediately to the west of the site have fragmented the local occurrence of CPSW-SGTF. In this context the northern basin would not significantly increase the degree of fragmentation of habitat in the locality.

Adversely affect habitat critical to the survival of an ecological community

The vegetation that comprises the CEEC within the footprint of the northern basin is an isolated patch surrounded by derived grassland and cleared land. Habitat in this area is isolated from the remainder of the local population and would make a minor contribution to its long term viability. Therefore the northern basin footprint does not comprise habitat critical to the survival of the CEEC as defined by the DEWHA (2009) guidelines.

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

The Proposal would substantially alter surface water drainage patterns within the footprint of the proposed northern basin. The area thus affected would only contain disturbed environments and so this modification would not directly affect any remaining areas of CPSW-SGTF in the locality.

The Proposal would also modify surface water flows across the broader study area by channelling storm water into the northern basin and then gradual discharge to Hinchinbrook Creek via the return drain. The northern basin is part of Liverpool City Council's detention strategy for Hinchinbrook Creek. The northern basin will follow stormwater best management practices (BMPs) and will eliminate or minimise the effects of excess runoff generated by the newly-constructed impervious surfaces for the development, including roads, driveways, parking lots and rooftops. This would be expected to have net positive impacts on CPSW-SGTF in the locality by mitigating potential negative impacts of other developments in the locality.

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

Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting

The northern basin footprint would remove a small, isolated patch of CPSW-SGTF. While the flora and fauna in this patch currently make a genetic contribution to the occurrence in the locality, its removal is not likely to substantially change the composition of the community in the locality, as much larger

patches are present (for example the patch to the west of the M7) that are likely to include a greater species and genetic diversity.

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

Much of the CEEC has been cleared from the Cumberland Plain, and most of what remains is in a degraded and fragmented state. Few large or high quality remnants of the ecological community now remain in comparison to those prior to European settlement (DEWHA 2010b).

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

The study area contains six species declared as noxious weeds in Liverpool LGA. The Project is not likely to increase the incidence of weeds in this area as the entire patch of CPSW-SGTF would be removed. Soil protection measures and techniques would be implemented during and following construction, to prevent the transmission of weed propagules to downstream areas via runoff from disturbed areas, including vegetation clearing areas, construction laydown areas and access roads. There are unlikely to be impacts from runoff on any nearby patches of CPSW-SGTF. The proposal is unlikely to lead to an increase in feral animals in any nearby patches of CPSW-SGTF.

- 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

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 a CEMP for the Proposal are likely to mitigate against negative impacts outside of the immediate surface disturbance footprint.

The proposed northern basin is designed to attenuate surface water flows by storing water for a limited period of a time and slowly releasing it into Hinchinbrook Creek via an existing open channel. The northern basin will follow stormwater best management practices (BMPs) and will eliminate or minimise the effects of excess runoff generated by the newly-constructed impervious surfaces for the development, including roads, driveways, parking lots and rooftops.

Interfere with the recovery of an ecological community.

Based on available NPWS (2002) mapping the Proposal would remove approximately 0.02 % of the extent of this vegetation type in the locality. The vegetation to be removed is an isolated patch surrounded by derived grassland and cleared land. Habitat in this area is isolated from the remainder of the local population and would make a minor contribution to its long term viability. The removal of this patch of vegetation 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.

There is no specific recovery plan for CPSW-SGTF. 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 are 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.

Conclusion

The Proposal will reduce the extent of this community by removing or modifying a total of approximately 3.09 of Shale Plains Woodland within the footprint of the northern basin. The value of the vegetation and habitat to be removed is limited by the isolation of this patch of CEEC. This remnant patch would make a relatively minor constribution to the viability of the local population of the CEEC.

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 and large, but disjunct patches to the west of the M7. Based on available NPWS (2002) mapping the Proposal would remove approximately 0.02 % 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.

Consideration of the above assessment criteria concludes that the development is considered unlikely to have a significant impact on CPSW-SGTF. However, given that CPSW-SGTF is listed as a 'critically endangered ecological community', it is recommended that the proposed development be Referred to the Commonwealth Minister to confirm the activity is not a controlled action and to provide certainty that no further assessment or approval under the EPBC Act is required.

GHD

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Document Status

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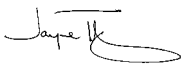
0	B. Harrington/ R. Hamer	J. Tipping		D. Williams		21.10.10
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