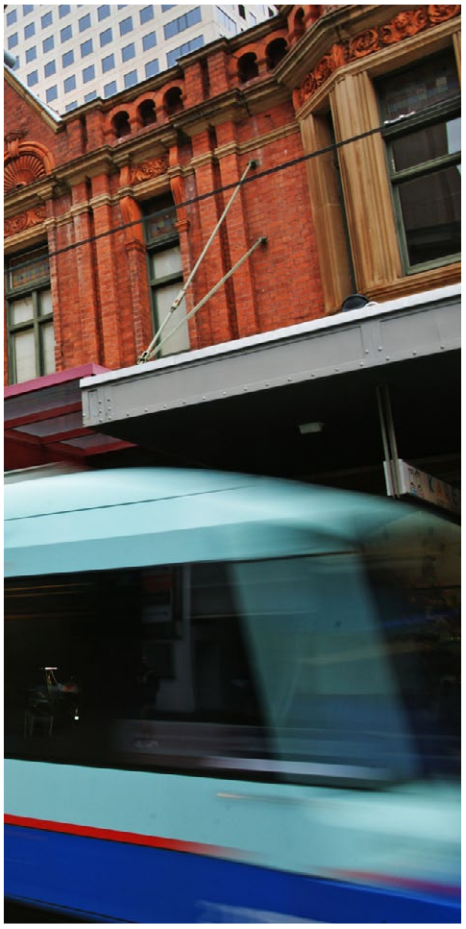
Transport NSW



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SYDNEY LIGHT RAIL EXTENSION
STAGE 1 – INNER WEST EXTENSION
Volume 2 - Technical Reports

NSW GOVERNMENT Transport

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ECOLOGY

Ecological assessment: Sydney Light Rail Extension – Stage 1

September 2010

Transport NSW

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Glossary

Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: ▪ genetic diversity — the variety of genes (or units of heredity) in any population ▪ species diversity — the variety of species ▪ ecosystem diversity — the variety of communities or ecosystems.
Bioregion (region)	A bioregion defined in a national system of bioregionalisation. For this study this is the Sydney Basin bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway & Cresswell 1995).
Critical Habitat	The whole or any part or parts of an area or areas of land comprising the habitat of an Endangered species, an Endangered population or an Endangered ecological community that is critical to the survival of the species, population or ecological community (Department of Environment and Conservation 2004). Critical habitat is listed under either the *Threatened Species Conservation Act 1995* or the *Environment Protection and Biodiversity Conservation Act 1999* and both the state (Department of Environment, Climate Change and Water) and Federal (Department of the Environment, Water, Heritage and the Arts) Directors-General maintain a register of this habitat. Capitalisation of the term 'Critical Habitat' in this report refers to the habitat listed specifically under the relevant state or Commonwealth legislation.
Department of Environment and Climate Change	The former name for the NSW Department of Environment, Climate Change and Water.
Department of Environment, Climate Change and Water	Broadly, the Department of Environment, Climate Change and Water works towards a healthy environment cared for and enjoyed by the whole NSW community; manages the state's natural resources, including biodiversity, soils and natural vegetation; manages natural and cultural heritage across the state's land and waters; acts to minimise the impacts of climate change; promotes sustainable consumption, resource use and waste management; regulates activities to protect the environment; and conducts biodiversity, plant, environmental and cultural heritage research to improve decision making.
Department of the Environment and Heritage	The former name for the Commonwealth Department of the Environment, Water, Heritage and the Arts.
Department of the Environment and Water Resources	The former name for the Commonwealth Department of the Environment, Water, Heritage and the Arts.

Department of the Environment, Water, Heritage and the Arts	The department develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage and administers the *Environment Protection and Biodiversity Conservation Act 1999*. The Commonwealth Department of the Environment, Water, Heritage and the Arts changed their name from the Department of the Environment and Water Resources in 2007, which was previously the Department of the Environment and Heritage.
Industry and Investment NSW	Formerly the Department of Primary Industries.
Ecological community	An assemblage of species occupying a particular area.
Environmental weed	Any plant that is not native to a local area that has invaded native vegetation.
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
GPS	Global Positioning System - a navigational tool that uses radio receivers to pick up signals from four or more special satellites to provide precise determination of location.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.
Key Threatening Processes	A process that threatens, or could threaten, the survival, abundance or evolutionary development of native species, populations or ecological communities (Department of Environment and Conservation 2004). Key threatening processes are listed under the *Threatened Species Conservation Act 1995*, the *Fisheries Management Act 1994* and the *Environment Protection and Biodiversity Conservation Act 1999*. Capitalisation of the term 'Key Threatening Processes' in this report refers to those processes listed specifically under the relevant state and Commonwealth legislation.
Likely	Taken to be a real chance or possibility (Department of Environment and Conservation 2004).
Local population	The population that occurs within the site, unless the existence of contiguous or proximal occupied habitat and the movement of individuals or exchange of genetic material across the boundary can be demonstrated as defined by Department of Environment and Climate Change (2007b).
Locality	The area within a 10 km of the site.
Migratory species	Species listed as Migratory under the *Environment Protection and Biodiversity Conservation Act 1999* relating to international agreements to which Australia is a signatory. These include Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Capitalisation of the term 'Migratory' in this report refers to those species listed as Migratory under the *Environment Protection and Biodiversity Conservation Act 1999*.

Noxious weed	An introduced species listed under the *Noxious Weeds Act 1993*. Under the Act, noxious weeds have specific control measure and reporting requirements.
NSW	New South Wales
Priorities Action Statements (PAS)	Priorities Action Statements outline the broad strategies and detailed priority actions to be undertaken in NSW to promote the recovery of Threatened species, population and ecological communities and manage key threatening processes (Department of Environment and Climate Change 2007a)
Protected species	Those species defined as protected under the *National Parks and Wildlife Act 1974*. Includes all native animals, as well as all native plants listed on Schedule 13 of the *National Parks and Wildlife Act 1974*.
Recovery plan	A plan prepared under the *Threatened Species Conservation Act 1995*, the *Fisheries Management Act 1994* or the *Environment Protection and Biodiversity Conservation Act 1999* to assist the recovery of a Threatened species, population or ecological community.
Significant	Important, weighty or more than ordinary as defined by Department of Environment, Climate Change and Water (2007b).
Study Area	The extent of indirect impacts, which may occur outside of the subject site as consequence of impacts within the subject site. This is taken to be an area of up to 100 m from the edge of the construction footprint
Subject Site	The extent of direct impacts that will be affected as a consequence of the project. This includes the construction footprint of the project, associated with proposed infrastructure and potential construction work sites.
Threatened biodiversity	Threatened species, populations or ecological communities as listed under the *Threatened Species Conservation Act 1995*, the *Fisheries Management Act 1994* or the *Environment Protection and Biodiversity Conservation Act 1999*.
Threatened species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, Endangered or Critically Endangered (collectively referred to as Threatened) under the *Threatened Species Conservation Act 1995*, the *Fisheries Management Act 1994* or the *Environment Protection and Biodiversity Conservation Act 1999*. Capitalisation of the terms 'Threatened', 'Vulnerable', 'Endangered' or 'Critically Endangered' in this report refers to listing under the relevant state and/or Commonwealth legislation.
TSC Act	NSW *Threatened Species Conservation Act 1995.*
Viable local population	A population that has the capacity to live, develop and reproduce under normal conditions, unless the contrary can be conclusively demonstrated through analysis of records and references (2007b).

1. Introduction

Transport NSW are undertaking an assessment under Part 3A of the *Environmental Planning and Assessment Act 1979* for the proposed Sydney Light Rail Extension Stage 1 project (the Project). The Project consists of construction of 5.6 km of light rail along the Rozelle goods line, from Lilyfield to Dulwich Hill. The SLRE will be integrated with the Cooks River to Iron Cove GreenWay. The proposed GreenWay is approximately 5.6 km long extending from the Cooks River at Earlwood in the south to Iron Cove in the north, following the line of the disused Rozelle freight corridor. This ecological assessment has been prepared as part of the broader environmental assessment and is concerned with impacts of the Project on biodiversity and ecological values.

1.1 Project description

In February 2010, the New South Wales (NSW) Government announced, as part of the Metropolitan Transport Plan, a $500 million commitment to extend the existing Sydney light rail system in the Inner West along the disused Rozelle goods line corridor from Lilyfield to Dulwich Hill and in the central business district (CBD) from Haymarket to Circular Quay via Barangaroo. This comprised:

- Stage 1 — an Inner West extension of 5.6 km along the disused Rozelle goods line corridor from Lilyfield to Dulwich Hill.
- Stage 2 — a Central Business District western corridor extension from Haymarket to Circular Quay via Barangaroo with consideration of a future light rail option from Circular Quay to Central via George Street.

Collectively these two stages are known as the Sydney Light Rail Extensions (SLRE).

In the 2010-11 NSW Budget, funding has been allocated to start construction on the SLRE Stage 1 (the Inner West extension) following an environmental assessment process, as well as to undertake pre-construction work on Stage 2.

In finalising the scope of work for the SLRE Stage 1 (the Inner West extension), the NSW Government took into account the many practical suggestions received from the community following the public release of the Sydney Light Rail - Inner West Extension Study (GHD 2010).

The community strongly favoured the inclusion of a walking and cycling shared path in the corridor, along with a number of Bushcare sites – termed a "GreenWay" - from the Cooks River to Iron Cove. On 19 July 2010, the NSW Government announced that the GreenWay would be included in the SLRE Stage 1 (the Inner West extension) project.

SLRE Stage 1 (the Inner West extension) including the GreenWay forms the project and is the subject of this ecological assessment.

An overview of the key features of the project is shown on Figures 1-1a to 1-1f and comprise:

- A 5.6 km extension of the light rail between the existing Lilyfield light rail stop and the proposed Dulwich Hill Interchange stop. The extension would be located within the existing disused Rozelle goods line corridor.

Figure 1-1a Key features of the project

Light rail alignment
Proposed light rail stops
Local government area
Watercourse
Existing GreenWay shared path (upgraded)
New GreenWay on-street cycle path
New GreenWay shared path (at-grade)
Potential future bushcare/landscaping
Potential substation location

Figure 1-1b Key features of the project

Light rail alignment
Proposed light rail stops
Local government area
Watercourse
Existing GreenWay shared path (upgraded)
New GreenWay shared path (at-grade)
New GreenWay shared path (elevated)
Existing bushcare site
Potential future bushcare/landscaping
Potential substation location

Figure 1-1c Key features of the project

Figure 1-1d Key features of the project

Figure 1-1e Key features of the project

Figure 1-1f Key features of the project

- Nine new light rail stops — Leichhardt North, Hawthorne, Marion, Taverners Hill, Lewisham West, Waratah Mills, Arlington, Dulwich Grove and Dulwich Hill Interchange.
- Minor modifications to the existing Lilyfield stop and surrounding track to tie-in new track and overhead wiring infrastructure with the existing light rail.
- Modifications to the existing northern car park at Bedford Crescent to accommodate the Dulwich Hill Interchange stop.
- Raising of the existing bridge over Parramatta Road which will carry the light rail.
- Provision of the GreenWay, a shared pedestrian and cycle path from Iron Cove at Dobroyd Point to the northern bank of the Cooks River.
- Provision of pedestrian linkages (access pathways) to surrounding neighbourhoods to enable access to the GreenWay shared path and light rail stops.
- Modification of the existing road bridge structures to accommodate the GreenWay shared path – namely at Hercules Street, Old Canterbury Road, Constitution Road, Davis Street and Longport Street.
- New pedestrian/cycle bridge at Parramatta Road adjacent to the light rail overbridge.
- New pedestrian/cycle bridge across the Hawthorne Canal near Hawthorne stop.
- New infrastructure to ensure accessibility and connectivity between the shared path, local streets and light rail stops.
- Provision of sites for Bushcare and vegetation remediation areas in order to provide for existing, and an increase in, local habitat for fauna.
- Appropriate safety fencing or separation of shared path and light rail operations, and the light rail operations and the heavy passenger rail operations at Dulwich Hill.
- Provision of overhead wiring, substation and utilities infrastructure.

1.2 Ecological studies completed for the project

A number of ecological studies have been completed with regard the Project. The *Sydney Light Rail – Inner West Extension Study* (GHD 2010) has been prepared and exhibited for the project focusing on the rail corridor. However, the ecology assessment was only a desk based review and did not include any field surveys. This review suggested that the impacts of the project would be of moderate significance due to vegetation removal resulting in loss of habitat for Threatened fauna as well as increased risk of collision during operation. Ecological surveys were recommended to form part of the environmental assessment for early works in order to ground truth vegetation communities, determine the likelihood or presence of Threatened species and the conservation values of the study area (GHD 2010).

A one day flora and fauna survey was undertaken for the Rozelle Goods Line- rail track maintenance and reconstruction, Review of Environmental Factors (Transport NSW 2010b) on 8 June 2010 by Biosis Research (Biosis Research 2010b). This survey was largely habitat based and included:

- incidental observations of flora and fauna

- general habitat assessment
- vegetation and fauna habitat condition assessment
- active searching and listening for fauna
- looking for indirect evidence of Long-nosed Bandicoots, such as diggings and scats.

The preliminary ecological assessment failed to detect Threatened ecological communities, Threatened species of plant or their habitats. No Threatened or migratory fauna were recorded, however the site was considered to provide potential habitat for 12 threat-listed species of animal (Biosis Research 2010b). This study recommended further surveys including targeted surveys for:

- Grey-headed Flying-fox – spotlighting
- Long-nosed Bandicoot – including infra-red camera surveys with trapping and hair tubing undertaken if individuals are recorded.

The additional surveys for the Long-nosed Bandicoot were conducted by Biosis Research in July 2010 and presented in an assessment of significance (Biosis Research 2010a). The surveys, conducted using remote cameras, did not locate any Long-nosed Bandicoots. The most frequently recorded animal was the domestic cat with 15 different individuals recorded including rats, European Red Foxes, domestic dogs, Australian White Ibis, and Australian Magpie. The high incidence of feral predators recorded may suggest that the Long-nosed Bandicoot population may be suffering high predation stress. Surveys for indirect evidence did not record any signs of Long-nosed Bandicoot activity (Biosis Research 2010a).

The preliminary environmental assessment (Transport NSW 2010c) concluded that the Environmental Assessment for the project would include:

- identification of vegetation and potential habitat in and around the project that may be directly or indirectly affected during construction or operation
- consideration of the potential impacts to threatened fauna and habitat during operation
- presentation of a strategy to avoid, mitigate or offset impacts on vegetation, habitat and bush regeneration areas.

1.3 Aims

This ecological assessment aims to meet the Director-General's requirements namely, to consider:

- flora, fauna and habitat, with specific consideration of threatened and vulnerable flora, fauna and populations, including the Long-nosed Bandicoot (*Perameles nasuta*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and the Eastern False Pipistrelle Bat (*Falsistrellus tasmaniensis*) and the protection of urban bushland
- vegetation clearing (and resultant foraging, nesting, roosting habitat loss; fragmentation, connectivity and edge effects) and operational impacts
- ecological surveys commensurate within the biology/ecology of species and the extent of suitable habitat within and adjacent to the rail corridor

- take into account the:
  - Draft guidelines for Threatened species assessment (Department of Environment and Conservation & Department of Primary Industries 2005)
  - Threatened biodiversity survey and assessment: guidelines for developments and activities (Department of Environment and Conservation 2004).

Specifically, this report provides:

- a description of the existing environment and identification of the significance of biodiversity within the proposed freight rail corridor and GreenWay
- identification of flora and fauna habitats and Threatened ecological communities, populations and species that may be affected by the Project
- assessments of the potential construction and operational impacts of the Project in accordance with Part 3A *Environmental Planning and Assessment Act 1979* guidelines for species, populations and communities listed under the *Threatened Species Conservation Act 1995*
- assessments for species listed under the *Environment Protection and Biodiversity Conservation Act 199*9 following the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of the Environment and Heritage 2006)
- maps of the location of threatened flora and fauna and the location of any significant vegetation and habitats on site including significant trees
- recommendations regarding the need for more detailed study, monitoring or mitigation measures.

2. Legislative and statutory framework

This section outlines the state and Commonwealth legislation and statutory framework relevant to the assessment of biodiversity for the project.

2.1 State assessment framework

The project will be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*, which is the principle strategic planning and approval instrument in NSW. Part 3A outlines the approval framework for major infrastructure, or other development that in the opinion of the Minister for Planning, is of state or regional environmental planning significance.

Legislation relevant to biodiversity and the project is summarised in Table 2.1.

Table 2-1 Legislation and guidelines relevant to biodiversity

Legislation (governing authority)	Objectives	Relevance to current project
Environmental Planning and Assessment Act 1979 (Department of Planning)	To encourage the proper management, development and conservation of natural and artificial resources for the purpose of promoting the social and economic welfare of the community and a better environment.	As the principle planning instrument in NSW, this Act dictates the assessment and approval pathway for the proposal and thereby the factors for consideration for assessment of the significance to biodiversity, and the requirements to consider or seek authorization under other NSW legislation and planning policies.
National Parks and Wildlife Act 1974 (Department of the Environment, Climate Change and Water)	The objects of this Act are the conservation of nature and objectives, places or features of cultural value. This Act contains provisions that relate to the protection of native terrestrial fauna and some flora and endangered ecological communities in addition to indigenous cultural heritage.	Penalties relating to causing harm to native flora and fauna (including Threatened species, populations and communities) are outlined in this Act. Actions approved under Part 3A of the *Environmental Planning and Assessment Act 1979* are exempt from prosecution as long as the impact is within the levels approved.

Legislation (governing authority)	Objectives	Relevance to current project
Threatened Species Conservation Act 1995 (Department of the Environment, Climate Change and Water)	To conserve biological diversity and prevent the extinction and promote the recovery of threatened species, populations and ecological communities. To ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed.	Threatened biodiversity are listed under this Act. These lists provide a trigger of an assessment of threatened species that are known or likely to occur and are likely to be directly or indirectly affected by the proposal. Significance assessments for projects assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* are completed in accordance with the heads of consideration outlined in Draft guidelines for threatened species assessment (Department of Environment and Conservation & Department of Primary Industries 2005).
Fisheries Management Act 1994 (Industry and Investment NSW)	The objectives of this Act are to conserve, develop and share the fishery resources of the state for the benefit of present and future generations. Included in this objective is to conserve Threatened species, populations and ecological communities of fish and marine vegetation.	Threatened aquatic biodiversity are listed under this Act. Significance assessments must be completed for all Threatened ecological communities, populations and species listed under this Act that are recorded in the study area, or likely to occur, and which will be directly or indirectly affected by the Project. Significance assessments for projects assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* are completed in accordance with the heads of consideration outlined in Draft guidelines for threatened species assessment (Department of Environment and Conservation & Department of Primary Industries 2005). Under s.205 of this Act, a permit is required to harm any harm marine vegetation, including mangroves or seagrasses. However, an action approved under Part 3A of the *Environmental Planning and Assessment Act 1979* is exempt from requiring a s.205 permit.

Legislation (governing authority)	Objectives	Relevance to current project
SEPP19 – Bushland in Urban Areas	SEPP 19 – Bushland in Urban Areas applies to all bushland within the Sydney Metropolitan area that is zoned or reserved as public open space. The aim of SEPP19 is to preserve remnant vegetation within urban areas and for retention of bushland areas to be given priority over developments. The determining authority must consider what impact the clearing of bushland might have on soil erosion, siltation of streams and the spread of exotic weeds and plants.	Although SEPP19 only applies to projects assessed under Part 4 of the *Environmental Planning and Assessment Act 1979* that are approved by Local Council, the highly urbanised nature of the study area necessitates that any remaining patches of bushland have inherent value. As the GreenWay is a large area of urban bushland that exists within an otherwise urbanised environment, the objectives of SEPP19 have been taken into account in this assessment.

Part 3A of the *Environmental Planning and Assessment Act 1979* makes provisions for the streamlining of the assessment and carrying out of actions to which it applies (refer section 75U and 75V of the Act). Under this NSW approval pathway, the project is therefore afforded the following exemptions that relate to biodiversity:

- A permit under Sections 201 (dredging or reclamation work), 205 (Marine vegetation—regulation of harm) or 219 (Passage of fish not to be blocked) of the *Fisheries Management Act 1994.*
- Approvals under sections 89 (water use approvals), 90 (water management work approvals) and 91 (activity approvals) under the *Water Management Act 2000.*

Furthermore, only the Minister or the Director General can issue enforcement orders under the *Environmental Planning and Assessment Act 1979* to actions approved under Part 3A of the Act.

Section 75R of the *Environmental Planning and Assessment Act 1979* also provides that environmental planning instruments, other than State Environmental Planning Policies (SEPPs), do not apply to or in respect of a Part 3A project (including Local Environment Plans). Under Section 75J however, the Minister may (but is not required to) take into account the provisions of any environmental planning instrument that would not (because of Section 75R) apply to the project if approved.

2.2 Commonwealth assessment framework

Approval of an action under the *Environmental Planning and Assessment Act 1979* does not negate the requirement to consider the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.* The *Environment Protection and Biodiversity Conservation Act 1999* relates to projects that involve or impact upon matters of National Environmental Significance (NES) and addresses Australia's commitments to international environmental law and treaties. The *Environment Protection and Biodiversity Conservation Act 1999* identifies eight matters of NES:

- world heritage properties
- wetlands of international importance (listed under the Ramsar convention)

- Commonwealth marine areas
- listed Threatened species and ecological communities
- Migratory species protected under international agreements
- national heritage places
- The Great Barrier Reef Marine Park
- nuclear actions (including uranium mines).

Where a project or action has potential to impact on a matter of NES, it should be referred to the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) to determine whether the development is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999*. If the Minister determines that the proposed action is controlled under the *Environment Protection and Biodiversity Conservation Act 1999*, a formal assessment process is required.

3. Methods

This ecological assessment included both desk-based assessment of the literature and relevant databases, as well as field survey of the study area and surrounding landscape.

3.1 Personnel

The contributors to the preparation of this report, their qualifications and roles are listed in Table 2.1.

Table 3-1 Contributors and their roles

Name	Qualifications	Role
Lukas Clews	BSc, GradCertAppSci, MSciStud	Ecological assessment
Selga Harrington	BSc (Hons)	Ecological assessment
Martin Predavec	PhD, BSc (Hons)	Technical review

All work was carried out under the appropriate licences, including a scientific licence as required under Clause 22 of the National Parks and Wildlife Regulations 2002 and Section 132C of the *National Parks and Wildlife Act 1974,* and an Animal Research Authority issued by the Industry and Investment NSW (Agriculture).

3.2 Nomenclature

Names of plants used in this document follow Harden (Harden 1992, 1993, 2000, 2002) with updates from PlantNet (Royal Botanic Gardens 2010). Scientific names are used in this report for species of plant followed by the common names in brackets. Scientific and common names of plants are listed in Appendices A and B. Introduced species are identified within the text with an asterisk following the name, for example *Lantana camara**.

Names of vertebrates follow the Census of Australian Vertebrates (CAVS) database maintained by the Department of the Environment, Water, Heritage and the Arts (Department of the Environment Water Heritage and the Arts 2009a). Common names are used in the report for species of animal. Scientific names are included in species lists found in Appendix A and C.

3.3 Literature and database review

Records of Threatened species known or predicted to occur within the locality of the study area were obtained from a range of databases as detailed in Table 2.2. Available literature was reviewed including regional assessments as well as ecological surveys of the site, such as:

- Sydney Light Rail - Inner West extension study (GHD 2010)
- Preliminary ecological assessment: Sydney Light Rail Extension, Stage 1 (Biosis Research 2010b)
- Assessment of significance: Rozelle goods line track maintenance and reconstruction (Biosis Research 2010a).
- GreenWay- Cooks River to Iron Cove. Flora and fauna literature review (Ward 2010)
- Cooks River to Iron Cove GreenWay master plan and coordination strategy (GreenWay Coordination Strategy Working Group 2009)

- Rozelle Goods Line- rail track maintenance and reconstruction, Review of Environmental Factors (Transport NSW 2010b)
- Preliminary Environmental Assessment report (Transport NSW 2010c)
- Light rail and GreenWay integration plan (Transport NSW 2010a)
- GreenWay Bushcare management plan, preliminary report (ecological 2010)
- Fauna study, Marrickville LGA (AMBS 2007)
- Yuppie bandicoots of inner west Sydney - in hiding or urban renewal? (Leary et al. unpublished).

Table 3-2 Database searches

Database	Search date	Search area	Source
Threatened species, populations and communities database	9 August 2010	Sydney Metro Catchment Management Area (Pittwater Part B sub catchment)	Department of Environment and Climate Change (2010b)
Atlas of NSW Wildlife	9 August 2010	10 km radius centred on the study area.	Department of Environment Climate Change and Water (2010a).
Protected Matters Search Tool	March 2010	10 km radius centred on the study area.	Department of the Environment, Water, Heritage and the Arts (2010b).

3.4 Survey

Previous surveys of the study area have been conducted by Biosis Research (2010a; 2010b). Flora surveys and habitat based fauna surveys for the preliminary ecological assessment were conducted in June 2010 with supplementary targeted Long-nosed Bandicoot surveys undertaken via remote cameras over a two week period from 8 – 22 July 2010 and habitat searches conducted on the 8 and 26 July 2010. The survey found no evidence of the Long-nosed Bandicoot in the study area, with little additional information provided on how Long-nosed Bandicoots use the rail corridor or adjacent lands or how significant the habitat is for the species (Biosis Research 2010a).

The surveys conducted within the study area for this assessment build upon the data collected to provide a more comprehensive ecological assessment.

Site inspections were undertaken on 18 and 24 August and 2 September 2010 to determine the nature and condition of vegetation within the study area and the presence of fauna habitats (Table 3-3). The location of vegetation and habitats identified during the desktop review was ground-truthed. The location of significant habitat features were recorded and mapped including foraging resources, habitat trees, and vegetation community boundaries.

Table 3-3 Site inspections

Date	Team members	Nature of inspection
18 August	Martin Predavec	Daytime inspection of GreenWay and inspection of corridor from outside.
24 August	Lukas Clews	Daytime inspection of GreenWay and

	Selga Harrington	inspection of corridor from outside. Spotlighting within Greenway
2 September	Lukas Clews Martin Predavec	Daytime inspection from within rail corridor.

Particular attention was paid to species of conservation concern identified from the desktop analysis including Threatened and migratory species or locally significant species.
The potential presence of Threatened species of animal was determined based on a habitat assessment rather than targeted survey as this is a more conservative approach likely to include species that are difficult to detect.

Areas containing remnant vegetation and dense weed growth were searched for cryptic Threatened species and populations. This included searches for Grey-headed Flying-fox roosts and indirect evidence of Long-nosed Bandicoots. The undersides of bridges were inspected for signs of roosting activity by microchiropteran bats.

3.4.1 Flora

The floristic diversity and possible presence of Threatened species was assessed using random meander surveys in accordance with the NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (Department of Environment and Conservation 2004).

Due to the linear nature of the project, random meander surveys were completed along the entire length of the project corridor. Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random manner throughout the site recording all species observed, boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

3.4.2 Condition of vegetation communities

The condition of vegetation was assessed through general observation and comparison against this benchmark data as well as using parameters such as intactness, diversity, history of disturbance, weed invasion and health. Three categories were used to describe the condition of vegetation communities:

- **Good**: Vegetation still retains the species complement and structural characteristics of the pre-European equivalent. Such vegetation has usually changed very little over time and displays resilience to weed invasion due to intact groundcover, shrub and canopy layers.
- **Moderate:** Vegetation generally still retains its structural integrity, but has been disturbed and has lost some component of its original species complement. Weed invasion can be significant in such remnants.
- **Low:** Vegetation that has lost most of its species and is significantly modified structurally. Often such areas have a discontinuous canopy of the original tree cover, with very few shrubs. Exotic species, such as introduced pasture grasses or weeds, replace much of the indigenous ground cover. Environmental weeds are often co dominant with the original indigenous species.

Following the biometric methodology (NSW Department of Environment and Conservation 2007), woody vegetation, is considered in low condition vegetation when:

- overstorey percent foliage cover is <25% of the lower values of the overstorey per cent foliage cover benchmark for that vegetation type, AND either
  - less than 50% of vegetation in the ground layer is indigenous species, OR
  - greater than 90% is ploughed or fallow.

3.4.3 Fauna

Survey effort considered the methodology detailed in the NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (Department of Environment and Conservation 2004). However, as much of the subject site was already largely disturbed, fauna habitat assessments were completed to assess the likelihood of Threatened species of animal occurring in the study area. Habitat assessments included the assessment and identification of habitat features, hollow tree surveys, targeted habitat searches and random meanders.

During habitat assessments and random meanders, opportunistic recordings of species were made through incidental sightings, aural recognition of calls and observations of indirect evidence of species' presence (i.e. Long-nosed Bandicoot diggings). This provided supplementary information on faunal species presence. Collected hairs were analysed for identification by Georgiana Story (Scats About Australia).

Spotlighting was used primarily to target the Long-nosed Bandicoot. However, the spotlighting technique was also used to locate arboreal, flying, and other ground-dwelling mammals, and nocturnal birds. Spotlighting was performed after dusk at four sites (Johnson Park, Hoskins Park, Blackmore Oval and Richard Murden Reserve). The rail corridor was also surveyed by spotlight from the road overpasses at Constitution Road (near the Arlington Stop) and Davis Street (near the Waratah Mills Stop). At least one person hour of survey effort, per site, was completed on foot using two 100 watt vari-beam spotlights. The speed of the spotlight surveys was approximately 1 km per hour. The spotlight surveys concentrated on areas that contained suitable habitat for the Long-nosed Bandicoot.

Fauna species recorded during the fauna surveys were documented and combined into a total species list (Appendix B).

3.4.4 Fauna habitats

Fauna habitats were assessed generally by examining characteristics such as the structure and floristics of the canopy, understorey and ground vegetation, the structure and composition of the litter layer, and other habitat attributes important for feeding, roosting and breeding. The following criteria were used to evaluate habitat values:

- **Good:** A full range of fauna habitat components are usually present (for example, old-growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.

- **Moderate:** Some fauna habitat components are missing (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.

- **Poor:** Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other

remnant ecosystems in the landscape have usually been severely compromised by extensive past clearing.

3.5 Likelihood of occurrence

For this study, likelihood of occurrence of Threatened species recorded or predicted to occur in the locality is defined in Table 3-4.

Table 3-4 Likelihood of occurrence of threatened species

Likelihood	Description
Low	Species considered to have a **low likelihood of occurrence** include species not recorded during the field surveys that fit one or more of the following criteria: ▪ Have not been recorded previously in the study area and surrounds and for which the study area is beyond the current distribution range. ▪ Rely on specific habitat types or resources that are not present in the study area. ▪ Are considered locally extinct. ▪ Are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
Moderate	Species considered to have a **moderate likelihood of occurrence** include species not recorded during the field surveys that fit one or more of the following criteria: ▪ Have infrequently been recorded previously in the study area and surrounds. ▪ Use habitat types or resources that are present in the study area, although generally in a poor or modified condition. ▪ Are unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically during variable seasons or migration. ▪ Are cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
High	Species considered to have a **high likelihood of occurrence** include species not recorded that fit one or more of the following criteria: ▪ Have frequently been recorded previously in the study area and surrounds. ▪ Use habitat types or resources that are present in the study area that are abundant and/or in good condition within the study area. ▪ Are known or likely to maintain resident populations surrounding the study area. ▪ Are known or likely to visit the site during regular seasonal movements or migration.
Present	Any Threatened species recorded during field surveys.

3.1 Significance assessments

The impact assessments followed the definitions in the Glossary and the proposal description provided in Section 1.1. Tests for significance were completed for Threatened species, populations or ecological communities considered to have a moderate or higher likelihood of occurrence.

For Threatened biodiversity listed under the *Threatened Species Conservation Act 1995*, significance assessment consider the heads of consideration for Threatened species assessment as suggested in the Department of Environment and Conservation/ Department of Primary Industries draft Guidelines for Threatened Species Assessment (Department of Environment and Conservation & Department of Primary Industries 2005).

For Threatened biodiversity listed under the *Environment Protection and Biodiversity Conservation Act 1999* significance assessment have been completed in accordance with

the EPBC Act Significant Impact Guidelines (Department of the Environment and Heritage 2006).

For species, populations or communities listed under both Acts, both assessments were completed.

3.2 Limitations

On all sites, varying degrees of non-uniformity of flora and fauna habitats are encountered. Hence, no sampling technique can entirely eliminate the possibility that a species is present on a site (e.g. species of plant present in the seed bank). The conclusions in this report are based upon data acquired for the site and the field survey conducted over one day and night. Therefore, the results are merely indicative of the environmental condition of the site at the time of survey, including the presence or otherwise of species. It should also be recognised that site conditions, including the presence of Threatened species, can change with time. However, a precautionary approach was taken and assessments have been undertaken based on the presence of suitable habitat and known occurrences of species even if a species wasn't recorded.

Due to the rail corridor being an active rail line at the time of the assessment, night time access, and hence survey, was not allowed due to safety concerns. However night time surveys were undertaken by Biosis Research as part of the early works REF and the results have been mentioned in the text where relevant.